Market Structure, Welfare and Banking Reform in China*

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Abstract

This paper examines the effects of market deregulation on consumers and state commercial banks in a developing country. I jointly estimate a system of differentiated product demand and pricing equations under alternative market structures. Overall, I find mixed results for the banking reform. Although total surplus of the deposit market increases, some existing consumers experience welfare losses. Encouragingly, the market appears to be better characterized by non-cooperative competitive behavior than collusion, and price-cost margins of some state commercial banks shrink over time. Furthermore, consumers benefit from low prices set by state commercial banks because of government interventions and fixed costs of switching banks faced by consumers. Revenues of state commercial banks have risen in the face of falling price-cost margins as a result of high GDP growth and government policies which favor state commercial banks over other financial institutions. The empirical results show that more branch locations and higher quality employees are valued by consumers; as such, recent branch consolidations and layoffs impose welfare costs on consumers. However, welfare effects are unevenly distributed and losses are skewed towards inland provinces.

Keywords: Banking reform, Banks in China, Demand Estimation, Market Structure.

JEL classifications: G21, L11

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1 Introduction

The role of saving and investment in economic growth is well-established (Barro, 1991). Subsequent works in the finance-development literature suggest that better financial development fosters growth by mobilizing saving, improving capital allocation, monitoring the use of funds and managing risks.[1] Empirical studies also confirm the importance of financial development on macroeconomic outcomes in various stages of development (King and Levine, 1993; Rousseau and Wachtel, 1998). In light of these benefits, many governments have deregulated their banking sectors over the last few decades in an effort to intensify the competition of the banking sector and hence to promote efficiency and productivity.

However, the degree to which different regulatory structures facilitate economic growth through their effect on markets for financial intermediation is less well-understood, particularly for developing countries. This paper attempts to enrich the existing literature by examining banking industry in China, with an emphasis on consumer welfare and market structure in a period with significant banking reforms. There are three reasons for studying the banking sector in China. First, China is a major developing country which has grown at an unprecedented pace and in which banks provide an unusually large share of capital financing.[2] The banking sector in China is important because banks intermediate about 72% of the capital in China, more than double the percentage in US and 1.5 times more than that in other Asian countries (Farrell et al., 2006). If there are persistent effects in per capita income as a result of an under-developed financial system, it will have a strong impact on the global economy.

Second, while economists have looked into banking reforms in China (Barnett, 2004; Dobson and Kashyap, 2006; Allen et al., forthcoming), previous studies have neglected the deposits market. The literature has so far focused on bank restructuring (Ma, 2006), credit pricing (Podpiera, 2006), the effects of informal financial institutions (Allen et al., 2005), and the measurement of non-performing loans (Barnett, 2004). However, there is little discussion on the deposits market, the area of the

[1] Levine (1997) provides an excellent review on the role of financial intermediation for economic growth. Moreover, Beck et al. (2007) provides evidence on financial intermediation reduces income inequality and poverty.

[2] Maddison (1998) documents that the share of world GDP of China increases from 5% in 1978 to 10.9% in 1995. In 2006, China was the world's 2nd largest economy (IMF, 2006).

banking sector which is responsible for resource mobilization. Rousseau (2003) argues that resource mobilization is particularly important in the early stages of development and provides historical evidence from the Dutch Republic, England, and the United States. Looking at India since 1951, Bell and Rousseau (2001) offer evidence which suggests that saving is a pre-condition for improving allocation in developing countries. A related study by Hao (2006) shows that a higher ratio of savings deposits to GDP enhances economic growth of Chinese provinces. Therefore, deposit services are important for economic growth in China because they encourage saving. This paper analyzes the deposit market in the post-reform era in China and provides evidence on changes in consumer welfare and competition among banks.

Third, the evidence on banking reform in China is also relevant to other developing countries. In those countries, capital markets are under-developed and the banking sector is typically the main channel of financial intermediation. Therefore, banks emerge as the primary financial intermediaries to centralize lending and maximize the effectiveness of talent. Barth et al. (2001) and La Porta et al. (2002) document that government ownership of banks is pervasive around the world and in developing countries, in particular. Moreover, banking sectors with a high proportion of government owned banks are generally less stable and less efficient markets for financial intermediation; this results in slower economic growth, financial development and productivity growth (La Porta et al., 2002). However, the existing literature on banking deregulation has focused primarily on developed economies in which government ownership of banks is limited. I examine a developing economy with a large share of government owned banks in order to better understand the effects of policy changes in alternative institutional environments.

My empirical strategy makes inference about consumer preferences and market structure based on observations on bank-level data from four state commercial banks in the deposits market during $1994-2001$. I propose an oligopolistic framework in which banks, offering differentiated products and facing asymmetric costs, maximize profit by setting prices. Product differentiation is an important determinant of market power in that banks develop a wide range of products to create their market niches. I jointly estimate: (i) a differentiated product demand system based on utility maximiza-

tion and (ii) first-order conditions derived from profit-maximizing behaviors of banks. The market structure is identified by goodness-of-fit tests among alternative models of competition. Finally, I also utilize the structural model to analyze the impacts of policy changes on consumer welfare and producer surplus.

Overall, I find mixed results for the banking reform. Although total surplus of the deposit market increases, some consumers experience welfare losses. Encouragingly, the market appears to be better characterized by non-cooperative competitive behavior than collusion, and price-cost margins of some state commercial banks (SCBs) shrink over time.[3] It indicates that competition exists after the banking deregulation even though the market is dominated by SCBs, but further intensification of competition is limited by high administrative barriers to entry and poor financial performance of the state-owned enterprises (SOEs) to which SCBs lend. Strikingly, prices in the deposits market are too low to be consistent with profit maximization, but it benefits consumers. I explore government interventions on subsidizing lending through interest rate regulation, and fixed costs faced by consumers in switching banks as explanations for the observed pricing behavior. Another positive result is that SCBs improve their profits by cutting costs and raising revenues. Part of the reform involves limiting the availability of alternative investments in an effort to maintain the health of SCBs. The combination of policies favoring SCBs over other financial institutions combined with high GDP growth has generated an exogenous increase in SCB profits through larger volume of deposit, even as price-cost margins fall. However, consumer welfare worsens by cost-cutting activities, such as branch consolidations and layoffs, because consumers prefer more branches and better quality employees. In particular, the welfare costs are unevenly distributed and losses fall disproportionately on inland provinces. It highlights the importance of financial market participation in improving welfare.

The remainder of the paper is organized as follows: Section 2 discusses the related literature. Section 3 provides an introduction to Chinese banking industry. Sections 4 and 5 describe the structural model and data, respectively. Section 6 presents the estimation procedures. Section 7

[3] I follow IMF (1996) to use the term state commerical bank rather than state-owned bank to emphasize the commercial nature of state-owned banks after the reform.

report the empirical results. Section 8 utilizes the structural model to perform policy evaluation. Section 9 concludes.

2 Related Literature

Recent empirical literature on banking market structure employs the econometric models developed in the industrial organization literature to analyze market power through demand estimation. Examples include: Ishii (2005), Adam et al. (2007), Dick (2008) and Knittel and Stango (2008) for the U.S., Nakane et al. (2006) for Brazil, Ho (2007) for Hong Kong, Molnar et al. (2007) for Hungary and Molnar (2008) for Finland. In contrast to previous works, my paper uses a random coefficients model of demand, and estimate the demand and first-order condition of pricing jointly. It allows for more flexible substitution patterns across banks rather than relying on pre-defined classification. Moreover, I apply the non-nested test proposed by Rivers and Vuong (2002) to select the market structure based on the GMM criteria from models with alternative market structures.

The demand estimates suggest that the consumer preferences in China are similar to those in the U.S. reported in Dick (2008). Chinese consumers have stronger preferences on branches than employees, but they do not have significant preferences on having more employees in a branch. I suggest it is related to the low employee efficiency of Chinese banks. In terms of pricing behavior, the own-price elasticity of service fees is lower for Chinese banks than that for U.S. banks. It indicates that Chinese banks charge their service fees at a lower level than their counterparts in the U.S. Utilizing the information on household and enterprise deposit,[4] I show that these two groups of consumers have different preferences. Enterprises prefer an extensive branch network, whereas households concern the availability of employees in a branch. Furthermore, firms are significantly more responsive to changes in price.

This paper also contributes to the understanding of the effect of banking deregulation in alternative institutional arrangements. Looking into the post-deregulation era during 1990s, Berger and Mester (2003) argue that U.S. banks raised their prices and hence profits by upgrading prod-

[4]For those studies on the U.S., they only examine total deposit. Both Nankane et al. (2006) and Molnar et al. (2007) look into demand and time deposit.

uct quality rather than increasing market power through consolidation. Dick (2008) argues that these quality improvements following deregulation of branching restrictions result in a net welfare improvement for consumers. On the other hand, after the 1993 regulatory reform removing barriers to entry, Cetorelli and Angelini (2003) show that the banking competition in Italy intensified. This study differs from these three studies by examining the competition among state-owned banks rather than private banks.

In closer relation to my work, Bichsel (2006) finds that the state-owned banks in Switzerland have the same profit objective as private banks. Using a sample of developing economies, Bonin et al. (2005a, b) show that state-owned banks are less efficient in cost and profit than private and foreign banks. In their investigation of the 1992 deregulation of Indian banks, Kumbhakar and Sarkar (2003) find that productivity of state-owned bank did not improve. When considering the banking sector of China, Chen et al. (2005), Kumbhakar and Wang (2005) and Fu and Hefferman (2007) consistently report that SCBs do not significantly improve in efficiency after the deregulation. Research also show that SCBs are less profitable than their competitors. Li et al. (2001) report that the return on assets and return on equity of joint stock banks are higher than those of SCBs. Ariff and Can (2008) and Berger et al. (2008) show that SCBs are less profit efficient than JSBs. Investigating the deposit market in China, this paper suggests that there is competition among SCBs after the reform. However, the pricing behaviors of SCBs seem to be affected by government policies and consumer switching cost.

Finally, this paper adds to the literature on the market structure of banking in China. Following Berger (1995), Fu and Hefferman (2008) employ the structure-performance approach[5] to show that SCBs have market power even though they are less efficient and less profitable.[6] On the other hand, Zhao et al. (2005) and Yuan (2006) use the Panzar and Rosse (1987) approach[7] to show that

[5] In the structural-performance approach, profitability is regressed on concentration and efficiency indices to examine market power hypothesis and efficient structure hypothesis, respectively. However, Bresnahan (1989) argues that the price, profit and concentration are jointly determined in equilibrium, thus the regression in the structural-performance approach is endogenous.

[6] Weaker profitability does not imply weak market power because it can also be attributed by poor efficiency of SCBs.

[7] In Panzar and Rosse (1987), they perform a regression of total bank revenue on input prices of capital, deposits and employees. The sum of the coefficients of the input prices from the revenue regression, known as Panzar-Rosse statistic, is the sum of the elasticity of total revenue with respect to input prices. If this statistic is less than one, it indicates monopoly power. However, their approach requires not only the market be in long run equilibrium, but also

while the banking industry is characterized by monopolistic competition, the degree of competition diminishes over time. However, no paper in the existing literature considers the welfare implications of the deregulation and policy changes. Using a structural model of demand and pricing, this paper provides a unified framework to study the market structure, product differentiation and consumer welfare. Moreover, the model can be used to conduct welfare analysis of policies such as branch consolidation and layoffs.

3 Chinese Banking Industry and its Reform

Banking industry reform in China has been ongoing since 1978 and continues today.[8] The reform set up a two-tier banking system by transforming the People's Bank of China (PBC) into the central bank of China and establishing specialized banks including four SCBs: Agricultural Bank of China (ABC), Bank of China (BOC), China Construction Bank (CCB) and Industrial and Commercial Bank of China (ICBC).[9] Moreover, there are joint-stock banks (JSBs), city commercial banks, and non-bank financial institutions. Non-bank financial institutions include trust and investment companies, the rural credit cooperative societies, and urban credit cooperative societies. The market was highly regulated and the deposit and loan markets were monopolized by the PBC until 1978. Since then, the SCBs have occupied a large share of these two markets.

In the first phase of the reforms from 1979 to 1993,[10] SCBs were heavily involved in lending to infrastructure projects and to SOEs (in sectors with priority). Most of the funding was provided by SCBs to projects regardless of their earning prospects, and as a result these banks accumulated a large volume of non-performing loans.[11] After the second phase of the reforms began in 1994, three policy banks – China Development Bank, Export-Import Bank of China, and Agricultural

places restrictive assumptions on cost structure in order to infer market structure.

[8] In this section, I focus on market structure of deposit market and interest rate deregulation. See Shirai (2002), Dobson and Kashyap (2006), Podpiera (2006) and Allen et al. (forthcoming) for detailed discussions on banking industry in China.

[9] The BOC established as a private bank in 1912. The ABC, CCB and ICBC were established in 1951, 1954, and 1984, respectively.

[10] In 1993, according to Almanac of China Finance and Banking (1994), the State Council announced the second stage of banking reform in the "Decision on Financial System". Thus, I refer the second stage of banking reform started in 1994

[11] Sapienza (2004) and Dinc (2005) shows that lendings of state-owned banks are driven by political motives other than economic motives.

Development Bank of China – were set up to take up the role of government lending for the aforementioned four SCBs. Reforms continued with the passing of the 1995 Commercial Banking Law which placed responsibility for profitability and assessment of credit worthiness on banks.[12] Table 1 shows that, beginning in 1996, the interest rate was deregulated gradually for lending, but deposit rate remained fixed at the official benchmark rate set by the PBC until 2004. However, the PBC maintains a positive interest rate spread between the benchmark rates of lending and the deposit in order to provide subsidies to SCBs and encourage lending to SOEs.

Table 1
Interest Rate Deregulation

Year	Loan	BR	Deposit	BR
1993	All 0.9-1.2 of BR	10.98	All = BR	10.98
1996	All 0.9-1.1 of BR	10.08	All = BR	7.47
1998	Medium/Large: 0.9-1.1; Small: 0.9-1.2 of BR	7.92	All = BR	5.22
1999	Large: 0.9-1.1; Small/Medium: 0.9-1.3 of BR	5.85	All = BR	2.25
Jan2004	All 0.9-1.7 of BR	5.31	All = BR	1.98
Oct2004	0.9 - No Upper limit	5.58	No Lower limit - BR	2.25

Sources: Shirai (2002) and Podpiera (2006).
Note: BR = Benchmark rate of lending and deposit rates set by the PBC for maturity = 1 year; Unit: %

Although banks are asked to maximize profit, SCBs are still state-owned and continue to be affected by policy directives.[13] On the one hand, SCBs can exercise market power by exploiting their dominant market shares, which results in higher prices. On the other hand, the policy-directed lending provides incentives for SCBs to attract large quantities of deposits in order to support the scale of their loans. Moreover, the subsidies created by interest rate regulation reduce the effective marginal costs of banks. These policies undermine their incentives to set high prices in deposit market because SCBs can maintain their profits by taking advantage of the profit opportunities in loan market.[14] This paper analyzes the effects of gradual reform in banking industry since 1994 by examining the overall impact on bank behavior, consumer welfare and competition.

[12] The law was passed on 10 May 1995 in the People Congress and effective on 1 July, 1995. These two items are listed on the chapter 1, article 4 and article 9 of the law, respectively. See IMF (1996) and Tokley and Ravn (1997) for details.

[13] No privatization was taken place in the banking reform.

[14] Moreover, there are short term policies which further hinder the incentive to set higher prices. For example, in 1995, the Ministry of Finance subsidized the interest expense due to the value guarantee program which index the deposit rate to inflation since 1988.

The domestic banking sector has actively financed the economic development of China since the onset of economic reform in 1978. Deregulation of the banking sector was one of the conditions for China's 2001 accession to World Trade Organization. The implementation of deregulation in 2006 opened up the banking market to competition from foreign banks which were previously highly limited in their role. The structural model developed in this paper provides an useful tool for analyzing banking policy, such as introduction of new foreign banks and consolidation through merger and acquisition.

4 Data and Descriptive Statistics

The data come from various issues of *Almanac of China Finance and Banking* (the Almanacs, hereafter) and *China Statistics Yearbook* (the Yearbooks, hereafter). Data on balance sheets, income statements, provincial deposits, branches and employees are obtained from the Almanacs. Provincial demographic and economic data are obtained from the Yearbooks. The sample includes annual observations from 1994 to 2001. Owing to the problem of missing data for ICBC, I exclude (1) year 1997; (2) the Tibet province and (3) Chongqing for year 1994-1996. Consequently, the sample has 828 observations at the level of bank-market-year. Appendix 1 reports the descriptive statistics of variables used in the empirical analysis.

4.1 Definition of a Market

SCBs provide deposit services in each provincial market in China.[15] In 1997, Chongqing was redefined to be a municipality and hence there are 30 provinces before 1997 and 31 thereafter. The definition of a market at the provincial level is supported by three reasons. First, competitors are more homogenous within a province than across provinces. Many domestic or foreign banks only operate in limited number of provinces, thus SCBs face different sets of competitors in different provinces. Second, potential consumers are more similar within a province than those across provinces (i.e., through large variation in per capita income across provinces). Third, banks in differ-

[15] The People's Republic of China administers 33 provincial level divisions, including 22 provinces, 5 autonomous regions, 4 municipalities, and 2 special administrative regions. I exclude the special administration regions, namely Hong Kong and Macau, due to their different economic structures.

ent provinces are separated by a huge geographical distance, which imposes a high transaction cost on potential consumers to deposit in a bank in another province.[16] The descriptive statistics on real GDP, real GDP per capita, agricultural share of GDP and population and population density (i.e., population per square kilometer).suggest that it is important to control for market characteristics in the estimation.

4.2 Market Size and Market Share

I use total provincial deposits[17] in financial institutions from the Yearbooks to measure market size of market m in year t, H_{mt}.[18] To compute market share, I divide the deposits of each SCB by the market size in each market-year. Let q_{jmt} be the quantity of deposits held by bank j, $S_{jmt} \equiv q_{jmt}/H_{mt}$ is the market share of bank j and $s_{0mt} \equiv 1 - \sum_{k=1}^{N} s_{kmt}$ is the market share of the outside good.

The market shares in Table 2 are computed by averaging the market shares of each bank across provinces. In year 1994, the SCBs have more than 70% of the deposit market. The ICBC has the largest market share in the deposit market. Over the sample period, the market share of the SCBs fell from about 72% to 67%. Most of the loss in SCB market shares was acquired by JSBs, the primary domestic competitors.[19] In particular, the market share of the ABC and the ICBC decreased by more than 3%.

[16] In the case of the U.S., Amel and Starr-McCluer (2002) document that people open their deposit accounts in a bank close to their home.

[17] The ratios of saving to total deposit are computed for each market-year for SCBs. Then, I divide the provincial saving deposit by that ratio to obtain the total provincial deposit.

[18] I can follow Dick (2008) and use the deposit per capita and provincial population to compute the potential market size. However, the population in the Yearbooks is the number of people registered as official residents in the province, it does not include immigrants from other provinces. Using the official data will underestimate the residential population for economically prosperous provinces with immigrants and overestimate those areas with migrants. Moreover, people have multiple deposit accounts in high income provinces. Therefore, the official population may not be appropriate for measuring market size.

[19] Market shares of JSBs in year 1994 and 2001 are 7% and 12%, respectively. Moreover, foreign Banks have less than 1% of market share. Source: Almanac of China Finance and Banking.

Table 2
Sample Statistics, 1994-2001

	Market Share		Branch		Employee		Service Fees	
Bank	**1994**	**2001**	**1994**	**2001**	**1994**	**2001**	**1994**	**2001**
ABC	19%	16%	2182	1464	18840	16198	0.05%	0.09%
BOC	7%	8%	435	417	6357	6051	0.29%	0.21%
CCB	15%	17%	361	429	11018	10457	0.13%	0.14%
ICBC	31%	26%	1277	945	19323	14284	0.04%	0.09%

Note: Branch and Employee are computed by averaging across provinces

4.3 Price

The service fee is computed as the ratio of income from commissions to total deposits. The income from commissions[20] and total deposits are obtained from income statements and balance sheets, respectively. The service fee includes fees for transferring money between accounts, trading securities and foreign currencies, managing assets and using bank cards. The data from financial reports are aggregated across provinces at the bank level, and thus the service fee of each bank does not vary across provinces (i.e., $p_{jmt} = p_{jt}$). The average service fee and benchmark rate of deposit are 0.14% and 1.9%, respectively, so that consumers pay about 7% of their deposit interest as service fees.[21]

4.4 Observed Characteristics

I use two bank characteristics, namely branches and employees at provincial level, to proxy service quality provided by SCBs. Since the branch and employee data is available at the provincial level, it has variation at the level of bank-market-year. The observed characteristics included are employees per branch and branch density (the ratio of the number of branches in a province to the area of that province in square kilometers). The density of branches and employees per branch captures the convenience of banks' location and the efficiency of branch operation, respectively. Second, I sum

[20] The commission fee of BOC during 1994-1996 is recorded together with other income sources such as non-operating income. I extract the income from commission from the data by using the ratio of commission fee to other incomes in 1996, i.e. 0.2.

[21] All banks provide the same deposit rate to consumers according to the benchmark rate set by the PBC. The price competition in deposit rate is restricted to SCBs and non-interest bearing investment vehicles. Moreover, the deposit rate is not used in the estimation because time dummies are employed.

the number of branches across the country to obtain the total number of branches, which proxies for the branch network size provided to consumers. This characteristics varies across bank-year observations, but not across provinces. Table 2 reports that the average number of branches and employees are lower at the end of the sample. Moreover, the service fees are generally higher in year 2001. Since the demand system suggests that changes in market share can be driven by changes in service quality and price, Table 2 provides preliminary evidence that changes in market shares are related to lower service quality and higher service fees. I also use total asset of each SCB as a control variable to capture the size effect of bank related to deposit demand. In practice, I construct this variable by computing the deviation of total asset of each bank to the average total asset.

4.5 Demographic Variable

To control for heterogeneity in consumer preferences, I utilize household income as a control variable. Following Nevo (2001), I simulate draws for the income of household i in province m, y_{im}, from an empirical distribution. The distribution is, in this case, from the *Household Income Distribution Survey 1995*, conducted by the Institute of Economics, Chinese Academy of Social Sciences. There are 6,930 households from 11 provinces, including Beijing, Shanxi, Jiangsu, Liaoning, Anhui, Henan, Hubei, Guangdong, Yunan, Sichuan, and Gansu. Meng (2004) compares the survey distribution to summary statistics from the confidential population distribution held by the National Bureau of Statistics and finds that they are close. Since there are 31 provinces in the bank sample and only 11 provinces in the income survey, I match provinces in the survey to the closest province in my sample by categorizing the provinces into three groups: eastern, central and western regions. Within each of these three regions, provinces in the bank sample are matched to provinces in the income survey by income level.

5 Model

The specification and estimation of the demand system follows Berry et al. (1995) and Nevo (2001) and is based on the aggregation of heterogeneous consumers' discrete choices. Employing

demand models based on product characteristics has the advantage of avoiding a large number of free parameters due to cross-price elasticities. In this paper, I model the demand for deposit services.[22] Deposit market is less subject to government intervention, whereas the lending behavior of SCBs are influenced by government policy.[23] Therefore, I focus on deposit demands because they are less subject to government intervention. The supply side is modelled under the assumption that profit-maximizing banks take into account the cross-price effects among SCBs. In the remainder of this section, I outline the model for demand deposit services and the banks' optimization decision.

5.1 Demand

The market is defined as the market for deposits in Chinese provinces, and thus the industry consists of four SCBs and M local markets. I index provincial markets by m and banks by j.[24] In a province, consumers choose to use deposit services from one of the SCBs (inside goods) or the outside good. Consumers with deposit accounts use not only the saving services, but also other services provided to account holders such as asset management, security and foreign currency trading and bank card services. The indirect utility function of a consumer i who uses deposit services from bank j in market m is:

$$\begin{aligned} u_{ijm} &= -\alpha_i p_{jm} + x_{jm}\beta + \xi_{jm} + \varepsilon_{ijm} \\ &\equiv V_{ijm} + \varepsilon_{ijm} \end{aligned} \tag{1}$$

where p_{jm} is the service fee of bank j, x_{jm} is a K-dimensional row vector of observed product characteristics of bank j (including the benchmark rate of deposit), and ξ_{jm} represents the unobserved product characteristics of bank j. The product characteristics represent the service quality provided by banks, such as the convenience of local branches and waiting time for being served at a branch. The consumer-specific preference is captured by the income of consumer i, y_{im}, and a deviation specific to bank j in province m, ε_{ij}. The deviation is assumed to be a mean zero stochastic term with i.i.d. extreme value Type 1 distribution.[25]

[22] Because provincial level data is only available for 4 SCBs, I cannot compare different types of financial institutions as Adams et al. (2007) did for U.S.

[23] The central planning through a credit quota implemented by SCBs was terminated in 1998. Park and Sehrt (2001) and Podpiera (2006) suggest that, after the banking reform, the importance of policy lending by state banks was still pervasive and lending by financial institutions did not respond to economic fundamentals.

[24] I suppress the time subscript in this section for simplifying the notation.

[25] It seems iid is a questionable assumption for ε_{ijm} since many households deposit more than once in a year. Rysman (2004) argues that it can be justified by a less restrictive assumption. In the case of deposit demand, I can

The utility for the outside good is

$$u_{i0m} = \sigma v_{i0m} + \varepsilon_{i0m} \tag{2}$$

where the index of the outside good is $j = 0$. The outside good captures utility from using the services of other financial institutions or not using any banking services at all. In the provinces with high income, the main competitors in the outside good are joint stock banks. In the agricultural provinces, the competition comes primarily from rural credit cooperatives. Heterogeneity in the outside good is captured by σv_{i0m}, which allows the unobserved variance in the idiosyncratic component of the outside good to be larger than that of the inside good.

This specification is different from those in the literatures (such as Dick, 2008) in two aspects. First, the interest rate paid by SCBs is fixed by the central bank and does not vary across banks, in contrast to studies using data from other countries. Consequently, price competition among banks is restricted to service fees. Second, the specification $\alpha_i \equiv \frac{\alpha}{y_{im}}$ allows a high price to have a smaller impact on the utility of a rich consumer. As a result, consumers with high income are less price elastic than consumers with lower income. This implies high income consumers are more likely to pay high service fees to use banks with better services.

As shown in Nevo (2001), the utility can be decomposed as follows:

$$\begin{aligned} u_{ijm} &= \delta(p_{jm}, x_{jm}, \xi_{jm}; \beta) + \mu(p_{jm}, x_{jm}, v_{im}, y_{im}; \theta_d) + \varepsilon_{ijm} \\ &= \delta_{jm} + \mu_{ijm} + \varepsilon_{ijm} \end{aligned} \tag{3}$$

where $\delta_{jm} = x_{jm}\beta + \xi_{jm}$ is the mean utility. The $K + 2$ dimensional vector $\theta = (\beta, \alpha, \sigma)$ represents the demand parameters, in which $\beta = (\beta_1, ..., \beta_K)$ is the set of parameters that associates mean utility with bank characteristics, and $\theta_d = (\alpha, \sigma)$ is the set of parameters associated with consumers' preference. Therefore, $\delta(p_{jm}, x_{jm}, \xi_{jm}; \beta)$ is independent of consumer characteristics, whereas $\mu(p_{jm}, x_{jm}, v_{im}, y_{im}; \theta_d)$ is a function of consumer characteristics.

It can be shown that the probability of an individual using bank j can be written as:

$$s_{ijm} = \frac{\exp\left(\delta_{jm} + \mu_{ijm}\right)}{1 + \sum_{k=1}^{J} \exp\left(\delta_{km} + \mu_{ikm}\right)} \tag{4}$$

allow ε_{ijm} to be correlated within a household, but require that is uncorrelated with the amount of money a household needs to deposit.

These conditions describe the unit demand of an individual consumer and define the set of unobservables that results in using bank j for deposit services as

$$A_{jm} = \{(\varepsilon_{ijm}, v_{im}, y_{im}) | u_{ijm} \geqslant u_{ijk} \ \forall k = 0, 1, .., J\} \tag{5}$$

Consumer i chooses bank j if and only if u_{ijm} is greater than the utility associated with other alternatives. To obtain aggregate demand, I have to integrate individual demands over the idiosyncratic variables $(\varepsilon_{ijm}, v_{im}, y_{im})$. Assuming ties occur with zero probability, the market share of bank j in market m is determined by the probability ε_{ijm} belongs to the set A_{jm} for all consumers. It is given by

$$s_{jm}(p_{jm}, x_{jm}, \xi_{jm}; \theta_d) = \int_{A_{jm}} dP(\varepsilon_m, y_m, v_m) \tag{6}$$

where P is the distribution function of ε_m, v_m, and y_m. The demand of bank j in market m is obtained by $s_{jm}(p_{jm}, x_{jm}, \xi_{jm}; \theta_d)H_m$ where H_m is the market size of market m.

5.2 Supply: Nash-Bertrand Equilibrium

Assume SCBs compete in a Bertrand fashion to set prices at the national level. Pricing decision is made at the national level rather than provincial level is consistent with SCBs became more prudent after the banking reform since 1994. This pricing policy reduces the influence of local governments, which concern more about local welfare rather than bank profitability, on price setting.[26] Banks collect funding by paying the benchmark deposit interest rate, r^d, and incur marginal cost, mc_j. On the revenue side, banks earn the benchmark lending interest rate on loans, r^l, and charge service fee, p_j, on deposits. Since the interest rates are regulated, each SCB sets the service fee on deposit to maximize profit

$$\sum_m \pi_{jm} = \sum_m (r^l - r^d + p_j - mc_j) s_{jm}(p, x_m, \xi_m; \theta_d) H_m - F_j \tag{7}$$

where $x_m = \{x_{1m}, .., x_{4m}\}$, $\xi_m = \{\xi_{1m}, .., \xi_{4m}\}$ and F_j is the fixed cost. I assume the lending rate is fixed across banks within a year. Although the lending rate can be set by SCBs within a band around the benchmark lending interest rate, Dobson and Kashyap (2006) documents that lending

[26] In order to reduce the influence of local governments on SCBs, the headquarter of each SCB obtains the power to appoint branch manager instead of sharing the rights with local governments. See Shirai (2002).

rates chosen by most of the banks cluster around the benchmark rate. Podpiera (2006) argues that this is the result of poor credit pricing. The first-order condition for profit maximization of bank j, which equalizes marginal revenue and marginal cost, is derived as follows[27]

$$p_j + \left(\sum_m \frac{\partial s_{jm}(p, x_m, \zeta_m; \theta_d)}{\partial p_j} H_m \right)^{-1} \sum_m s_{jm}(p, x_m, \xi_m; \theta_d) H_m \quad = \quad mc_j - (r^l - r^d) \tag{8}$$

The terms on the right-hand side of the equation characterize the effective marginal cost of bank j. It includes the subsidy from the central bank through interest rate spread between lending and deposit rates, $-(r^l - r^d)$. The subsidy also highlights the effect of the connection between lending and deposit markets on pricing decisions of banks.

5.3 Supply: Monopoly

In order to assess the competition among SCBs, I compare the Nash-Bertrand equilibrium to the monopoly outcome. In a monopoly arrangement, SCBs agree with each other to set service fees to maximize the joint profit of all SCBs. Monopoly pricing enables SCBs to set higher prices than those in the Nash-Bertrand equilibrium because SCBs internalize the substitution effects of demand while setting their service fees. The profit function of the joint monopoly is

$$\begin{aligned} \sum_m \sum_j \pi_{jm} \quad &= \quad \sum_m (r^l - r^d + p_j - mc_j) s_{jm}(p, x_m, \xi_m; \theta_d) H_m - F_j \\ &+ \quad \sum_m \sum_{k \neq j} (r^l - r^d + p_k - mc_k) s_{km}(p, x_m, \xi_m; \theta_d) H_m - F_k \end{aligned} \tag{9}$$

The first-order conditions for profit maximization of the monopoly are derived as follows

$$\begin{pmatrix} p_1 \\ \vdots \\ p_4 \end{pmatrix} + \Delta_d^{-1} \begin{pmatrix} \sum_m s_1(p, x_m, \xi_m; \theta_d) H_m \\ \vdots \\ \sum_m s_4(p, x_m, \xi_m; \theta_d) H_m \end{pmatrix} \quad = \quad \begin{pmatrix} mc_1 \\ \vdots \\ mc_4 \end{pmatrix} - \begin{pmatrix} r^l - r^d \\ \vdots \\ r^l - r^d \end{pmatrix} \tag{10}$$

where

$$\Delta_d \quad = \quad \begin{pmatrix} \sum_m \frac{\partial s_{1m}(p, x_m, \zeta_m; \theta_d)}{\partial p_1} H_m & \cdots & \sum_m \frac{\partial s_{4m}(p, x_m, \zeta_m; \theta_d)}{\partial p_1} H_m \\ \vdots & & \vdots \\ \sum_m \frac{\partial s_{1m}(p, x_m, \zeta_m; \theta_d)}{\partial p_4} H_m & \cdots & \sum_m \frac{\partial s_{4m}(p, x_m, \zeta_m; \theta_d)}{\partial p_4} H_m \end{pmatrix} \tag{11}$$

[27] Assume the existence of a pure strategy equilibrium and strictly positive service fee at equilibrium.

The off-diagonal elements in Δ_d capture the fact that SCBs internalize the substitution effects when setting their service fees.

6 Estimation

In this section, I specify the parametric forms for demand and cost functions. Estimation of the static model can be divided into two parts: demand and pricing. The main task of the demand estimation is to obtain the mean utility of bank services provided to consumers; this is then used to recover the preferences consumers have over bank service characteristics. Similarly, the pricing side makes use of the first-order conditions of optimal pricing in order to estimate marginal cost. In the estimation, I also exploit the interaction between the demand and cost (or pricing) side of the problem: both equations are estimated jointly.

6.1 Demand System

The estimation exploits the system of equations provided by $s_{jmt} = s_{jmt}(\delta_{jmt}; \theta_d)$. It searches for a set of parameters θ_d which matches observed market share, s_{jmt}, to the predicted market share from the model, $s_{jmt}(\delta_{jmt}; \theta_d)$. Given the initial estimate $\theta_d = \{\alpha, \sigma\}$, the predicted market share is computed by aggregating the potential consumer choices

$$s_{jmt}(\delta_{jmt}; \theta_d) = \int\int \frac{\exp\left(\delta_{jmt} + \mu_{ijmt}\right)}{1 + \sum_{k=1}^{J} \exp\left(\delta_{kmt} + \mu_{ikmt}\right)} dP(y_{im}) dP(v_i) \tag{12}$$

Berry et al. (1995) suggests that the integration can be computed by simulation. Monte Carlo draws from the density $P(v_i)$ are standard normal, and draws from the density $P(y_{im})$ are obtained from an empirical distribution in the Chinese Household Income Survey.

$$s^{ns}_{jmt}(\delta_{jmt}; \theta_d) = \sum_{i=1}^{ns} \frac{\exp\left(\delta_{jmt} + \mu_{ijmt}\right)}{1 + \sum_{k=1}^{J} \exp\left(\delta_{kmt} + \mu_{ikmt}\right)} \tag{13}$$

Moreover, Berry et al. (1995) show that δ_{jmt} can be found by using the contraction mapping

$$\delta^{new}_{jmt} = \delta^{old}_{jmt} + \ln(s_{jmt}) - \ln(s^{ns}_{jmt}(\delta^{old}_{jmt}; \theta_d)) \tag{14}$$

where s_{jmt} is the actual market share of bank j and s^{ns}_{jmt} is the market share predicted by the model based on the random draws $\{y_{im}, v_i\}_{i=1}^{ns}$. Normalizing the mean utility of the outside alternative to be zero, the linear component to mean utility is

$$\delta_{jmt} \equiv x_{jmt}\beta + \xi_{jmt} \tag{15}$$

where the vector of exogenous bank characteristics and demographic variables x_{jmt} is

$$\begin{aligned} x_{jmt} \equiv & \ (\ \textit{Employee per Branch}_{jmt},\ \textit{Branch Density}_{jmt},\ \textit{Total Branches}_{jt}, \\ & \textit{Total Asset}_{jt},\ \textit{Agricultural Share of GDP}_{mt},\ \text{real } \textit{GDP}_{mt}\ ) \end{aligned} \tag{16}$$

The demographic variables capture two factors which are important determinants of demand. First, they represent the strength of other competitors included in the outside good (i.e., competitors in poor agricultural areas may have very different characteristics from wealthier coastal regions). Second, demographic variables capture variation across provinces preferences over SCB characteristics (i.e., which would allow people in rural provinces to trust SCBs more than other banks). I also employ several sets of dummy variables to control for unobserved product characteristics. The unobserved product characteristics can be decomposed as

$$\xi_{jmt} = \xi_j + \xi_m + \xi_t + \zeta_{jmt} \tag{17}$$

where ξ_j is a dummy variable which captures the time-invariant value of bank j relative to other banks in the market, ξ_m is a province dummy which captures heterogeneity in preferences across provinces, ξ_t is a time dummy which captures changes in macroeconomic conditions which affect all banks at time t, and ζ_{jmt} is a bank-market-year dummy for unobserved product characteristics.

6.2 Pricing Equation

I assume a linear functional form for the effective marginal cost function for bank j in year t which is given by

$$mc_{jt} - (r^l - r^d) = c_{jt}\theta_s + \omega_{jt} \tag{18}$$

where θ_s is a vector of parameters to be estimated. Marginal cost is a function of bank and time dummy variables included in the vector c_{jt} and the random cost shock ω_{jt}. The bank dummy

captures the effects of unobserved differences in the cost of providing services across banks. Both the bank and time dummies capture the subsidy provided by the central bank through the interest rate spread between lending and deposit rates.

6.3 Estimation Methodology

Following Berry et al. (1995), I use the Generalized Method of Moments (GMM) estimation procedure. The estimation procedure is as follows: Let $z = (z_d, z_s)$ be the set of instruments to be used, where z_d and z_s are the instruments for the demand and pricing equations, respectively. For the pricing equation, $z_s = c$ because no instrument is required. I assume z is exogenous and independent of the error terms in the demand and pricing equations and therefore z_d and z_s are correspondingly orthogonal to ζ and ω. Utilizing the conditions $E(z_d'\zeta) = 0$ and $E(z_s'\omega) = 0$, I construct the following set of moments

$$m \quad = \quad \begin{bmatrix} z_d'\zeta \\ z_s'\omega \end{bmatrix}. \tag{19}$$

Define $\theta = \{\theta_d, \theta_s\}$ and the GMM estimator given my moment conditions is defined as

$$\min_{\theta} \; m'\Omega m \tag{20}$$

where Ω is the optimal weighting matrix. The joint estimation of demand and pricing equations has two advantages. First, market shares enter both demand equations and first-order conditions. It imposes a cross-equation restriction on the coefficient on service fees. Second, there is a gain in efficiency from exploiting the correlation in the error structure induced by the service fee.

Note that the first-order conditions are only used to determine whether the data is better explained by the Nash-Bertrand price competition or the joint monopoly outcome. In order to maintain the robustness of other results such as demand elasticity, price-cost margin and consumer welfare, I only apply enough instruments to just-identify the first-order condition so that it does not affect the point estimates of the demand parameters.[28]

[28] This method is also used in Rysman (2004), but it is different from Berry et al. (1995) in which they make use of first-order condition to identify the coefficient on price. In my case, the estimates of the demand parameters from the joint estimation of demand and pricing equations are almost identical to those obtained from estimation of the demand equation alone.

6.4 Instruments

Equilibrium prices depend on the observed and unobserved product characteristics, and therefore the regressors p_{jt} are correlated with the unobservables ζ_{jmt}. The correlation is positive and therefore the OLS estimator of α is biased toward zero (i.e. it underestimates own-price elasticity). I handle this endogeneity problem using the instrumental variables approach. To estimate the demand equation, I use the following set of instruments to identify the coefficients for service fees and consumer heterogeneity

$$\begin{aligned} z_{d,jmt} \equiv \quad & (\ Interest\ Expense_{jt},\ Operating\ Expense_{jt},\ Loan/Asset_{jt},\ Cash/Employee_{jt}, \\ & Equity/Employee_{jt},\ rival\ Employee\ per\ Branch_{jmt},\ rival\ Branch\ Density_{jmt}\ ) \end{aligned} \tag{21}$$

The instruments consist of several cost shifters as in Dick (2008). Cost shifters are valid instruments because they affect service fees through the pricing equations but are unrelated to the unobserved product characteristics. The first cost shifter is the input price of deposits. Although the deposit rate is fixed by the central bank, this rate is different for different deposit maturities; as bank deposits differ in their maturities, the effecive deposit rate varies across banks at each point in time. The second cost shifter is the input price of labor. Since wage and salary expenses are included in operating costs, I proxy for the input price of labor through the ratio of operating costs to total employees. Operating expenses are obtained from the income statements of each bank. In estimation, I normalize these variables by total number of employees.[29]

Credit risk variables are included in the second group of cost shifters. Banks with high levels of credit risk may require higher costs of operation and auditing which shift up the cost function. To proxy for credit risk, I use the ratio of loans to total assets. Additionally, liquidity variables are informative about credit risk and hence the cost function. I use the ratio of cash to total employment and equity to total employment to proxy the liquidity of the banks. The variables in this group of cost shifters are obtained from the balance sheets of banks in the Almanacs.[30]

[29] The non-operating and commission expenses are used to capture other parts of cost. However, they do not provide any further effect on controlling endogeneity in price.

[30] Yuan (2006) and Zhao (2005) use this variable in the Panzar-Rosse regression for input price of labor.

I also use a set of markup shifters, which include the product characteristics of other banks as instruments (Berry et al., 1995). I construct this set of instruments using the average observed characteristics of rival banks in each market. Given that product characteristics are exogenous, these instruments are orthogonal to unobserved product characteristics. Service fees are determined by the location of banks in characteristics space. For example, the service fee of a bank is lower if it faces a close competitor than if it does not.[31]

Appendix 1 reports the descriptive statistics of instruments, and Appendix 2 presents the results from OLS regressions of service fees on bank characteristics and costs instruments.[32] The R^2 statistic is high at 0.46 and an F-test rejects joint insignificance of the all variables at 5% confidence level. Therefore, cost shifters therefore provide exclusion restrictions that can be used to identify service fees.

6.5 Market Structure

As suggested by Nevo (1998), I employ measures of goodness of fit of these alternative specifications to make inference about the underlying competitive behavior among banks. I apply the Rivers and Vuong (2002) test for model selection among non-nested models. The test statistic is based on the difference between the GMM objective function values, normalized by sample size, $\sqrt{N}(Q(\theta_m) - Q(\theta_c))$, and has an asymptotically normal distribution with variance σ_Q^2.[33] Therefore

$$\frac{\sqrt{N}(Q(\theta_m) - Q(\theta_c))}{\sigma_Q^2} \quad \sim \quad N(0,1) \tag{22}$$

[31] In practice, the results do not improve any further when the average of total number of branches of other banks is added as an instrument. Therefore, I do not include it in the instrument set.

[32] In practice, the product characteristics of competitors are only useful for identifying the random coefficient on the intercept term.

[33] The test statistic is based on the values of the first step GMM objective function in which both models have the same weighting matrix, called A_N. Define m_j be the vector of moment conditions for observation j. The standard error of the test statistic is given by

$$\begin{aligned}
\sigma_Q^2 &= 4(\sigma_m^2 + \sigma_c^2 - 2\sigma_{mc}^2) \\
&\textit{where} \\
\sigma_m^2 &= (\frac{1}{N}\sum_{j=1}^{N} m_j(\theta_m))' A_N (\frac{1}{N}\sum_{j=1}^{N} m_j(\theta_m) m_j(\theta_m)') A_N (\frac{1}{N}\sum_{j=1}^{N} m_j(\theta_m)) \\
\sigma_c^2 &= (\frac{1}{N}\sum_{j=1}^{N} m_j(\theta_c))' A_N (\frac{1}{N}\sum_{j=1}^{N} m_j(\theta_c) m_j(\theta_c)') A_N (\frac{1}{N}\sum_{j=1}^{N} m_j(\theta_c)) \\
\sigma_{mc}^2 &= (\frac{1}{N}\sum_{j=1}^{N} m_j(\theta_m))' A_N (\frac{1}{N}\sum_{j=1}^{N} m_j(\theta_m) m_j(\theta_c)') A_N (\frac{1}{N}\sum_{j=1}^{N} m_j(\theta_c))
\end{aligned}$$

where $Q(\theta_m)$ and $Q(\theta_c)$ are the GMM criteria of the collusive model and the competitive model, respectively. If $Q(\theta_m)$ is significantly larger than $Q(\theta_c)$, then the test statistics indicates that the competitive model provides a better description of the equilibrium outcome revealed in the data. On the other hand, if $Q(\theta_m)$ is significantly smaller than $Q(\theta_c)$, then the test statistics indicates that the collusive model is a better description of the equilibrium outcome revealed in the data.

7 Empirical Results

In this section I discuss the results obtained from logit demand followed by a presentation of the results of the full model, as described in the previous section. This is followed by an analysis of the estimated demand elasticities, consumer preferences and consumer welfare. Then, I employ the structural model to analyze market structure.

7.1 Parameter Estimates

Before proceeding to the estimation of the full model described in the previous section, I use a logit demand to analyze the explanatory power of bank characteristics on market shares and to examine the usefulness of the instruments to control for endogeneity. The results from OLS and IV estimations on logit demand are reported in Table 3. In this case, the model is simplified to

$$\ln(s_{jmt}) - \ln(s_{0mt}) \quad = \quad x_{jmt}\,\beta - \alpha\,p_{jt} + \xi_{jmt} \tag{23}$$

The R^2 of the OLS estimation is 0.87 which implies about 90% of the mean utility is explained by the observed bank characteristics, service fees and other control variables. The coefficient on service fees becomes more negative when IV estimation is used to control for endogeneity. The estimated influence of bank characteristics on mean utility are not affected significantly by the IV estimation. This suggests that unobserved product characteristics create endogeneity for service fees in the OLS estimation, and methods which do not control for endogeneity may understate the importance of service fees.

Table 3
Logit Demand

Variable	OLS	IV	IV-H	IV-E
Emp per Branch	0.001	0.001	0.004	0.001
	(0.002)	(0.002)	(0.002)*	(0.002)
Bdensity	7.708	7.707	13.119	3.510
	(1.362)*	(1.363)*	(1.363)*	(1.659)*
Total Branch	0.067	0.073	0.027	0.122
	(0.027)*	(0.029)*	(0.029)	(0.035)*
Service Fee	−56.29	−76.42	9.149	−226.27
	(16.79)*	(35.27)*	(35.29)	(42.95)*
Total Asset	−0.049	−0.027	−0.084	−0.486
	(0.108)	(0.114)	(0.114)	(0.138)*
Real GDP	61.21	61.18	104.87	−84.30
	(27.71)*	(27.73)*	(27.75)*	(33.77)*
Agricultural Share of GDP	2.183	2.184	2.249	−0.456
	(0.568)*	(0.569)*	(0.569)*	(0.693)
Bank Dummies	*Yes*	*Yes*	*Yes*	*Yes*
Province Dummies	*Yes*	*Yes*	*Yes*	*Yes*
Time Dummies	*Yes*	*Yes*	*Yes*	*Yes*
R^2	0.87	0.87	0.86	0.83

Observation = 828. Dependent variable: ln(s_{jmt}) - ln(s_{0mt}).
Note: OLS and IV use total deposit for s_{jmt}; IV-H and IV-E use household deposit and enterprise deposit for s_{jmt} ,respectively
*Estimated standard error are in parentheses; * significant at 5% level*

To allow for more flexible patterns of substitution among banks, I use a random coefficients demand specification. I extend the logit model to incorporate random coefficients on the constant term and service fees.[34] I subsequently augment the random coefficients model with two alternative pricing equations. In one model, which I will refer to as $(RC - C)$, banks compete in service fees in to arrive at a Nash-Bertrand equilibrium. In the other, which I will refer to as $(RC - M)$, banks set service fees jointly in a way that fully internalizes the effect of their pricing decision on the profits of other firms.

Table 4 reports the results for the random coefficients models. As expected, the estimates of demand parameters across specifications are close to each other in these two models. Nonetheless, there are important differences in the estimates of cost parameters from the two specifications which result from alternative pricing equations. However, the over-identifying conditions are rejected at a 5% level in all cases.[35]

[34]There is no random coefficient on deposit rate because it is substituted by the time dummies in the demand equation.

[35]The J-statistic = N*GMM follows Chi-square distribution with degree of freedom = Number of instruments - Number of parameters = $7 - 2 = 5$.

Table 4
Demand and Pricing Equations

Variable	RC-C	RC-M	Variable	RC-C	RC-M
Demand - Linear			*Cost*		
Constant	−0.954 (0.224)*	−0.954 (0.224)*	*Constant*	−0.0137 (0.0004)*	−0.0391 (0.0002)*
BOC	−0.201 (0.156)	−0.202 (0.156)	*BOC*	0.0027 (0.0003)*	0.0014 (0.0003)*
CCB	0.432 (0.123)*	0.431 (0.123)*	*CCB*	0.0000 (0.0003)	−0.0004 (0.0003)
ICBC	0.732 (0.080)*	0.732 (0.080)*	*ICBC*	−0.0035 (0.0004)*	−0.0011 (0.0003)*
Emp per Branch	0.002 (0.002)	0.002 (0.002)	*Year 1995*	0.0002 (0.0003)	0.0011 (0.0002)*
Bdensity	8.017 (1.551)*	8.017 (1.551)*	*Year 1996*	0.0008 (0.0006)	0.0026 (0.0005)*
Total Branches	0.075 (0.028)*	0.075 (0.028)*	*Year 1998*	0.0001 (0.0003)	0.0003 (0.0002)
Total Asset	−0.018 (0.116)	−0.018 (0.116)	*Year 1999*	0.0001 (0.0003)	0.0024 (0.0002)*
real GDP	63.74 (27.14)*	63.73 (27.14)*	*Year 2000*	0.0001 (0.0003)	0.0004 (0.0001)*
Agricultural share of GDP	2.278 (0.650)*	2.278 (0.650)*	*Year 2001*	0.0005 (0.0005)	0.0044 (0.0003)*
Demand - Nonlinear					
Constant	0.150 (0.446)	0.150 (0.446)			
Pfee	−159.46 (66.687)*	−159.30 (66.684)*	*J statistic*	11.2336	11.2337
Demand - Dummies			*P-value(J statistic)*	0.05	0.05
Province	*Yes*	*Yes*			
Time	*Yes*	*Yes*			

Observation: 828 for demand & 28 for pricing; Dependent variable: Mean Utility $\delta_{jmt}(s_{jmt})$
*Estimated standard error are in parentheses; * significant at 5% level*

In the following sub-sections, I will discuss the results related to the demand estimates on product characteristics and followed by those derived from the cost estimates.

7.2 Consumer Preferences

The coefficients on employees per branch, density and total number of branches are positive, but that on employees per branch is insignificant. This indicates that consumers are more concerned about the efficiency of branch operation than the availability of staff. It also suggests that SCBs can attract more consumers by expanding branch network and increasing branch density. There is an additional reason for branch network to be an important factor in selecting a bank in China. The economic development in China is skewed towards provinces in coastal regions and the job opportunities in those provinces are better than those in other provinces. As a result, migrant

workers commonly move from less-developed inland provinces to more developed coastal regions to seek work. A portion of their income is frequently remitted back to their family in their province of origin and a larger branch network facilitates transcations like this.

To show the importance of various bank characteristics on consumer choices, I compare their impacts on utility by increasing each characteristic above its mean by one standard deviation. The results are presented in the column ΔUtility of Table 5. The corresponding rises in utility are 0.02, 0.10 and 0.14 for employees per branch, branch density, and total number of branches; respectively. It suggests that consumers respond to branch expansion more than increases in employees. To quantify the changes in utility, in the column WTP, I compute the willingness to pay of consumers in exchange for these improvements in service quality reported in the column ΔUtility. A consumer is willing to pay 0.01% of their deposit to enjoy an increase in employees per branch by one standard deviation. Analogously, the willingness to pay for corresponding increases in branch density and total number of branches are 0.07% and 0.10%, respectively. The willingness to pay for these hypothetical changes are significant and range from 9% to 59% of the average service fees. In addition to prices (i.e. service fees), it suggests that service quality is another effective way to attract consumers. The demand estimates suggest that the consumer preferences in China are similar to those in the U.S. reported in Dick (2008). Chinese consumers have stronger preferences on branches than employees, but they do not have significant preferences on having more employees in a branch. I suggest it is related to the low employee efficiency of Chinese banks. Human resource policies, such as on-the-job training, may be effective for SCBs.

Table 5
Marginal Utility

Variables	ΔUtility	WTP	$\frac{\text{WTP}}{\text{Service Fee}}$
Emp per Branch	0.02	0.01%	9%
Bdensity	0.10	0.07%	44%
Total Branch	0.14	0.10%	59%

Note: Average service fee = 0.15% of deposit
Unit: % of deposit for WTP; % for WTP/Service fee

These results on consumer preferences can help making inference about competition in banking

industry after the market was further opened in Dec 2006. The strong preferences consumers show for a large branch network indicate that foreign banks will not be able to provide a strong competitive force on SCBs in the near future. This result supports the idea in Hansakul (2006) that foreign banks, such as Citibank and HSBC, are at a disadvantage in developing their consumer banking due to the lack of branch network. On the other hand, some domestic banks have high branch density will be strong competitors of SCBs in several provinces. The limited branch networks place on the competitive effects of new entrants provides incumbents with an opportunity to improve their service quality. In this regard, SCBs have introduced strategic foreign investors to foster their capacities for product innovation, new business development and technology adoption for intern management.

The demographic variables indicate that the demand of SCBs in a province depends on industrial structure and economic development: market shares of SCBs are higher in provinces with higher proportion of agricultural production and higher real GDP. In provinces with stronger focus on agriculture, the competitors of SCBs are mainly rural credit cooperatives. SCBs are more attractive to depositors because they feel SCBs are too big to fail and depositors may feel greater assurance that their deposits are safe. Moreover, SCBs have higher market shares in rich provinces because SCBs are more capable of providing a broad range of banking services to wealthy consumers than small- and medium-sized banks.

The bank dummies capture preferences for banks conditional on the same level of service quality. The largest bank dummy is the one for ICBC (0.73) and is followed by that of CCB (0.43). The bank coefficients capture preferences for banks relative to ABC. Accordingly, the postive coefficients for ICBC and CCB indicate that consumers value those two banks more than ABC, which is more valuable than BOC (-0.20).

In addition to the total amount of deposit, I use household deposit and enterprise deposit held by bank j to compute market share for demand estimation. The $IV-H$ and $IV-E$ show the estimates of the logit demand using the household deposit and enterprise deposit, respectively. This analysis elaborates on the driving forces behind the results based on total deposit, and illustrates the differences between households and enterprises in deposit behavior. The results indicate that

households and enterprises value the accessibility of branches in the local market, as branch density is positive and significant in these two equations. Enterprises care about the total number of branches in determining deposit demand, whereas households pay attention to the number of employees per branch in choosing their banks. It suggests that firms utilize the branch network to manage their deposit and households concern the time cost incurred for bank activity in a branch. The demographic variables show similar results for estimation with total deposit and household deposit. For enterprise deposit, the deposit demand is less affected by the agricultural share of GDP. However, SCBs have lower market share in provinces with higher real GDP, which suggests that SCBs face string competition from JCBs for enterprises deposits.

7.3 Demand Elasticity

In Table 6, I compute cross- and own-price elasticities to analyze the price competition among SCBs. The own-price elasticities are less than unity for all markets, indicating banks do not set service fees to maximize profit according to static Nash-Bertrand equilibrium.

Table 6
Demand Elasticity

Bank	ABC	BOC	CCB	ICBC
ABC	−0.067	0.016	0.014	0.013
BOC	0.013	−0.199	0.014	0.013
CCB	0.013	0.016	−0.070	0.013
ICBC	0.013	0.016	0.014	−0.033
Outside	0.001	0.002	0.001	0.001

Note: The element (i,j) indicates the elasticity of market share i w.r.t. to the price of bank j
The number is average across markets and years

To investigate the bank behavior at the aggregate level, I define market share at the aggregate level s_j as follows

$$s_j = \frac{\sum_{m=1}^{M} s_m H_m}{H} \tag{24}$$

where H is the total market size of all markets. The elasticity of service fees of aggregate demand is also less than 1 because the elasticity at the aggregate level is related to those at the market level

in the following way

$$\frac{\partial s_j}{\partial p_j} = -\alpha p_j \left[\sum_{m=1}^{M} (1 - s_{jm}) \frac{Q_{jm}}{Q_j} \right] \tag{25}$$

where Q_{jm} is the deposit amount of bank j in market m and Q_j is the total deposit of bank j. This result is consistent with the evidence from Nakane et al. (2006), Molnar et al. (2007), Dick (2008) and Molnar (2008) which shows that banks set service fees in the inelastic portion of the demand curve (i.e. banks could have increased profits by raising their service fees). In particular, the own-price elasticity of service fees is lower for Chinese banks than that for U.S. banks. It indicates that Chinese banks charge their service fees at a lower level than their counterparts in the U.S. They argue that low service fees are used to attract more deposits. In China, the interest rate spread provided by the central banks provides an incentive for SCBs to attract deposits to maximize profit. For example, according to Lardy (1998), the BOC has the highest proportion of funding from the government for lending to SOEs. It is therefore relatively less reliant on deposits for funding loans to SOEs and accordingly exerts more market power as seen by the fact that it sets service fees closer to the elastic portion of the demand curve. Comparing the bank behaviors between 1994 and 2001, Table 7 indicates that SCBs, with the exception of BOC, set their service fees at levels closer to elastic portion of the demand.

Table 7
Own-price Elasticity, 1994-2001

Bank	ABC	BOC	CCB	ICBC
1994	0.032	0.202	0.081	0.018
2001	0.056	0.147	0.092	0.049

Note: The number is average across markets within the year indicated

7.4 Consumer Welfare

In this section, I utilize the structural model of demand to evaluate the welfare effects of the banking reform. In the random coefficient model, the consumer surplus generated by a set of products

can be written as

$$CS_{im} = \frac{\ln\left(\sum_{j=1}^{J}\exp\left(\delta_{jm}+\mu_{ijm}\right)\right)}{\alpha_i} \tag{26}$$

Following Nevo (2001), I use the compensating variation to measure the change in consumer welfare. It measures how much money should be taken away from the consumer to leave him/her as well off as he/she was facing before the change. A positive (negative) compensating variation implies the consumers are better-off (worse-off). McFadden (1981) and Small and Rosen (1981) show that the compensating variation for a representative consumer in market m is given by

$$CV_m = \int\int \frac{CS_{im}^{2001} - CS_{im}^{1994}}{\alpha_i} dP(y_{im})dP(v_i) \tag{27}$$

where CS_{im}^{1994} and CS_{im}^{2001} are consumer surplus in year 1994 and 2001, respectively. Therefore, CV_m represents the compensating variation for each dollar deposited in market m, i.e. percentage gain per Yuan deposited.[36] To compute the welfare impact per capita in the market, I multiply the median compensating variation with deposits per capita in market m

$$D_m * Median(CV_m) \tag{28}$$

where D_m is the deposit per capita in market m.

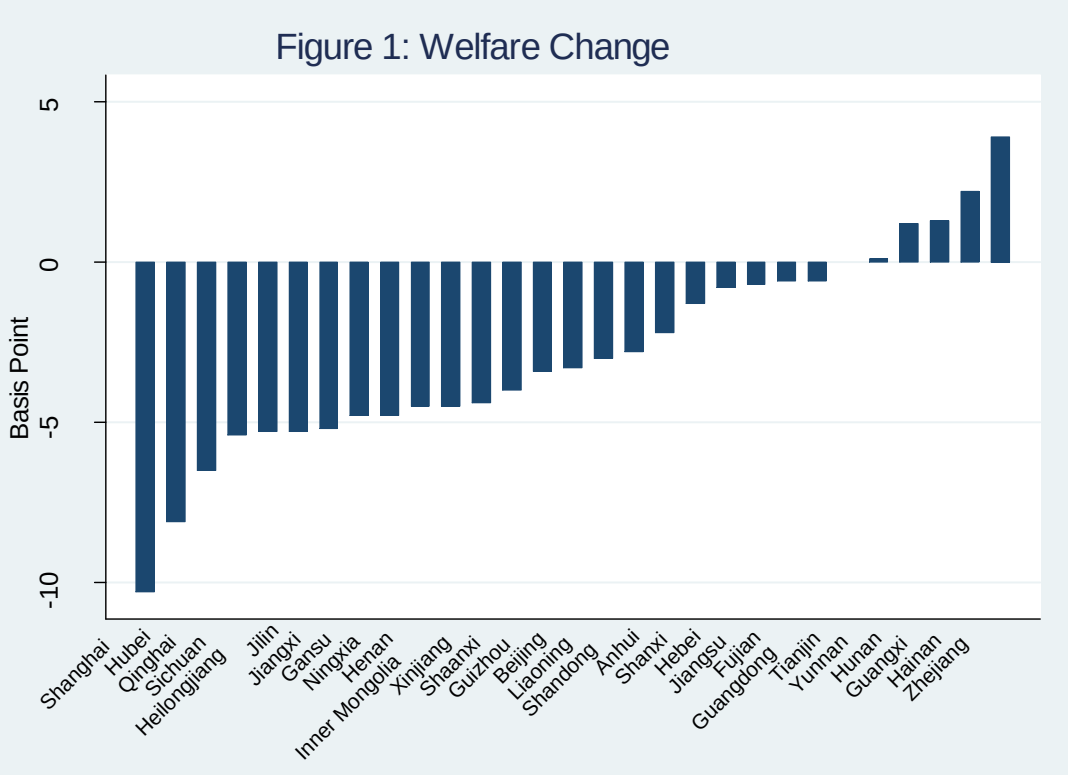
TABLE 8
Consumer Welfare

	25%	*Median*	*75%*
$Median(CV_{im})$	-0.48%	-0.33%	-0.06%
$D_m * Median(CV_{im})$	-46	-19	-5
	Eastern	*Central*	*Western*
$Median(CV_{im})$	-0.18%	-0.40%	-0.45%
$D_m * Median(CV_{im})$	-12	-25	-38

Unit: Yuan for $D_m * Median(CV_{im})$. *Note: Average deposit per capita in urban area in year* 1994 *is* 4870 *Yuan.*

The upper panel of Table 8 displays the lower quartile, median, upper quartile of the compensating variation for one Yuan, $Median(CV_{im})$, and compensating variation per capita, $D_m * Median(CV_{im})$. The results indicate that the changes in consumer welfare vary from -0.48% to

[36] Yuan is the unit of Chinese curreny. I assume CNY/US = 7 in this paper.



-0.06%. In monetary terms, it ranges from -46 to -5 Yuan ($\$US$ -6.6 to 0.7). Most of the provinces experience welfare loss because (1) SCBs have consolidated branches and reduced employees since 1998 and (2) SCBs have increased their service fees gradually. In order to make sense of the distribution of these welfare changes, I examine the median welfare change in the eastern, central and western regions in order to understand the distribution of the welfare effects across geographical regions. The median losses in consumer surplus are -0.18%, -0.40% and -0.45% for the eastern, central and western regions, respectively. The welfare costs fall on the less-developed inland provinces disproportionately.

Figure 1 shows the percentage change in consumer welfare at the provincial level. It indicates that the welfare effects of banking reform on consumers are uneven across provinces. The most dramatic improvement is the more than four basis point improvement in welfare in the Zhejiang province; other provinces, like Qinghai and Heilongjiang, see their welfare fall by about seven basis points. Shanghai experienced the largest welfare loss due to the massive closure of branches and

layoffs. Overall, the variance of changes in consumer welfare is mainly explained by the demographic variables, time dummies and unobserved product characteristics, which account for about 74% of the changes. This indicates that as GDP has grown, consumers have favored SCBs over the alternatives in a way that raised SCB market shares relative to the outside good. To a lesser extent, the changes in observed product characteristics explain the rest of changes in consumer welfare. However, service fees explain about 6% of the variance of changes in consumer welfare because there is no variation in service fees at provincial level.

As in many other developing countries, banking reform is part of the development strategy which aims to improve financing. Although there are policies on consolidating branches and reducing employees to cut costs, the implementation of the policies are uneven across provinces. The consumer welfare analysis suggests that the welfare costs fall on the inland provinces disproportionately. As shown in Boyreau-Debray and Wei (2005), saving and investment are highly correlated in Chinese provinces.[37] I compute the correlation between changes in consumer welfare and economic growth is 0.28 which suggests that deposit market is an integrated part of the economic development in China.[38] Therefore, the uneven changes in deposit services will slow down capital accumulation in the western provinces and may worsen income inequality across regions.[39]

7.5 Market Structure

There are important differences in the estimates of cost parameters reported in Table 3, which will have implications on the effective marginal costs of SCBs and market structure of deposit market. The cost parameters suggest that effective marginal costs vary across banks and over time. In particular, the bank-specific and year-specific intercepts indicate that the implied marginal costs of banks are negative. It is because these terms include the subsidy through interest rate regulation, thus the subsidy is a negative term in the cost component of SCBs. The price-cost margins for service fees are higher in the monopoly model than those of the competitive model. Consequently,

[37] Regarding the lending behavior, Demurger et al. (2002) that the state banks distribute most of their funding to SOEs, which are mainly located in the eastern region.

[38] The data of economic growth is for the period 1992 through 1998. Source: Demurger et al. (2002). Moreover, the correlation between the ranking of the welfare change and the ranking of economic growth is 0.35.

[39] Using a large panel of countries, Beck et al. (2007) provides evidence on financial intermediation reduces income inequality and poverty.

the implied marginal costs are more negative in the monopoly model than those in the competitive model.

According to the GMM criteria, the Rivers and Vuong (2002) non-nested test statistic is 0.3 which favours the model with competitive pricing. However, it is not statistically significant at any conventional confidence level. It indicates that the model with competitive pricing provides a better description of the equilibrium outcome revealed in the data. Although SCBs dominate the deposit market, SCBs are still competing with each other in the way they set their service fees. This is because the interest rate spread provided by the central bank creates incentives for SCBs to attract deposits for lending. It suggests that the deposit market is competitive after the reforms. In the remaining portion of the paper, I will focus on the estimates obtained from the Nash-Bertrand competitive model $RC - C$ for further analysis.

To examine the dynamics of competition of banking industry over time, I compute the price-cost margins of those four SCBs over the sample period.

Table 9

Price-cost Margin, 1994-2001				
Bank	**ABC**	**BOC**	**CCB**	**ICBC**
1994	1.72	1.54	1.64	2.03
2001	1.64	1.56	1.65	1.89
%Changes	−4.65	1.30	0.61	−6.90
Effective Marginal Cost, 1994-2001				
Bank	**ABC**	**BOC**	**CCB**	**ICBC**
1994	−1.37	−1.10	−1.37	−1.71
2001	−1.32	−1.05	−1.32	−1.67
Producer Surplus, 1994-2001				
%Changes	248	31.1	201	126

Note: Price-cost margin is the markup in the pricing equation; Unit: % of deposit

The results in Table 9 indicate that the level of competition is similar throughout the sample period, except that the price-cost margins are reduced by 5% and 7% for ABC and ICBC, respectively. The competitive effects of banking reform are less significant than in market economies documented in Shaffer (1993) for Canada, Drees and Pazarbasioglu (1998) for Finland, Norway and

Sweden; Gruben and McComb (2003) for Mexico; and Ho (2007) for Hong Kong. There are several reasons this phenomenon occurs in China. First, entry of new banks is limited. The only noteworthy post-reform entrants are Shanghai Pudong Development Bank (established in 1993), and Bohai Bank and Minsheng Bank (both established in 1996).[40] New entrants are much more limited in their geographical coverage than market incumbents and are concomitantly limited in their ability to compete. Moreover, Berger and Humphery (1997) argue that the effects of banking deregulation should depend greatly on the state of the industry prior to deregulation. For example, the strength of incumbent banks and other barriers to entry (i.e., administrative) may allow incumbent banks to exploit their market shares in a monopolistic way. On the other hand, it is possible entry or the threat of entry might increase competitive pressures on incumbent banks. The exceptionally high collective market shares of SCBs relative to other banks in China provides an unique setting to examine the impacts of regulatory reform on market structure with dominant state-owned firms. The results suggest that the competitive effects of banking deregulation in China are less significant than those in market economies.

Table 9 also reports that the effective marginal costs are negative for all SCBs. The equation (18) indicates that the negative marginal cost is related to the subsidies provided by the central bank through interest rate spread between lending and deposit rates, $r^l - r^d$. According to Table 6 and 9, the marginal cost is more negative for banks which have low price elasticity. It means that SCBs set low service fees and expect the loss to be recouped in the loan market. Furthermore, the effective marginal costs have increased over the period between 1994 and 2001. It contributes to the reduction of price-cost margins and induces banks to raise service fees to respond to the new environment. The rises in effective marginal costs are contributed by the reductions in lending profit and the deterioration of efficiency.[41]

[40] Minsheng Bank is the only entry of domestic private bank.

[41] Although the lending rate is close to the benchmark rate set by the central bank, the profit of lending can be varied by the probability of repayment.

7.6 Producer and Total Surplus

For evaluating the impacts on SCBs, I extend the preceeding discussion on price-cost margin changes and look into the changes in producer surplus (or profit), i.e. $\pi_j = (r^l - r^d + p_j - mc_j)\sum_m s_{jm}(p, x_m, \xi_m; \theta_d)H_m$. The profit of a bank is composed of two parts: price-cost margin and the amount of deposits. The first term reflects the competitive pressure on unit profit and the latter term represents the demand effect on profit. The percentage change of producer surplus is the sum of the percentage change of the price-cost margin and the percentage change in the quantity of deposits. As indicated in the bottom panel of Table 9, the profits of ABC and CCB increase more than 200% over the sample period. Other banks exhibited more modest growth in that the profits of BOC and ICBC by 31% and 126%, respectively. For all cases, the main driver for the changes in producer surplus is demand. It suggests that market expansion helps state commercial banks remain profitable. The expansion of market in the sample period is a result of high GDP growth and government policies which favor SCBs to alternatives. In the future, the demand effect is expected to be smaller in that investors are likely to have more investment choices and higher propensities to consume. Therefore, SCBs should explore sources of revenue which increase price-cost margins. For example, improvements in service quality are an effective way to increase market power because consumers strongly value service quality.

To understand the overall effects of the reform, I examine total surplus by combining consumer welfare and producer surplus. The reform increased total surplus by 123% (equivalent to 96 billion Yuan at 1994 prices or $\$US$ 13.7 billion), even though some consumers experience welfare losses. In per capita terms, the total welfare gain is about 80 Yuan ($\$US$ 11.4), which is close to 5% of the deposits per capita in year 1994.[42] The primary driving force behind the welfare gain is the exogenous increase in the volume of deposits which accompanied high GDP growth from 1994 to 2001. The increase in wealth resulted in more prevalent use of banking services and higher deposit levels, to the degree that deposit volumes increased SCB profits even as price-cost margins fell. It highlights the importance of financial market participation in improving welfare.

[42] Deposit per capita in urban area in year 1994 was 4870 Yuan ($\$US$ 696).

8 Policy Evaluations

Utilizing the structural model of demand, I can evaluate the welfare effects of a policy change. I use the model to analyze the change in consumer welfare due to branch consolidation and layoffs. SCBs closed a large number of branches and scaled back employment to reduce costs. In particular, ABC and CCB eliminated more than 30% of their total branches in 2001. The main difference between policy evaluation and welfare analysis is that policy evaluation employs a hypothetical change in product characteristics which has not occurred in the sample period, whereas welfare analysis uses changes in product characteristics within sample period. Table 10 documents the number of branches and number of employees during year 2001 through 2004. It also provides the resulting changes in the number of branches, number of employees, branch density, and employees per branch during this period. Observations on branches and employees in 2004 are not available at the provincial level, and for this reason the reductions in branch density and employees per branch are computed using data at the national level under the assumption that changes are uniform across provinces.

Table 10
Policy Changes

Bank	Branch 2001	Branch 2004	ΔBranch	%ΔBranch	ΔBDensity
ABC	44,417	31,004	−13,413	−30.2%	−0.000040
BOC	12,529	11,307	−1,222	−9.8%	−0.000004
CCB	23,921	14,458	−9,463	−39.6%	−0.000028
ICBC	28,345	21,223	−7,112	−25.1%	−0.000021

Bank	Emp 2001	Emp 2004	ΔEmp	%ΔEmp	ΔEmp/Branch
ABC	490,999	489,425	−1,574	−3.2%	4.73
BOC	184,529	164,193	−20,336	−11.0%	−0.21
CCB	316,329	254,689	−61,646	−19.5%	4.39
ICBC	429,709	375,781	−53,928	−12.5%	2.55

Note: Benchmark interest rate of demand deposit in 2001 & 04 = 0.99 & 0.72%, respectively
Average service fees in 2001 & 04 = 0.13 & 0.22%, respectively

I perform two counterfactual experiments and report the results in Table 11. In case 1, I focus on the welfare impacts of changes in bank characteristics, and therefore I assume the service fees remain unchanged at its level in the year 2001. In case 2, I allow the service fees to take its actual

values in the year 2004. Moreover, I assume there is no change in unobserved product characteristics and utilities obtained from the outside good in both cases.[43]

TABLE 11
Welfare Effects

Case 1	*25%*	*Median*	*75%*
$Median(CV_{im})$	-0.08%	-0.08%	-0.08%
$D_m * Median(CV_{im})$	-7.74	-7.74	-8.03
Case 2	*25%*	*Median*	*75%*
$Median(CV_{im})$	-0.19%	-0.19%	-0.18%
$D_m * Median(CV_{im})$	-18.38	-17.90	-17.42

Unit: Yuan for $D_m * Median(CV_{im})$. *Note: Average deposit per capita in urban area in year* 2001 *is* 9676 *Yuan at* 1994 *price.*

In case 1, consumer welfare is decreased by about 0.08%. The demand estimates suggest that consolidating branches imposes a welfare cost on consumers, but the increases in employees per branch do not offset the negative impact. The overall effect is worth about 7 Yuan (about 1 US dollars) per depositor. In case 2, the rises in service fees and degradation of service quality worsens consumer welfare by 0.19%, i.e. 18 Yuan (about 2.6 US dollars) per depositor. It indicates that price and service quality are important in determining welfare loss. Nonetheless, the welfare loss is less than that incurred during the sample period.

9 Conclusion

This paper examines the demand for deposits and the competition of deposit market in China. I find that more convenient branch locations and higher quality employees are valued by consumers and hence increases demand for deposits. The competition among the state commercial banks exists over the sample period (1994 to 2001) and the market structure is better characterized by a competitive model rather than a cartel model. My results show that average price-cost margin decreases over the sample period, although it does not fall for all banks. Even though price-cost margins are generally lower, the producer surplus still increases by more than 100%. This is because

[43] The assumptions are reasonable because there was not much product innovations in deposit market before 2004 and the competing financial institutions in the outside good were similar as those in the sample period. However, the industry underwent a dramatic change after the market had opened in 2006.

market expansion made the volume of deposits increase dramatically. On the consumer side, welfare for existing consumers declines because of branch consolidations and layoffs. The total consumer welfare increases because more people and money enjoy services in deposit market. As a result, the total welfare in the deposit market increases by more than 100%.

Finally, I suggest several contributions of this paper. First, it aims to extend our understanding on the effect of banking deregulation. Since the literature focuses on industrialized countries, I provide evidence on a large developing country. Second, this paper tries to enrich the growing literature on the demand estimation for banking services. Demand estimates are useful in analyzing potential merger in the future and formulating banking policy. Third, I try to provide an unified framework to evaluate market structure and welfare for Chinese banking industry and its reforms. The results also provide several policy implications. The welfare results suggest that encouraging financial market participation is important for improving welfare. Moreover, policy makers should aware the uneven effects of banking policy across provinces. Future research can look into the effects of consumer switching costs in affecting bank behavior.

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Appendix 1
Descriptive Statistics

Variable	Mean (S.D.)	Median	Minimum	Maximum
Market/Demographic Information				
real GDP	1.718 (1.369)	1.350	0.109	7.249
real GDP per capita	4.647 (3.298)	3.482	1.243	21.76
Agricultural share of GDP	0.199 (0.083)	0.207	0.018	0.379
Population Density	0.036 (0.044)	0.025	0.001	0.265
Market Share				
s_{jmt}	0.175 (0.089)	0.161	0.040	0.568
Price				
Service fee	0.0014 (0.0010)	0.0009	0.0004	0.0035
Deposit rate	0.019 (0.009)	0.016	0.010	0.032
Bank Characteristics				
Employees per Branch	17.75 (10.40)	14.46	6.12	84.13
BDensity	0.009 (0.013)	0.005	0.000	0.095
Total Branch	2.99 (1.88)	2.18	1.05	6.60
Total Asset	0.000 (0.239)	−0.102	−0.342	0.415
Instruments				
intexp (per Yuan deposit)	0.064 (0.041)	0.053	0.019	0.208
opexp (100 mil Yuan per employee)	0.001 (0.000)	0.001	0.000	0.001
Loan/Asset (per Yuan asset)	0.59 (0.08)	0.61	0.43	0.70
Cash/emp (100 mil Yuan per employee)	0.001 (0.000)	0.001	0.000	0.001
Equity/emp (100 mil Yuan per employee)	0.003 (0.003)	0.003	0.001	0.012
rival Emp/Branch (people)	17.75 (10.40)	16.34	8.49	50.89
rival Bdensity (Branch per km^2)	0.009 (0.011)	0.006	0.000	0.071

Unit: GDP = Million Yuan; GDP per capita = 1,000 Yuan at 1993 price level;
Agricultural share of GDP = %/100; Population density = 10,000 per km^2;
s_{jmt}, *Service fees and deposit rate = %/100; Employees per branch = unit;*
BDensity (Branch density) = branch per; km^2; Total Branch = 10,000 unit;
intexp = interest expense/deposit; opexp = operating expense/employee
Standard deviations are in bracket;
The figures are computed over the sample period

Appendix 2	
Price Regression	
Variable	
Constant	0.0059 (0.0027)*
Intexp	−0.0009 (0.0068)
Opexp	0.4933 (1.077)
Cash/Emp	−0.6877 (1.054)
Equity/Emp	0.0623 (0.1287)
Loan/Asset	−0.0078 (0.0033)*
R^2	0.46
P-value(F(5, 22))	0.01

Dependent variable: P_{jt}*;*
Observation = 28;
** significant at 5% level*