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# Cardiff Economics Working Papers



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## The determinants and profitability of switching costs in Chinese banking

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# The determinants and profitability of switching costs in Chinese banking

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## **Abstract**

Using a sample of 151 banks over the period 2003 to 2010, this paper estimates a model that examines the effect of switching costs in the Chinese loan market on banking profitability. In keeping with the extant empirical literature it reports a positive relationship between bank profitability and switching costs. Furthermore it reports the estimation of a systems model of switching costs and profitability. The main result is that bank size measured by total assets is has a complex relationship with switching costs. Competition between small banks creates the incentive for lock-in and increased switching costs whereas very large banks are less exercised by lock-in and switching costs. The study also finds that concentration has a negative relationship with switching costs and profitability, confirming the accepted view that the large state-owned banks are concerned with social as well as profit objectives.

**Key Terms** Chinese banking, switching costs, bank profitability

**JEL Codes** G21, C51, L14

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## **1. Introduction**

Switching costs in banking represents a source of rent that reduces the competitiveness of the market. In addition to the administrative costs of changing a bank account, it is conjectured that in the loan market there are additional costs associated with informational asymmetries where the existing lender is more informed about the quality of the borrower than a potential new lender. Switching costs in the Chinese banking market is a relatively unexplored area of research. It can be argued that in a highly competitive and homogeneous market as in China a borrower may face non-negligible switching costs when switching between banks as a means of ‘locking in’ customers.

The Chinese banking market is large and expanding. By the end of 2011 there were over 400 banks operating in China. However, there has been little in the way of research that investigates the topic of switching costs in the banking sector. What has been published focuses on the credit card or deposit market using survey data or macro data. While these studies recognize the significance of switching costs on banks’ market share and profits, there has been no study of switching costs in the loan market, or its determination.

This paper seeks to fill this gap in the applied literature and enhance the understanding of the magnitude of switching costs in the loan market and its influence on profits in China’s banks. The objective of this paper is twofold. Since switching costs are heterogeneously across banks and cannot be observed, this paper applies the structural model developed by Shy (2002) to measure the switching costs for each bank in the data sample. Second, it analyzes the determinants of the magnitudes of switching costs in the Chinese banking sector and their effects on banks’ profits in a simultaneous equations system. The

objective of the paper is to identify the principal drivers of switching costs in the Chinese banking sector.

This paper is organized as follows: the next section introduces the characteristic of the Chinese banking industry; section 3 reviews the relevant theoretical foundation and the literature on switching costs; section 4 describes the methodology of the relationship between switching costs and competition, section 5 introduces the empirical model and describes the data; section 6 presents the results of estimation; and section 7 concludes.

## **2. The Chinese banking market**

The Chinese banking industry has been in a state of reform since 1978. Numerous papers have described the Chinese banking market in detail and it is not the intention of this paper to repeat the same here. We instead focus on the key elements of the banking sector that is germane to the empirical research reported herein. The entry of China to WTO gave an additional impetus to the process of banking sector reform. In 2003, the Chinese National People's Congress approved the establishment of the China Banking Regulatory Commission, which replaced the Central bank's regulatory function of financial market. In the same year the Law of banking supervision was promulgated.

The commercial banking market can be separated into large commercial banks (state owned banks – SOBs), joint-stock commercial banks (JSBs), city commercial bank (CCBs), rural commercial banks (RCBs) and foreign banks (FBs). Despite the seemingly diverse nature of the banking market, more than half of market share is dominated by the five large

commercial banks. However, with the growth of other types of banks and competition of the market, the five large commercial banks' market share keep decreasing, shrinking from 69.63% in 2003 to 54.89% in 2011. Since China entered into WTO in 2001, the joint-stock banks, city commercial banks and foreign banks have been increasing their market share at the expense of the SOBs.

Recapitalization, profitability and cost efficiency have been joint objectives of the SOBs aided by international listing<sup>1</sup>, global outreach and acceptance of strategic foreign investors (Justin Y. Lin et al, 2012). Profitability of the non-SOB sector has improved as has their productivity and efficiency (Matthews and Zhang, 2010). The reform process has been extended to loan pricing and limited loan rate differentiation between banking entities became a possibility since 2004. Table 1 shows the development of interest rate deregulation in China banking market. In 1996, loan rate margins on the benchmark loan rate set by the PBOC was a tight 0.9 to 1.1. In 1999, this rate range extended to 0.9-1.3 of the benchmark to small and medium enterprise, while kept same for large enterprise. However, in 2004, the upper limit of loan rate had been moved as well as the lower limit of deposit rate. Hence, banks are almost free to price according to risk and market conditions.

In small steps, Chinese banks have been experiencing limited loan rate differential pricing capability since the beginning of the reform period. Table 1 suggests that since 2004 Chinese banks have the capability to price differentiate and use the loan rate for strategic

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<sup>1</sup> BOCOM was listed on Hong Kong Stock Exchanges in June 2005, and on Shanghai Stock Exchange in May 2007; CCB was listed on Hong Kong Stock Exchanges in Oct 2005, and on Shanghai Stock Exchange in Sep 2007; BOC was listed on Hong Kong Stock Exchanges in June 2006, and on Shanghai Stock Exchange in July 2006; ICBC was listed on Hong Kong and Shanghai Stock Exchanges Oct, 2006; ABC was listed on Hong Kong and Shanghai Stock Exchanges in July, 2010.

pricing to attract and ‘lock-in’ customers by developing switching costs.

**Table 1: Interest Rate Deregulation**

Year	Loan	Deposit
1996	All enterprises: 0.9-1.1 of benchmark rate	Equal to the benchmark rate
1998	Medium and large enterprise: 0.9-1.1 times; small enterprise: 0.9-1.2 times	Equal to the benchmark rate
1999	Large enterprise: 0.9-1.1 times; small and medium enterprise: 0.9-1.3 times	Equal to the benchmark rate
January 2004	All enterprises: 0.9-1.7 times	Equal to the benchmark rate
October 2004	0.9 times - Upper limit removed.	No lower limit-benchmark rate

Sources: Podpiera (2006)

### 3. Literature Review

The concept of switching costs can be traced to Porter (1980). Numerous theoretical studies explore the effects of consumer’s switching behavior on firms’ competition strategy and market outcome. Klemperer (1995) summarizes the relevant literature and concludes that, in general, switching costs for consumers exist in many markets resulting in higher market prices. Sharpe (1990) proposes a model of borrowing under asymmetric information to explain borrower loyalty. It is suggested that banks make the best offers to their existing borrowers because they know the quality of their customers better than their competitors. Customers are then ‘informational captured’ by their own banks, and will thus be charged higher price if they switch, since they are unable to transfer their quality information to new banks. Vesala (2007) distinguishes between switching costs and the informational advantage gained in the banking-firm relationship, and examines how switching costs affect the profitability from relationship based lending. The value of the informational advantage is non-

linear in profitability, firstly decreasing and then increasing due to the size of switching costs. Very low switching costs discourage competing banks from making offers, since it increases the probability of low quality borrowers to switch banks, but very high switching costs, lock in high quality borrowers to their current bank and make it costly for competitor banks to extract rents.

Empirical studies have focused on the relationship between switching costs, bank lending and the bank-customer relationship. Hubbard et al. (2002) use a matched sample of individual loans, borrowers, and banks with contract-level loan data of US to find that small firms or firms with no bond rating will face higher loan rate when switching between banks. The existence of asymmetric information underpins switching costs for small firms. Stango (2002) examines the credit card market and investigates the relationship between price setting and consumer switching costs. Using a detailed panel of credit card issuers, it is found that switching costs are an important influence on pricing for commercial banks, but have almost no influence on pricing for credit unions. Waterson (2003) compares switching behavior among different industries and finds that borrowers in the banking industry are much less likely to switch than those in other industries.

Kim et al. (2003) apply a novel model to Norwegian bank-level data to estimate the magnitude of switching costs for customers. It is claimed that switching costs are encountered when firms open a new relationship with its current main banks, or when firms switch to a lender that is one of its non-main banks in the previous period. The empirical result shows that switching costs on average are about one-third of the average lending rate<sup>2</sup>. Santos and

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<sup>2</sup> They take switching costs as homogenous among banks and evaluate the average value for the whole banking industry.



Winton (2008) use contract-level loan data to find that during a recession, bank-dependent firms without accessibility to the bond market pay significantly higher loan rates than those firms with accessibility. This indicates the bank-dependent firms pay a rent to the banks in respect of their information monopoly. But firms with access to the bond market pay lower spreads. It follows that spreads rise significantly less in recessions, which suggest that the macro economy is likely to affect the magnitude of switching costs. With bank-firm level data on four Italian local credit markets, Barone et al. (2011) show that firms tend to borrow from their main bank over time because of the lock-in effect of switching costs.

Since switching costs cannot be observed directly, other studies have focused on methods of estimating switching costs. According to Kim et al. (2003), the average cost of switching in the market costs can be estimated parametrically using a model based on bank loans, market share, interest rate, and net interest margin. Shy (2002) constructs a ‘quick-and-easy’ way to calculate consumer switching costs in a given industry based on the Nash-Bertrand equilibrium model. Concluding that consumers’ switching costs will be determined by price setting mechanisms and the market share of firms, Shy (2002) evaluates switching costs for the largest four banks in Finland.

Studies of switching costs in the Chinese banking sector focus on the deposit and credit card markets<sup>3</sup>. Su (2007) compares the competition between local banks and foreign banks. It is argued that as new-comers, the absence of a branch network makes it harder for foreign banks to suck-in and lock-in customers. Su and Chen (2009) use survey data to study the determinations of switching costs in the deposit market based on individual and banks

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<sup>3</sup> For a survey see Chen (2011)

characteristics. Switching costs are separated into four types, which are transaction costs, learning costs, uncertainty costs and relationship costs<sup>4</sup>. A questionnaire analysis is conducted to determine the key factors affecting the switching decision. Similarly, Yu et al. (2008) focus on the relationship of banks and consumers, to evaluate the effect of switching costs on the consumers' decision to change deposit accounts. The empirical results show that switching costs have a negative effect on consumers' switching actions. They find that the stronger the bank-client relationship, the lower the consumers' switching probability.

Chun-Yu Ho (2007) adds transaction costs to a static demand model to explore whether the switching costs influences consumer preferences. The results show that consumers face switching costs when changing providers and depositors prefer banks with more branch locations and higher quality employees. In an improved model, Chun-Yu Ho (2009) studies the relationship between switching costs and the demand for deposits in China. Using provincial data for the big four banks in China it is shown that switching cost is an important factor in the choice of bank choice, and consumer need to stand 5% of their deposit value loss as switching costs when they switch to other banks. Meanwhile, the research finds that banks reduce their service fees to attract consumers initially followed by the expectation of earning more from the same consumers in the future.

#### **4. Methodology**

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<sup>4</sup> The results show that the bank-client relationship and service quality significantly affect the switching costs, and young people are more likely to have lower switching costs than old people.

Models of switching cost are typically based on the two-period models of Klemperer (1987a, b), set in a Bertrand competition framework. Based on Shy (2002), we describe the model used to construct switching costs. There are two firms A and B competing Bertrand style with brand A and brand B products respectively. The marginal costs of the two firms are assumed to be 0. Consumers are distributed between the firms so that initially  $N_A$  consumers have already purchased brand A and  $N_B$  consumers have already purchased brand B. All consumers face switching costs,  $SC > 0$ , if they wish to change supplier. The utility function of each consumer type derived from the next purchase is given by:

$$U_A \stackrel{\text{def}}{=} \begin{cases} -P_A & \text{if staying with A} \\ -P_B - SC & \text{if buying from B} \end{cases} \quad (1)$$

$$U_B \stackrel{\text{def}}{=} \begin{cases} -P_A - SC & \text{if buying from A} \\ -P_B & \text{if staying with B} \end{cases} \quad (2)$$

If firm A wishes to poach customers from firm B it has to offer a lower price than firm B does. Furthermore, the price difference has to be larger than the switching cost  $S$  to make it worth for consumers to switch. Let  $N_A$  denote the (endogenously determined) number of brand A buyers (the next period purchase), and  $N_B$  denote the number of brand B buyers (the next period purchase). Then, (1) and (2) implies that

$$N_A = \begin{cases} 0 & \text{if } P_A > P_B + SC \\ N_A & \text{if } P_B - SC \leq P_A \leq P_B + SC \\ N_A + N_B & \text{if } P_A < P_B - SC \end{cases} \quad (3)$$

$$N_B = \begin{cases} 0 & \text{if } P_B > P_A + SC \\ N_B & \text{if } P_A - SC \leq P_B \leq P_A + SC \\ N_A + N_B & \text{if } P_B < P_A - SC \end{cases} \quad (4)$$

Assume that firms' production costs are zero. Denote  $\pi_A$  and  $\pi_B$  as the profit of firm A and B.

Thus, the profits of each firm are given as:

$$\pi_A(P_A, P_B) = P_A N_B \text{ and } \pi_B(P_A, P_B) = P_B N_B \quad (5)$$

A Nash-Bertrand equilibrium would be a pair of non-negative prices  $\{P_A, P_B\}$ . For a given  $P_B$ , firm A chooses  $P_A$  to maximize  $\pi_A$ , and symmetrically for firm B to maximize  $\pi_B$ . Nash-Bertrand equilibrium does not exist in pure strategies, but an undercut-proof equilibrium does. According to Shy (2002) definition 1: Firm  $i$  is said to undercut firm  $j$ , if it sets its price to  $P_i < P_j - SC$ ,  $i = A, B$  and  $i \neq j$ . That is, if firm  $i$  ‘subsidizes’ the switching cost of firm  $j$ ’s customers.

Prices represent an undercut-proof equilibrium if it is impossible for any firm to increase profits by undercutting the competitor while it is impossible for any firm to raise its price without being profitably undercut by the competitor. The undercut-proof property is formally designed (definition) as in Shy (2002):

A pair of prices  $\{P_A^U, P_B^U\}$  satisfies the undercut-proof property (UPP) if (a) For a given  $P_B^U$  and  $N_B^U$ , firm A chooses the highest price  $P_A^U$  subject to the constraint;

$$\pi_B^U = P_B^U N_B^U \geq (P_A - SC)(N_A + N_B) \quad (6)$$

(b) For a given  $P_A^U$  and  $N_A^U$ , firm B chooses the highest price  $P_B^U$  subject to the constraint

$$\pi_A^U = P_A^U N_A^U \geq (P_B - SC)(N_A + N_B) \quad (7)$$

Firm A sets the highest price possible in order to maximize profits, but the price is still sufficiently low to prevent firm B from undercutting and taking the whole market. Firm A’s price is set low enough to make firm B’s profit from not undercutting,  $P_B^U N_B^U$  larger than the profit firm B would make when undercutting and capturing the whole market,  $(P_A^U - SC)(N_A + N_B)$ . But since both firms set prices as high as possible, the inequalities hold as equalities. These equalities give the unique pair of prices  $\{P_A^U, P_B^U\}$  where

$$P_A^U = \frac{(N_A + N_B)(N_A + 2N_B) * SC}{(N_A)^2 + N_A N_B + (N_B)^2} \quad (8)$$

and

$$P_B^U = \frac{(N_A + N_B)(2N_A + N_B) * SC}{(N_A)^2 + N_A N_B + (N_B)^2} \quad (9)$$

Then solve for the switching costs based on undercut-proof equilibrium. Inserting equations (6) and (7) in the equalities of definition gives that  $N_A^U = N_A$  and  $N_B^U = N_B$ . The solution for switching costs given as follow:

$$SC_A = P_A - \frac{P_B N_B}{N_A + N_B} \quad (10)$$

$$SC_B = P_B - \frac{P_A N_A}{N_A + N_B} \quad (11)$$

Shy (2002) extends the model described above to a multi-firm industry for estimating switching cost using merely information on market shares and prices, which is based on a solution to the non-existence of a Nash-Bertrand equilibrium. In the case of banks, we replace price by the average lending interest rate. Define  $S_i$  to be the switching cost of a brand  $i$  consumer, and assume that  $S_i$  ( $i=1,2,\dots,L$ ) are known by all firms and consumers. Then, each firm  $i \neq L$  takes  $P_L$  as given and sets maximal  $P_i$  to satisfy:

$$\pi_L = P_L N_L \geq (P_i - SC_i)(N_i + N_L) \quad (12)$$

Accordingly switching costs is given as:

$$SC_{it} = P_{it} - \frac{P_{Lt} N_{Lt}}{N_{it} + N_{Lt}} \quad (13)$$

, where the switching costs of bank  $i$  is estimated as a function of the average interest  $P$  set by bank  $i$  and  $L$ , and the market share of bank  $i$  and  $L$  at period  $t$ .  $P_{Lt}$  and  $N_{Lt}$  denote the average interest rate and market share of bank  $L$  which has the lowest market share in period  $t$  respectively. Assume that the firm with the smallest market share, firm  $L$ , is prey target of firm 1. Therefore, the price  $P_L$  of firm  $L$  would make undercutting its price by firm 1 unprofitable. That is,

$$\pi_1 = P_1 N_1 \geq (P_L - SC_L)(N_1 + N_L) \quad (14)$$

Since  $P_{Lt}$  is observed, the unobserved remaining switching cost  $SC_{Lt}$  can be solved by treating equation (12) as an equality. Thus the switching costs of the bank that has the lowest market share at period t can be estimated as:

$$SC_{Lt} = P_{Lt} - \frac{P_{1t}N_{1t}}{N_{1t}+N_{Lt}} \quad (15)$$

Switching costs arise mainly from asymmetric information which contains two aspects, - information asymmetry in the bank-borrower relationship and lack of information sharing between banks. Large banks tend to have more customers and resources that give them an informational comparative advantage. Small firms which are usually considered as opaque are less likely to switch banks (Gopalan et al., 2011)<sup>5</sup>. Hence bank size may be an important driver in determining the level of switching costs.

Operational efficiency differs between banks and it is likely that the degree of switching costs will also depend on the efficiency of the bank's ability to exploit the advantage of asymmetries information<sup>6</sup>. Banks also can create barriers for consumers to change suppliers (Smidt et al., 2006). Strategies that strengthen the bank-firm relationship increases the degree of switching costs and multiple bank relationships is an effective response by firms to reduce the bank's lock-in power.

Liability management remains undeveloped in Chinese banks and customer deposits funding remains the principal source of funds for lending. Loan growth has averaged 28.8% a

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<sup>5</sup> Information sharing by banks will reduce switching costs (Gehriga and Stenbecka, 2007) but in China information sharing is confined to negative information.

<sup>6</sup> Berger et al. (2005) argue that small banks are better able to collect and act on "soft"<sup>6</sup> information than large banks.

year between 2003 and 2011. Firms are more likely to switch banks when credit conditions are light and strong deposit funding and therefore availability of credit may also be a significant driver.

Based on above analysis, we use the switching costs as the dependent variable regressed on the bank characteristics (a measure the degree of asymmetric information, operational efficiency, and artificial barrier and funding sources) and a set of macro variables (macroeconomic measures of the economy and industry). That is:

$$SC_{it} = \alpha_0 + X_{it}\alpha_1 + M_{it}\alpha_2 + u_{it} \quad (16)$$

, where  $X_{it}$  stands for bank characteristics,  $M_{it}$  is a set of macroeconomics variables.

Following Kim et al (2003), it can be shown that bank profits will depend positively on switching costs. But the literature on bank profitability also shows that profits are linked to bank characteristics and macroeconomics variables as in Stephan et al (2009) and Gopalan et al (2011):

$$\pi_{it} = \beta_0 + \beta_1 SC_{it} + X_{it}\beta_2 + M_{it}\beta_3 + \varepsilon_{it} \quad (20)$$

Based on above analysis, the systems model of switching costs determination and profitability determination is given as:

$$SC_{it} = \alpha_0 + \alpha_1 \ln(Size)_{it} + \alpha_2 NEI_{it} + \alpha_3 DEP_{it} + \alpha_4 NIR_{it} + \alpha_5 GGDP_{it} + \alpha_6 MCR + u_{it} \quad (21)$$

$$ROA_{it} = \beta_0 + \beta_1 SC_{it} + \beta_2 \ln(Size)_{it} + \beta_3 NEI_{it} + \beta_4 DEP_{it} + \beta_5 CAP_{it} + \beta_6 MCR + \varepsilon_{it} \quad (22)$$

In equation (21) and (22), switching costs are values, which have been evaluated according to the method of Shy (2002) and described in the appendix. GGDP stands for annual growth rate

of real GDP, which measures the macro effect on switching costs. Other variables are banks' characteristic variables. Details of each variable are described below:

**Return on asset (ROA)**, which is measured as net income over total assets. The switching costs will be reinforced through better using of asymmetric information. Hence, switching costs is expected to have a positive impact on profits.

**Bank Size (SIZE)** is defined as total asset. Stephan et al (2009) find that bank size has a negative effect on firm's switching behavior, which suggests that large banks have a stronger lock-in power. Large banks have more client and branches than small banks, which strength the asymmetric informational comparative advantage and lock-in power. Hence bank size is expected to have a positive effect on switching costs.

**Non-interest expense ratio (NEI)**, is defined as the ratio of non-interest expense over income on loans, provides information on variations in operating costs. The ratio reflects a firm's efficiency in generating profits and measures the level of management efficiency. Low NEI reflect efficient management, skilled employers and low bureaucracy enable stronger lock-in and improve profitability. Non-interest expense ratio is expected to have a negative influence on switching costs but positive effect on profits.

**Non-interest income ratio (NIR)**, is defined as Non-interest income over total gross income, measures the income structure of banks. Banks with high non-interest income ratios indicate a wider range of off-balance sheet business, which strengthens the lock-in power of the banks through strategic cross-selling to borrowers.

**Capital ratio (CAP)** is expected to have positive relationship with profits of banks, which is measured by total equity over total asset. Capital ratio reveals capital adequacy and



captures the general average safety and soundness of the financial institution. Banks with higher capital to asset ratios are considered relatively safer compared to institutions with lower ratios. Safer banks will normally have a lower cost of external funding, which has a positive effect on their profitability.

**Fund source (DEP)** is captured by the total deposit over total assets, which is expected to have a positive effect on switching costs and profits. Deposits remain the major source of funding for banks in China.

**Annual growth of GDP (GGDP)** is expected to have a positive relationship with switching costs. It is commonly accepted that the demand for lending is pro-cyclical. Banks' market power will rise with an increase in demand for bank lending. Then consumers will be charged higher interest rate when switching banks.

**Market concentration ration (MCR)** measures the loan market structure in the banking industry by means of the market concentration variable, which is defined as the ratio of the five largest banks' assets to the total assets of the entire banking sector. A higher market concentration ratio may result in higher rates being charged on loans and lower interest rates being paid on deposits. On the other hand, a higher bank concentration might be the result of a tougher competition in the banking industry, which would suggest a negative relationship between performance and market concentration (Boone and Weigand, 2000).

An important difference between the banks in China is their heterogeneity in operation. The SOBs operate nationally and are constrained to operate throughout the nation. The JSBs have the jurisdictional capability to do the same but concentrate on the economically profitable regions of the eastern coastal area. The CCBs and RCBs operate

within the provincial and rural area. Therefore the backgrounds for different categories of banks are not same. These differences are captured by dummy variables. Similarly it is argued that big bank have less motivation to lock-in their client, therefore bank size dummy variables are included to test whether the banks with different sizes have different switching costs.

We include control dummy variables for regions and foreign ownership. **RD** is a regional dummy where the HQ is in the east part of China = 1, otherwise 0. **FD** measures foreign banks as 1, and domestic banks as 0. Foreign banks are newcomers to banking market in China. Compared with local banks, foreign banks are lack of network relationship. Domestic banks include large commercial banks, joint-stock commercial banks, city and rural commercial banks. Large commercial banks are the biggest banks in China, established earliest and now taking largest share of the banking market. Joint-stock commercial banks, city and rural commercial banks are usually considered as having higher efficiency and better services than large commercial banks.

**Large banks dummy (LD)** measures bank asset larger than 10000 Billion CNY in 2010 as 1, otherwise 0. **Medium size banks dummy (MD)** measures bank asset smaller than 10000 Billion CNY and larger than 1000 Billion CNY in 2010 as 1, otherwise 0. **Small size banks dummy (SD)** measures bank asset smaller than 1000 Billion CNY, in 2010 as 1, otherwise 0.

Table 2 summarises the variables.

**Table 2: Variable Definition**

Variables	Definition	Unit
SC	Estimated value according to Shy (2002)	-
ROA	Net income over total asset	%
SIZE	Annual total asset of Banks	Mil CNY
NEI	Non-interest expense over income on loans	%

NIR	Non-interest income over total gross income	%
CAP	Total equity over total asset	%
DEP	Total deposit over total assets	%
GGDP	Annual growth ratio of real GDP	%
MCR	Share of the five largest banks	%
RD	Headquarter of bank located in east region of China equal to 1, otherwise 0	-
FD	Foreign banks equal to 1, otherwise 0	-
LD	Bank asset $> 1 \times 10^7$ Mil CNY = 1	-
MD	$1 \times 10^7$ Mil CNY $>$ Bank asset $> 1 \times 10^6$ Mil CNY = 1	-
SD	$1 \times 10^6$ Mil CNY $>$ Bank asset = 1	-

## 5. Data

The bank-level data are collected from BANKSCOPE. Only commercial banks are included in the sample. In addition, the sample excludes the banks whose market share is less 0.01%, which can be neglected when doing the nationwide research. The sample contains 151 banks in 8 years data, from 2003 to 2010<sup>7</sup>. Some banks have zero cells for data during some years in financial reports, creating gaps in the data set. Hence the regression data is unbalanced<sup>8</sup>. Total loans of the sample banks take an average 74.7% of total loans in lending market<sup>9</sup> of China. Table 3 shows the average switching costs, which are estimated according to the method of Shy (2002)<sup>10</sup>, in different groups of banks in sample year. Due to a lack of reported data, foreign banks' switching costs cannot be calculated for 2003 and 2004.

**Table 3: Estimated switching costs of banks (% of loans)**

<sup>7</sup> China Banking Regulatory Commission established in 2003, which indicated China banking market entry into a new age. So here the sample begins from 2003.

<sup>8</sup> These gaps appear randomly and it is not expected to bias the results. See Woolridge (2009).

<sup>9</sup> Total loans include the loans from banks and trust companies.

<sup>10</sup> The method of estimation is described in the appendix.

	2003	2004	2005	2006	2007	2008	2009	2010
Large commercial banks	4.62	4.56	4.82	5.14	6.16	6.67	4.69	4.71
Joint-stock commercial banks	3.84	5.08	5.21	5.21	5.90	6.57	4.72	5.01
City and rural commercial banks	3.89	4.14	4.86	4.59	4.91	5.96	4.65	4.96
Foreign banks	NA	NA	3.56	4.77	2.70	4.64	3.11	3.20

A summary of the variables used in the model are presented in table 4. Several facts are worth noting. The gaps between the max and min numbers of switching costs and other bank characteristics are very large, which indicate heterogeneity performance among banks. Switching costs ranges from 0.45 to 9.78, reflecting big difference in lock-in power<sup>11</sup>. The average market share is 0.945. The smallest market share numbers in each year is either a city commercial bank or a rural commercial bank, while the highest one is ICBC in 2004. Although the maximum value of ROA is very large, it is an occasionally value. Most ROA of banks are below 2% with average value of ROA is 1.335% in the sample. The large commercial banks hold the largest market share, but do not have the highest profit rates. This is likely to show that the ability to generate profit is not based on market share.

**Table 4: Summary Statistics<sup>12</sup>**

	Obs.	Mean	S.D.	Min	Max
Key variables					

<sup>11</sup> The lowest value is switching costs of China Zheshang Bank in 2004. In 2004, China Zhejiang Commercial Bank was reorganized and started business as a new private bank. The highest value is switching costs of Qishang Bank in 2008. On March 22, 2009, Zibo City Commercial Bank changed its name to Qishang Bank.

<sup>12</sup> Subgroup summary statistics are attached in appendix, table A1-A4.

SC (%)	512	4.831	1.415	0.450	9.758
ROA(%)	630	1.335	1.226	-1.535	18.587
Other bank's characteristics					
SIZE (Mil CNY)	640	518846	1629853	2164.600	13458622
NEI (%)	512	41.819	31.449	8.212	542.783
NIR (%)	535	11.432	1.278	5.564	20.705
CAP (%)	635	6.568	4.940	-13.714	42.024
DEP (%)	631	75.394	16.866	0.027	103.364
Macro Variables					
GGDP (%)	1216	16.311	3.927	8.552	22.881
MCR (%)	1216	55.028	3.264	51.473	59.175

## 6. Empirical results

The system of equations is estimated simultaneously using 3SLS. The variables NEI, DEP and CAP are treated as endogenous. Lag vales of, SIZE, MCR, GGDP, CAP and DEP are used as excluded instruments. Table 5 presents some selected results of the base line model.

In column 2 we see that as expected, *SIZE* is a significant driver of switching costs. The large banks in China are the SOBs which have a nationwide branch network that is preferred by Chinese bank customers (Chun-Yu Ho, 2012) but also provides a stronger capability of lock-in strategy. Also, bigger banks have an advantage in exploiting the asymmetric information, gap with small firms (Gopalan et al, 2007).

**Table 5: Estimation for the Simultaneous Equations Model with 3SLS**

Variables	SC	Variables	ROA
Ln(SIZE)	0.111*** (3.326)	SC	0.180*** (6.646)
NEI	-0.015***	Ln(SIZE)	-0.010

	(-3.723)		(-0.445)
DEP	0.021***	NEI	-0.010***
	(5.065)		(-5.393)
NIR	0.280***	DEP	0.013***
	(6.849)		(3.066)
GGDP	-0.042	CAP	0.099***
	(-1.078)		(2.701)
MCR	-0.051**	MCR	-0.046***
	(-1.967)		(-3.078)
Intercept	4.569***	Intercept	1.794
	(2.786)		(1.308)
R <sup>2</sup>	0.405	R <sup>2</sup>	0.362
D.W.	1.643	D.W.	1.813
Obs	277	Obs	312

Notes: Standard errors are reported in the parentheses. \* significant at 10% level; \*\* significant at 5% level; \*\*\* significant at 1% level.

As expected, non-interest expenditure which acts as a proxy for bank efficiency has a significant negative effect on switching costs. Efficient management will enable the banks to take advantage of its ‘information monopoly’ more effectively and increase banks market power to lock-in their customers. Greater access to funding measured by *DEP* has a positive significant relationship with switching costs as a liquid source of funding means greater bargaining power in lending and lock-in capability. The measure of income mix *NIR* is an indicator of the strength of the off-balance sheet business conducted by the bank. A bank that has significant earnings from services has the capability to cross-sell financial services with loan products creating a stronger lock-in effect. Other business relationships than the customer-loan relationship alone strengthen the bank-firm relationship.

Market concentration (MCR) has a negative effect on switching costs which indicates the big banks which hold the ‘monopoly power’ tend to be less aggressive. In addition, small banks do not have enough resource to lock-in their customers effectively under this condition.

This suggests that switching costs will decrease when market become more concentrated (Tirri, 2007; Mercieca et al, 2008).

Column 4 of table 5 shows the base-line result for bank profits. It is clear that *SC* provides a source of hidden profit to the bank. This result is consistent with the prediction of theory (Klemperer, 1987; Beggs and Klemperer, 1992), indicating the lock-in power as an important variable in banks' profit strategy. Banks benefit from higher switching costs, and then higher profit lead to strengthen the information asymmetries. Profit and SIZE has no significant relationship indicating the conventional finding of constant returns to scale for banks however, the market structure measured by the concentration ratio has a negative effect on profits indicating a perverse effect in the case of the Chinese banking market. This suggests that the concentrated market power of the big-5 SOBs in China is used to support loss-making social projects than the collusive behaviour associated with the structure-conduct-performance hypothesis. This result is similar to Dietricha and Wanzenried (2009), for Swiss banks. Banks with higher capital to asset ratios (*CAP*) are considered relatively safer compared to institutions with lower ratios and have access to lower funding cost. In addition, banks with higher equity to assets ratios will normally have a lower need of external funding, which has again a positive effect on their profitability (Dietricha and Wanzenried, 2009; Vong and Chan 2006).

We now turn to the analysis of the regional and ownership effect in the model. The East region of China takes an average of 65% and 64% loans and deposit respectively. Similarly, 66% of banks in the sample have their headquarters in east area of China. As the most developed area in China, the competition of the lending market is intensive. Some

scholars point out that the predator bank will pay the switching cost to poach new customers. Chen (1997) suggests that firms will ‘pay to switch’ to get new customers, and ‘pay to switch’ make the market more competitive. Farrell and Klemperer (2007) claims that small firms act aggressively and price low to attract new consumers which they can exploit in the future. Using the Bolivian credit registry data between 1999 and 2003, Ioannidou and Ongena (2010) finds that banks follow a loss-leader strategy and initially discount the loan rate to attract new customers, and then after a period of about one and a half years, increase the loan rate. However, there is no evidence that fierce competition will lead to information sharing between banks, and reduce the asymmetric information. Therefore the regional difference is expected to have no effect on switching costs. However, intensity of competition in the profitable region of the East means that while the majority of lending goes on in those regions the profit rate is commensurately lower.

**Table 6: Structural Estimation with regional and foreign dummy**

Variables	SC	Variables	ROA
Ln(BANK SIZE)	0.085** (2.181)	SC	0.174*** (6.582)
NEI	-0.014*** (-3.349)	Ln(BANK SIZE)	-0.010 (-0.391)
DEPOSITA	0.020*** (4.203)	NEI	-0.008*** (-4.146)
NIR	0.260*** (6.380)	DEPOSITA	0.009*** (2.683)
GGDP	-0.041 (-1.055)	CAPITAL RATIO	0.085*** (2.721)
MCR	-0.067** (-2.522)	MCR	-0.055*** (-3.923)
RD	0.156	RD	-0.173**



	(0.872)		(-2.223)
FD	-0.431**	FD	-0.297**
	(-2.463)		(-2.020)
C	5.824***	C	2.756***
	(3.365)		(2.342)
R <sup>2</sup>	0.411	R <sup>2</sup>	0.410
D.W.	1.651	D.W.	1.820
Observations	277	Observations	312

Notes: Standard errors are reported in the parentheses. \* significant at 10% level; \*\* significant at 5% level; \*\*\* significant at 1% level.

As recent entrants to the China banking market, foreign banks are in the early stages of building a relationship network and accumulation of information in the local market. These factors create barriers to construct switching costs when they compete with domestic banks. For similar reasons, foreign banks earn lower profitability rates.

Farrell and Klemperer (2007) argue that larger firms tend to be lazier and lose their consumers to the smaller firm, which is known as ‘fat cat’ effect, with the larger firm being a nonaggressive “fat cat” and small firms being more aggressive in attracting and keeping consumers. Translating to the banking market this suggests that large size bank have less motivation in raising their switching costs, but small size banks will be more positive. To capture this effect we divide banks into three categories, large, medium and small size banks, to test whether the size effects have a significant difference on switching costs. Table 7 summarizes our findings.

**Table 7: Structural Estimation of different bank size affecting on switching costs**

	(1)	(2)	(3)	(4)
Variable	SC	SC	SC	SC
Ln(BANK SIZE)	0.185***	0.164***	0.089**	0.137***

	(4.190)	(3.713)	(2.331)	(3.328)
NEI	-0.016***	-0.015***	-0.016***	-0.015***
	(-4.081)	(-4.021)	(-4.022)	(-3.862)
DEPOSITA	0.020***	0.021***	0.022***	0.020***
	(4.900)	(5.141)	(5.166)	(4.881)
NIR	0.294***	0.282***	0.262***	0.298***
	(7.232)	(6.985)	(6.564)	(7.305)
GGDP	-0.015	-0.032	-0.047	-0.020
	(-0.374)	(-0.804)	(-1.201)	(-0.508)
MCR	-0.057**	-0.061**	-0.067**	-0.063**
	(-2.075)	(-2.147)	(-2.378)	(-2.232)
LARGE× Ln(BANK SIZE)	-0.083***	-0.044**		
	(-3.181)	(-2.336)		
MEDIUM× Ln(BANK SIZE)	-0.028		0.006	
	(-1.545)		(0.400)	
SMALL× Ln(BANK SIZE)		0.033**	0.037**	
		(2.014)	(2.152)	
Ln(BANK SIZE) <sup>2</sup>				-0.049*
				(-3.335)
C	0.830	1.949	3.869**	-3.798
	(0.397)	(1.043)	(2.247)	(-1.230)
R <sup>2</sup>	0.429	0.430	0.417	0.431
D.W.	1.726	1.722	1.659	1.722
Observations	277	277	277	277

Notes: Standard errors are reported in the parentheses. \* significant at 10% level; \*\* significant at 5% level; \*\*\* significant at 1% level.

The results from Table 7 show that the interactive term LARGE× Ln(BANK SIZE) has a significant negative effect on switching costs but the interaction term SMALL× Ln(BANK SIZE) has a significant positive effect on switching costs. As a robustness test we use the square of bank size (Ln(SIZE)<sup>2</sup>) which has a significant negative relationship on switching costs at the 10% level indicating a potential non-linearity in the association.

## 7. Conclusion

This paper has examined the determinants of bank switching costs in terms of bank characteristics and macro variables and the influence of switching costs on banks' profits. Our finds are fourfold: first, the relationship between bank size and switching cost is complex. Our results show that in general there is a positive relationship between bank size and switching costs. A rise in size and number of sub branches will strengthen information flow, reduce the problem of asymmetric information and strengthen its lock in power. However, small banks have a stronger motivation to increase their switching costs power, and extend their market share; while large banks are less aggressive, which is called the big banks' 'fat cat effect' (Farrell and Klemperer, 2007). However, we find that in China, the 'very large' banks have lower switching costs than 'large' banks suggesting a non-linear relationship between bank size and switching costs, where after some critical size switching costs decline.

Second, Non-interest expense ratio (NEI), has a significant positive relationship with switching costs. This implies that efficient management can take advantage of asymmetries in information to enhance switching costs of banks. The switching costs also have a significant influence on the profits of banks, which indicates that switching costs provide a separate mechanism for profits generation. Third, the profit determination regression results show that market share has no significant effect on profits of banks. We also confirm other findings that the market concentration ratio has a negative effect both on switching costs and profits of banks. Fourth, as new-comers to the China banking market, foreign banks are in a weak position in raise switching costs. Banks in the east region face more intense competition and are less able to generate lock-in power.

The results highlight the effect of bank size and market concentration as two important variables in the determination of switching costs. In doing so these results confirm what is already widely known about the Chinese banking system. Market concentration has a negative effect on bank profitability which is out of step with the *Structure Conduct Performance Hypothesis*. Indeed, the more concentrated the banking market the lower the switching cost. We also find that the large banks are less concerned with the lock-in strategy of extracting rent from switching costs than the smaller banks, largely because the competitive pressure faced by the joint stock banks and city commercial banks are fiercer than that faced by the big-4 state-owned banks. Indeed our finding confirm the standard view that the SOBs have social objectives as well as profit objectives, which means maintaining branches in unprofitable regions and conducting investment in loss-making ventures as part of a wider social objective. As a result the switching costs and profit performance associated with the very large state-owned banks is lower than that of other commercial banks in China. While SOBs remain large and dominate the banking market, lower switching costs increase banks consumer welfare. As competition intensifies and the SOBs lose market share, banks will increasingly use their lock-in power to increase switching costs.

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## Appendix

Table A1: List of banks in sample

<b>Large commercial bank</b> Industrial and commercial bank of China, Agricultural bank of China Bank of China China Construction Bank Bank of Communications	Zhejiang Tailong Commercial Bank Qishang Bank Bank of Ningxia China & South Sea Bank Ltd Bank of Liaoyang Zhejiang Chouzhou Commercial Bank Jiangsu Wujiang Rural Commercial Bank Bank of Luoyang Wuxi City Commercial Bank First Sino Bank Commercial Bank of Zhengzhou Xiamen Bank Lanzhou City Commercial Bank Zhejiang Xiaoshan Rural Cooperative Bank Dongying City Commercial Bank Bank of Guilin Yantai Bank Laishang Bank Linshang Bank Nanchong City Commercial Bank Bank of Inner Mongolia Bank of Jinhua Kunshan Rural Commercial Bank Bank of Liuzhou Zhuhai City Commercial Bank Taizhou City Commercial Bank Bank of Anshan Suzhou City Commercial Bank Bank of Fuxin Handan Commercial Bank Dezhou City Commercial Bank Nantong City Commercial Bank Bank of Deyang Yingkou City Commercial Bank Chinese Mercantile Bank Jiaxing City Commercial Bank Datong City Commercial Bank Zhanjiang City Commercial Bank Bank of Xinxiang Ningbo Yuyao Rural Cooperative Bank Panzhihua City Commercial Bank Nanning City Commercial Bank Zhejiang Mintai Commercial Bank Bank of Jining Changzhi City Commercial Bank Jiaozuo City Commercial Bank Huzhou City Commercial Bank Changshu Rural Commercial Bank Mianyang City Commercial Bank
<b>Joint-stock commercial bank</b> China Citic bank China Everbright Bank Huaxia Bank Guangdong Development Bank (China Guangfa Bank) Shenzhen Development Bank (Ping An Bank) China Merchants Bank Shanghai Pudong Development Bank Industrial Bank China Minsheng Banking Corporation Evergrowing Bank China Zheshang Bank Bohai Bank	
<b>City and Rural commercial bank</b> Bank of Beijing Huangshi City Commercial Bank Bank of Shanghai Bank of Jiangsu Beijing Rural Commercial Bank Chongqing Rural Commercial Bank Bank of Ningbo Ping An Bank Shanghai Rural Commercial Bank Bank of Nanjing Bank of Hangzhou Xuchang City Commercial Bank Guangzhou Rural Commercial Bank Huishang Bank Bank of Tianjin Bank of Dalian Bank of Guangzhou Bank of Chengdu Dongguan Rural Commercial Bank Harbin Bank Foshan Shunde Rural Commercial Bank Hankou Bank Shengjing Bank Bank of Chongqing Bank of Dongguan Bank of Jilin Bank of Jinzhou Bank of Changsha Baoshang Bank	



<p>Sin Hua Bank</p> <p>United Rural Cooperative Bank of Hangzhou</p> <p>Xiamen International Bank</p> <p>Wuhan Rural Commercial Bank</p> <p>Kwangtung Provincial Bank</p> <p>Guiyang Commercial Bank</p> <p>Bank of Qingdao</p> <p>Xi'an City Commercial Bank</p> <p>Qilu Bank</p> <p>Guangxi Beibu Gulf Bank</p> <p>China Investment Bank</p> <p>Fujian Haixia Bank</p> <p>Bank of Hebei</p> <p>Jiangsu Jiangyin Rural Commercial Bank</p> <p>Jiangsu Zhangjiagang Rural Commercial Bank</p> <p>Fudian Bank</p> <p>Bank of Wenzhou</p> <p>Kincheng Banking</p> <p>Shenzhen Rural Commercial Bank</p> <p>Bank of Nanchang</p> <p>National Commercial Bank</p> <p>Bank of Jiujiang</p> <p>Bank of Weifang</p> <p>Weihai City Commercial Bank</p> <p>Ningbo Yinzhou Rural Cooperative Bank</p> <p>Bank of Rizhao</p> <p>China State Bank</p> <p>Bank of Shaoxing</p> <p>Yien Yieh Commercial Bank</p>	<p>Cangzhou City Commercial Bank</p> <p>Ganzhou City Commercial Bank</p> <p>Yangzhou City Commercial Bank</p> <p>Hengyang City Commercial Bank</p> <p>Jiujiang City Commercial Bank</p> <p>Chengde City Commercial Bank</p> <hr/> <p><b>Foreign Bank</b></p> <p>HSBC Bank (China)</p> <p>Standard Chartered Bank (China)</p> <p>Bank of East Asia (China)</p> <p>Citibank (China)</p> <p>Bank of Tokyo Mitsubishi UFJ (China)</p> <p>Sumitomo Mitsui Banking Corporation (China)</p> <p>DBS BANK (China)</p> <p>Mizuho Corporate Bank (China)</p> <p>Hang Seng Bank (China)</p> <p>Nanyang Commercial Bank (China)</p> <p>Deutsche Bank (China)</p> <p>BNP Paribas (China)</p> <p>OCBC Bank (China)</p> <p>Royal Bank of Scotland (China)</p> <p>United Overseas Bank (China)</p> <p>Australia and New Zealand Bank (China)</p> <p>JP Morgan Chase Bank (China)</p> <p>Woori Bank (China)</p> <p>Wing Hang Bank (China)</p> <p>Hana Bank (China)</p> <p>Shinhan Bank (China)</p> <p>Bangkok Bank (China)</p>
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### The method to estimate switching cost:

Switching costs are calculated through each year's cross section data. First we got the lowest market share ( $N_{Lt}$ ) of bank in year  $t$ . Then multiply the corresponding bank's average interest rate ( $P_{Lt}$ ), which calculated by income from loans divided by total loans. Accordingly we get the switching costs of bank  $i$  in year  $t$ .

$$SC_{it} = P_{it} - \frac{P_{Lt}N_{Lt}}{N_{it}+N_{Lt}} \quad (A.1)$$

,  $P_{it}$  is average interest rate of bank  $i$  in year  $t$ ;  $N_{it}$  is market share of bank  $i$  in year  $t$ .

Taking the interest rate ( $P_{1t}$ ) and market share ( $N_{1t}$ ) of biggest market share bank data into the follow equation to calculate the lowest market share bank's switching costs in year  $t$ , with the data of  $P_{Lt}$  and  $N_{Lt}$ .

$$SC_{Lt} = P_{Lt} - \frac{P_{1t}N_{1t}}{N_{1t}+N_{Lt}} \quad (A.2)$$

The example below illustrates;

Example:

	Bank 1	Bank 2	Bank 3	Bank 4
Market share	40%	30%	20%	10%
Average interest rate	5.5	5.3	5.6	5.4

In this example, Bank 4 is the smallest bank. Therefore:

$$SC_1 = P_1 - \frac{P_4N_4}{N_1+N_4} = 5.5 - \frac{5.4*10\%}{40\%+10\%} = 4.42 ; SC_2 = P_2 - \frac{P_4N_4}{N_2+N_4} = 5.3 - \frac{5.4*10\%}{30\%+10\%} = 3.95$$

$$SC_3 = P_3 - \frac{P_4N_4}{N_3+N_4} = 5.6 - \frac{5.4*10\%}{20\%+10\%} = 1.80 ; SC_4 = P_4 - \frac{P_1N_1}{N_1+N_4} = 5.4 - \frac{5.5*40\%}{40\%+10\%} = 1.00$$