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Chun-Yu Ho

Market structure, welfare,
and banking reform in China



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All opinions expressed are those of the author and do not necessarily reflect the views of the Bank of Finland.

Chun-Yu Ho

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Tiivistelmä

Tässä tutkimuksessa tarkastellaan markkinoiden vapauttamisen vaikutuksia kuluttajiin ja valtion omistamiin liikepankkeihin Kiinassa. Erilaisten markkinoiden rakennetta koskevien oletusten vallitessa estimoidaan yhtäaikaisesti erilaistettujen tuotteiden kysyntä- ja hintayhtälöitä. Kiinan pankkisektorin uudistusten tulokset eivät ole olleet pelkästään positiivisia, mutta talletusmarkkinoilla kuluttajien saama ylijäämä on kasvanut. Pankkireformien hyvinvointivaikutukset ovat jakautuneet epätasaisesti. Hyvinvointitappioita on ollut erityisesti sisämaan alueilla ja tietyissä kuluttajaryhmissä. Ei ole lainkaan selvää, että pankkipalveluiden hinnoittelu olisi tullut kilpailullisemmaksi reformien jälkeen, ja hallitus näyttää edelleen vaikuttavan pankkipalveluiden hintoihin. On kuitenkin rohkaisevaa, että joidenkin valtion omistamien pankkien marginaalit ovat supistuneet reformien jälkeen.

Asiasanat: pankkireformit, kiinalaiset pankit, kysynnän estimointi, markkinarakenne

banks have room to increase profits by raising service fees). These authors argue that low service fees are used to attract deposits. Thus, service fees can be set lower than the level derived from static profit maximization when the switching cost for the consumer is significant. The own-price elasticity of service fees is lower for Chinese banks than for US banks, indicating that Chinese banks charge their lower service fees than their counterparts in the US. In China, the interest rate spread provided by the central banks provides an incentive for SCBs to attract deposits to finance SOEs. Lardy (1998), for example, notes that 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. Moreover, SCBs can set low service fees to get more funding to earn profit through the interest rate spread. My results contrast with those of Bichsel (2006), who finds that state-owned banks in Switzerland have the same profit objective as private banks. Comparing bank behaviors between 1994 and 2001, Table 6 indicates that SCBs, with the exception of the BOC, set service fees at levels closer to elastic portion of the demand. However, the pricing behaviors of SCBs seem to be still affected by government policies and consumer switching cost.

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

6.3 Consumer welfare

In this section, I utilize the structural model of demand to evaluate the welfare effects from China's banking reforms. In the random coefficient model, the consumer surplus generated by a set

of products can be written as

$$CS_{im} = \frac{\ln \left(\sum_{j=1}^J \exp(\delta_{jm} + \mu_{ijm}) \right)}{\alpha_i} . \quad (19)$$

Following Nevo (2001), I use the compensating variation to measure the change in consumer welfare. This measures how much money should be taken away from consumers to leave them as well off as they were before the change. A positive (negative) compensating variation implies the consumer is 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

$$CV_m = \int \int \frac{CS_{im}^{2001} - CS_{im}^{1994}}{\alpha_i} dP(y_{im}) dP(v_i) , \quad (20)$$

where CS_{im}^{1994} and CS_{im}^{2001} are the consumer surpluses in 1994 and 2001, respectively. Therefore, CV_m represents the compensating variation for each dollar deposited in market m , i.e. the percentage gain per yuan deposited.³⁴ To compute the welfare impact per capita in the market, I multiply the median compensating variation with deposits per capita in market m

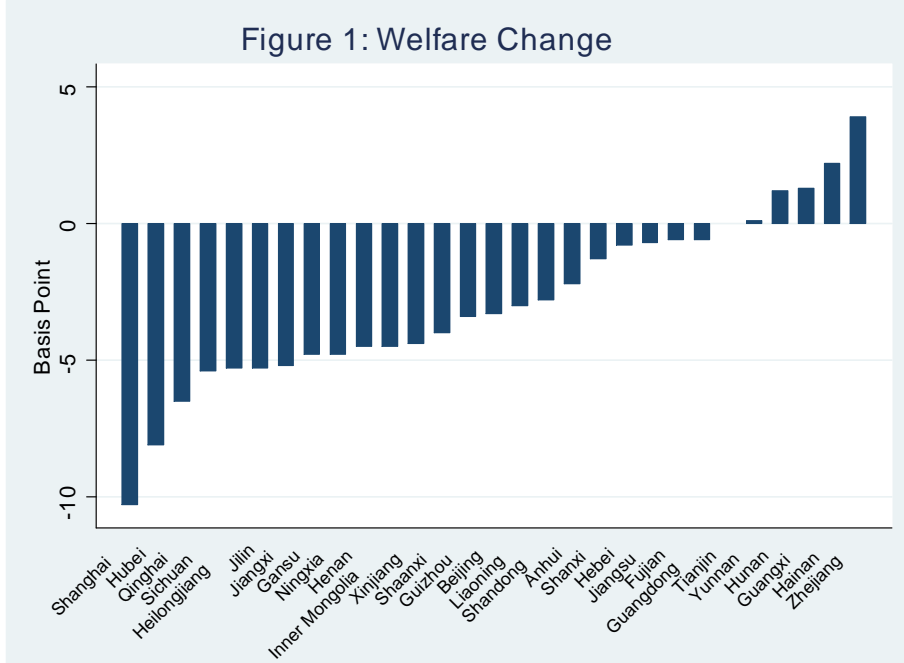
$$D_m * Median(CV_m) , \quad (21)$$

where D_m is the deposit per capita in market m .

TABLE 7			
Consumer Welfare			
	<i>25%</i>	<i>Median</i>	<i>75%</i>
<i>Median(CV_{im})</i>	-0.48%	-0.33%	-0.06%
<i>D_m * Median(CV_{im})</i>	-46	-19	-5
	<i>Eastern</i>	<i>Central</i>	<i>Western</i>
<i>Median(CV_{im})</i>	-0.18%	-0.40%	-0.45%
<i>D_m * Median(CV_{im})</i>	-12	-25	-38
<i>Unit: Yuan for D_m * Median(CV_{im}). Note: Average deposit per capita in urban areas in 1994 is 4,870 yuan.</i>			

The upper panel of Table 7 displays the lower quartile, median, upper quartile of the compensating variation for one yuan, $Median(CV_{im})$, and compensating variation per capita, $D_m *$

³⁴The yuan is the unit of Chinese currency. An exchange rate of 7 yuan to the US dollar is assumed here.



$Median(CV_{im})$. The results indicate that the changes in consumer welfare vary from -0.48% to -0.06% . In monetary terms, the welfare effect ranges from -46 to -5 yuan ($US\$ -6.6$ to 0.7). Most provinces experience welfare losses. SCBs have consolidated branches and reduced employees since 1998, and SCBs have gradually increased their service fees. To make sense of the distribution of these welfare changes, I examine the median welfare change in the eastern, central, and western regions to understand the distribution of the welfare effects across geographic regions. The median losses in consumer surplus are -0.18% for the eastern region, -0.40% for the central region, and -0.45% for the western region. Again, welfare costs fall disproportionately on the less-developed inland provinces. The Chinese experience contrasts with that of the US during the 1990s, when, Berger and Mester (2003) argue deregulation of branch restrictions allowed US banks to raise their prices and profits by improving product quality. Dick (2008) also finds such quality improvements result in a net welfare improvement for consumers.

Figure 1 shows the percentage change in consumer welfare at the provincial level. It indicates the welfare effects of banking reform on consumers are uneven across provinces. The most dramatic improvement is an over four-basis-point improvement in welfare in the Zhejiang province.

Other provinces such as Qinghai and Heilongjiang see their welfare fall by about seven basis points. Shanghai experienced the largest welfare loss due to a sharp reduction in the number of employees per branch (the average employees per branch of the four SCBs in Shanghai decreased from 34.3 in 1994 to 23.1 in 2001).

Overall, the variance of changes in consumer welfare is mainly explained by the demographic variables, time dummies, and unobserved product characteristics. Together these account for about 74% of the changes. Thus, as GDP has risen, consumers have favored SCBs over 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 as there is no variation in service fees at the provincial level.

Although some existing consumers experience welfare losses, the increase in market size indicates that more fund access to financial services which enhances welfare. The increase in consumer welfare due to this channel is about 25 billion yuan at 1994 prices or *US*\$ 3.6 billion, which is larger than the loss of consumer welfare due to branch consolidation and layoff, i.e. 5 billion yuan or *US*\$ 0.7 billion. The net gain is 20 billion yuan (*US*\$ 3.5 billion) in total, or 19 yuan (*US*\$ 2.80) per capita.³⁵ The primary driving force behind the welfare gain is the exogenous increase in the volume deposits that accompanied high GDP growth from 1994 to 2001. The increase in wealth results in more prevalent use of banking services and higher deposit levels, and highlighting the importance of financial market participation in improving welfare.

6.4 Testing for government interventions

The cost parameters indicate that implied marginal costs vary across banks. In particular, as shown in Table 8, the implied marginal costs are negative for all SCBs. Equation (6) suggests that the negative marginal cost is related to subsidies provided by the central bank through the interest rate spread between lending and deposit rates, $(1 - res)(1 - d_j)r^l - r^d$, and the marginal benefit of deposit acquisition for funding SOEs, which enter into the marginal cost equation of SCBs negatively.

³⁵Deposits per capita in urban areas in 1994 averaged 4,870 yuan (*US*\$ 696).

Table 8				
Implied 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

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

Note: The price-cost margin is the markup in the pricing equation. Unit: % of deposit

According to Table 5 and 8, the marginal cost is higher for SCBs with low price elasticity, i.e. SCBs set low service fees, expecting to recoup their losses in the loan market. Furthermore, the year dummies suggest that implied marginal costs do not change after deregulation. The stable estimates of implied marginal costs suggest that government intervention does not diminish after banking deregulation. This is further supported by the facts that (1) the interest rate spread provided by the government regulation increased from 0% to 3.6% over the sample period (see Table 1), and (2) detailed studies on the cost efficiency of Chinese banks (e.g. Chen et al., 2005; Ariff and Can, 2008) indicate SCB cost efficiency stayed about the same after reforms.

6.5 Competitive effects

To examine the competitive effects of banking reform over time, I compute the price-cost margins of those four SCBs over the sample period in Table 8. The level of competition is similar throughout the sample period, except that the price-cost margins are reduced by 5% for ABC and 7% for ICBC. 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; Cetorelli and Angelini (2003) for Italy; Gruben and McComb (2003) for Mexico; and Ho (forthcoming) for Hong Kong. China's differences are explained by several factors. First, entry of new banks is limited.³⁶ The only noteworthy post-reform entrants are Shanghai Pudong Development

³⁶Cetorelli and Angelini (2003) argue that the removal of barriers to entry contributed to the intensification of banking competition in Italy after its 1993 regulatory reform.

Bank (established in 1993), and Bohai Bank and Minsheng Bank (both established in 1996).³⁷ Moreover, the new entrants are much more limited in their geographical coverage than market incumbents, and thereby limited in their ability to compete.

Berger and Humphrey (1997) argue that the effects of banking deregulation 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, possible entry or the threat of entry may 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 in developed economies.

7 Robustness checks

This section provides several robustness checks for the results shown in the previous section. I start by checking whether the results are robust to alternative pricing arrangements, and then explore the implications of alternative demand systems.

7.1 Alternative pricing arrangements

To assess the impacts of pricing arrangement among SCBs on the empirical results, I analyze a supply model of a joint monopoly where service fees are determined collusively to maximize a joint objective function. This model is employed as a robustness check on the pricing arrangement as it delivers the lowest marginal costs. This is opposite to the model used in the previous section, ($RC - C$). The objective function of the joint monopoly is written as

$$\begin{aligned} \sum_m \sum_j \pi_{jm} &= \sum_m \{ [(1 - res)(1 - d_j)r^l - r^d + p_j - mc_j]s_{jm}H_m + \lambda_j\Phi(s_{jm}H_m) - F_{jm} \} \\ &+ \sum_m \sum_{k \neq j} \{ [(1 - res)(1 - d_k)r^l - r^d + p_k - mc_k]s_{km}H_m + \lambda_k\Phi(s_{km}H_m) - F_{km} \} \end{aligned} \quad (22)$$

³⁷Minsheng Bank is the only domestic private bank entrant.

I now derive the first-order conditions for objective maximization of the joint monopoly as

$$\begin{aligned} \begin{pmatrix} p_1 \\ \vdots \\ p_4 \end{pmatrix} + \Delta_d^{-1} \begin{pmatrix} \sum_m s_{1m} H_m \\ \vdots \\ \sum_m s_{4m} H_m \end{pmatrix} &= \begin{pmatrix} mc_1 \\ \vdots \\ mc_4 \end{pmatrix} - \begin{pmatrix} (1 - res)(1 - d_1)r^l - r^d \\ \vdots \\ (1 - res)(1 - d_4)r^l - r^d \end{pmatrix} \\ &- \Delta_d^{-1} \sum_{k=1}^4 \lambda_k \begin{pmatrix} \sum_m \Phi'(s_{km}) \frac{\partial s_{km}}{\partial p_1} H_m \\ \vdots \\ \sum_m \Phi'(s_{km}) \frac{\partial s_{km}}{\partial p_4} H_m \end{pmatrix} \end{aligned} \quad (23)$$

where

$$\Delta_d = \begin{pmatrix} \sum_m \frac{\partial s_{1m}}{\partial p_1} H_m & \cdots & \sum_m \frac{\partial s_{4m}}{\partial p_1} H_m \\ \vdots & & \vdots \\ \sum_m \frac{\partial s_{1m}}{\partial p_4} H_m & \cdots & \sum_m \frac{\partial s_{4m}}{\partial p_4} H_m \end{pmatrix} \quad (24)$$

Collusive pricing enables SCBs to set higher markups than those in the competitive equilibrium. This is because SCBs internalize substitution effects (through the off-diagonal elements in Δ_d) when setting service fees. Furthermore, equation (6) is a special case of equation (23) with the restriction that Δ_d is a diagonal matrix and no cross-price derivative on market share.

I employ goodness-of-fit measures to alternative models to infer the underlying pricing behavior among banks. Here, I apply the Rivers-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 .³⁸ This gives

$$\frac{\sqrt{N}(Q(\theta_m) - Q(\theta_c))}{\sigma_Q} \sim N(0,1) , \quad (25)$$

where $Q(\theta_m)$ is the GMM criterion for the collusive model and $Q(\theta_c)$ for the competitive model. 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 $Q(\theta_c)$, the test statistics indicate the collusive model better describes the equilibrium outcome revealed in the data.

The empirical results of this model are reported in Table 3 under the column, $(RC - M)$. The estimates of demand parameters of this model are close to those in the model, $(RC - C)$, but there are important differences in the estimates of cost parameters between two specifications which result from alternative pricing arrangements. Since banks set service fees jointly in a way that fully internalizes the effect of their pricing decision on the objectives of other banks, the price-cost margins for service fees are higher in the joint monopoly model than those of the competitive model. Consequently, the implied marginal costs are more negative in the joint monopoly model than those in the competitive model. Although the implied marginal cost increases over time under the model $(RC - M)$, the point estimates are negative for all sample years. Alternative models consistently suggest that government interventions in the deposit market are evident after the banking reform.

Under the GMM criteria, the Rivers-Vuong non-nested test statistic is 0.3, which indicates that the model with competitive pricing provides a better description of the equilibrium outcome revealed in the data. However, it is not statistically significant at any conventional confidence level, which

³⁸The test statistic is based on the values of the first-step GMM objective function, where both models have the same weighting matrix, A_N . The GMM criteria for the models with competitive pricing and collusive pricing are 0.6081577 and 0.6081583, respectively.

Define m_j to be the vector of moment conditions for observation j , the standard error of the test statistic is given by

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

suggests that there is no further evidence to support the deposit market becomes more competitive after the reform in addition to the results on price-cost margin.

7.2 Decentralized pricing model

While the market for demand model is defined at the provincial level, the supply specifications of the previous models assume there is a single price at the aggregate level. There are three justifications for this assumption. First, the model is tailored to fit the data on service fees, which is only available at the national level. Second, the management at SCB headquarters, not local governments, appoint branch managers (see Shirai, 2002). Third, the PBC's local branches are prohibited from relending to SCB branches in their provinces. These policies are expected to reduce the influence of local governments on pricing of bank services as local governments are likely to be more concerned about local welfare than bank profitability. However, Park and Sehart (2001) show that lending decisions of SCBs are influenced by policy and economic factors at the provincial level. This finding suggests that prices may be set at the provincial level rather than the national level when fund allocation across provinces is imperfect. For this reason, I next consider the effects of aggregation in the supply model on the empirical results.

In a competitive arrangement, each SCB in province m sets its service fee to maximize its objective. The objective function of an SCB is

$$\pi_{jm} = [(1 - res)(1 - d_j)r^l - r^d + p_{jm} - mc_j]s_{jm}H_m + \lambda_j\Phi(s_{jm}H_m) - F_{jm} \quad (26)$$

The first-order conditions for objective maximization of SCBs take the following form

$$p_{jm} + \left(\frac{\partial s_{jm}}{\partial p_j}\right)^{-1} = mc_j - ((1 - res)(1 - d_j)r^l - r^d) - \lambda_j\Phi'(s_{jm}) \quad (27)$$

The first-order condition resembles equation (6). However, in this model, each SCB in province m only needs to consider the trade-off between pursuing profit and acquiring deposits in its own province.

Similar to the model with centralized pricing, I analyze the effect of the pricing arrangement on the empirical results by using a model with a collusive pricing arrangement. The objective function

of the joint monopoly in province m is written as

$$\begin{aligned} \pi_{jm} &= [(1 - res)(1 - d_j)r^l - r^d + p_{jm} - mc_j]s_{jm}H_m + \lambda_j\Phi(s_{jm}H_m) - F_{jm} \\ &+ \sum_{k \neq j} \{[(1 - res)(1 - d_k)r^l - r^d + p_{km} - mc_k]s_{km}H_m + \lambda_k\Phi(s_{km}H_m) - F_{km}\}. \end{aligned} \quad (28)$$

Under the joint monopoly, SCBs in province m agree with each other to set service fees at a level that maximizes the joint objective of all SCBs. The first-order conditions for objective maximization of the joint monopoly are derived as follows

$$\begin{pmatrix} p_{1m} \\ \vdots \\ p_{4m} \end{pmatrix} + \Delta_d^{-1} \begin{pmatrix} s_{1m} \\ \vdots \\ s_{4m} \end{pmatrix} = \begin{pmatrix} mc_1 \\ \vdots \\ mc_4 \end{pmatrix} - \begin{pmatrix} (1 - res)(1 - d_1)r^l - r^d \\ \vdots \\ (1 - res)(1 - d_4)r^l - r^d \end{pmatrix} - \begin{pmatrix} \lambda_1\Phi'(s_{1m}) \\ \vdots \\ \lambda_4\Phi'(s_{4m}) \end{pmatrix}, \quad (29)$$

where

$$\Delta_d = \begin{pmatrix} \frac{\partial s_{1m}}{\partial p_1} & \dots & \frac{\partial s_{4m}}{\partial p_1} \\ \vdots & & \vdots \\ \frac{\partial s_{1m}}{\partial p_4} & \dots & \frac{\partial s_{4m}}{\partial p_4} \end{pmatrix}. \quad (30)$$

Collusive pricing enables SCBs to set a higher markup than those in the competitive equilibrium, because SCBs internalize substitution effects (through the off-diagonal elements in Δ_d) when setting their service fees. Furthermore, the first-order conditions (27) are a special case of equation (29) with the restriction that Δ_d is a diagonal matrix.

The empirical results of the models with provincial pricing are reported in Appendix 3. The estimates of demand and marginal cost parameters of those two models described in this section are close to those of the models ($RC - C$) and ($RC - M$). The empirical results for demand, consumer welfare, price-cost margins and the extent of government interventions are robust to the aggregation level of supply model. However, the non-nested test indicates that the model with collusive pricing included provides a better fit to the data than the model with competitive pricing.³⁹ This suggests there is limited evidence that the deposit market will become more competitive.

7.3 Alternative demands

The estimation of the benchmark model utilizes the technique of random coefficient, which allows for more flexible patterns of substitution among banks. Here, I estimate a commonly used logit model

³⁹The GMM criteria for the models with competitive pricing and collusive pricing are 0.6081569 and 0.6081568, respectively.

as a robustness check for the demand model. The advantage of the logit model is that there is no need to draw income from the sample only available for eleven provinces. The disadvantage is that the substitution patterns of logit model exhibit the property of independent of irrelevant alternatives (IIA). Here, the logit model take the following form

$$\ln(s_{jmt}) - \ln(s_{0mt}) = x_{jmt} \beta - \alpha p_{jt} + \xi_{jmt} . \quad (31)$$

The results from OLS and IV estimations on logit demand are reported in Table 9. The results from the IV estimation are close to those in Table 3. Furthermore, the random efficient model provides a slightly larger magnitude on the price coefficient due to the flexible substitution patterns.⁴⁰

Variable	OLS	IV
<i>Emp per Branch</i>	0.001 (0.002)	0.001 (0.002)
<i>Bdensity</i>	7.708 (1.362)*	7.707 (1.363)*
<i>Total Branch</i>	0.067 (0.027)*	0.073 (0.029)*
<i>Service Fee</i>	-56.29 (16.79)*	-76.42 (35.27)*
<i>Total Asset</i>	-0.049 (0.108)	-0.027 (0.114)
<i>Real GDP</i>	61.21 (27.71)*	61.18 (27.73)*
<i>Agricultural Share of GDP</i>	2.183 (0.568)*	2.184 (0.569)*
<i>Bank Dummies</i>	<i>Yes</i>	<i>Yes</i>
<i>Province Dummies</i>	<i>Yes</i>	<i>Yes</i>
<i>Time Dummies</i>	<i>Yes</i>	<i>Yes</i>
<i>R²</i>	0.87	0.87

*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*

Comparing the results obtained from OLS and IV estimations, 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 demand factors create endogeneity for service fees in the OLS estimation,

⁴⁰The mean of the income draw is normalized to 1.98, which indicates that the coefficient on service fees in the logit demand need to be multiplied by 1.98 before comparing to that in the random coefficient model.

and that methods which do not control for endogeneity may understate the importance of service fees.

8 Conclusions

This paper examined demand for deposits and competition in the deposit market in China during a period of banking sector reform. The results indicate that consumers value convenient branch locations, which, in turn, increases demand for deposits. Further, average price-cost margin decreased for some banks, but there is no clear evidence that the market structure of Chinese banking is better characterized by a competitive model rather than a cartel model in the sample period (1994 to 2001). On the consumer side, welfare for existing consumers declined due to branch consolidations. Nevertheless, total consumer welfare increased as more people partook of services in the growing deposit market.

This paper contributes to the discussion in several ways. First, as part of a growing literature on demand estimation for banking services, it considers a joint estimation strategy for determining market structure and develops a test for government interventions using first-order conditions. Second, it extends the banking deregulation discussion, which has traditionally focused on developed economies, to a large developing country. Third, it attempts a unified framework for evaluating market structure and welfare implications of Chinese banking during a period of reform.

As in many developing countries, banking reform has been incorporated into development strategies geared to improving access to financial services. The most notable policy implication here was that welfare improvements appear to be linked to promotion of financial market participation. This insight, however, needs to be coupled with an awareness that banking policy can have uneven effects across provinces or states. Moreover, moves to save money by consolidating branches and reducing employees created further disparities in policy implementation across provinces. The consumer welfare analysis here suggests that welfare costs have fallen disproportionately on the inland provinces. Furthermore, uneven changes in deposit services appear to have slowed resource mobilization in the

western provinces and increased income inequality across regions.⁴¹

Deregulation of the banking sector was a condition for China's 2001 accession to the World Trade Organization. The implemented deregulation in 2006 under its WTO commitments opened up the banking market to competition from foreign banks. The structural model developed in this paper provides an useful tool for future research to analyze banking policy such as introduction of new foreign banks and consolidation through mergers and acquisitions. Future research might also tackle the effects of consumer switching costs as they affect bank behavior.

⁴¹Using a large panel of countries, Beck et al. (2007) provide evidence that financial intermediation reduces income inequality and poverty.

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Appendix 1
Descriptive Statistics

Variable	Mean (S.D.)	Median	Minimum	Maximum
<i>Market/Demographic information</i>				
<i>Real GDP</i>	1.718 (1.369)	1.350	0.109	7.249
<i>Real GDP per capita</i>	4.647 (3.298)	3.482	1.243	21.76
<i>Agricultural share of GDP</i>	0.199 (0.083)	0.207	0.018	0.379
<i>Population density</i>	0.036 (0.044)	0.025	0.001	0.265
<i>Market share</i>				
<i>s_{jmt}</i>	0.175 (0.089)	0.161	0.040	0.568
<i>Price</i>				
<i>Service fee</i>	0.0014 (0.0010)	0.0009	0.0004	0.0035
<i>Deposit rate</i>	0.019 (0.009)	0.016	0.010	0.032
<i>Bank characteristics</i>				
<i>Employees per branch</i>	17.75 (10.40)	14.46	6.12	84.13
<i>BDensity</i>	0.009 (0.013)	0.005	0.000	0.095
<i>Total branch</i>	2.99 (1.88)	2.18	1.05	6.60
<i>Total asset</i>	0.000 (0.239)	-0.102	-0.342	0.415
<i>Instruments</i>				
<i>intexp (per yuan deposit)</i>	0.064 (0.041)	0.053	0.019	0.208
<i>opexp (100 million yuan per employee)</i>	0.001 (0.000)	0.001	0.000	0.001
<i>Loan/Asset (per yuan asset)</i>	0.59 (0.08)	0.61	0.43	0.70
<i>Cash/emp (100 million yuan per employee)</i>	0.001 (0.000)	0.001	0.000	0.001
<i>Equity/Emp (100 million yuan per employee)</i>	0.003 (0.003)	0.003	0.001	0.012
<i>rival Emp/Branch (people)</i>	17.75 (10.40)	16.34	8.49	50.89
<i>rival Bdensity (branch per km²)</i>	0.009 (0.011)	0.006	0.000	0.071

Unit: GDP in million yuan; GDP per capita in thousand yuan at 1993 price level; Agricultural share of GDP = %/100; Population density: 10,000 persons per km²; s_{jmt}, Service fees and deposit rate = %/100; Employees per branch = unit; BDensity (branch density) = branch per; km²; Total Branch = 10,000 unit; intexp = interest expense/deposit; opexp = operating expense/employee
Standard deviation in brackets
The figures are computed over the sample period.

Appendix 2
Price Regression

Variable	
<i>Constant</i>	0.0019 (0.0029)
<i>Intexp</i>	-0.0145 (0.0070)*
<i>Opexp</i>	1.1711 (0.9768)
<i>Cash/Emp</i>	-0.2142 (0.8442)
<i>Equity/Emp</i>	-0.1053 (0.1168)
<i>Loan/Asset</i>	-0.0090 (0.0030)*
<i>Rival Emp/Branch</i>	0.0001 (0.0000)*
<i>Rival BDensity</i>	0.0904 (0.0443)*
R^2	0.69
<i>P-value(F(7, 20))</i>	0.00

Dependent variable: P_{jt}

Observations = 28

** significant at 5% level*

Appendix 3					
Demand and Pricing Equations of the Decentralized Pricing Model					
Variable	RC-C	RC-M	Variable	RC-C	RC-M
<i>Demand - Linear</i>			<i>Cost</i>		
<i>Constant</i>	-0.954 (0.224)*	-0.954 (0.224)*	<i>Constant</i>	-0.0131 (0.0002)*	-0.0443 (0.0017)*
<i>BOC</i>	-0.201 (0.156)	-0.201 (0.156)	<i>BOC</i>	0.0029 (0.0001)*	0.0016 (0.0013)
<i>CCB</i>	0.432 (0.123)*	0.432 (0.123)*	<i>CCB</i>	-0.0001 (0.0001)	0.0001 (0.0013)
<i>ICBC</i>	0.732 (0.080)*	0.732 (0.080)*	<i>ICBC</i>	-0.0031 (0.0002)*	-0.0004 (0.0013)
<i>Emp per Branch</i>	0.002 (0.002)	0.002 (0.002)	<i>Year 1995</i>	0.0003 (0.0003)	0.0027 (0.0020)
<i>Bdensity</i>	8.017 (1.551)*	8.017 (1.551)*	<i>Year 1996</i>	0.0009 (0.0003)	0.0043 (0.0019)*
<i>Total Branches</i>	0.075 (0.028)*	0.075 (0.028)*	<i>Year 1998</i>	0.0003 (0.0003)	0.0029 (0.0020)
<i>Total Asset</i>	-0.018 (0.116)	-0.018 (0.116)	<i>Year 1999</i>	0.0002 (0.0002)	0.0052 (0.0018)*
<i>real GDP</i>	63.73 (27.14)*	63.73 (27.14)*	<i>Year 2000</i>	0.0003 (0.0003)	0.0037 (0.0020)**
<i>Agricultural share of GDP</i>	2.278 (0.650)*	2.278 (0.650)*	<i>Year 2001</i>	0.0006 (0.0002)	0.0086 (0.0017)*
<i>Demand - Nonlinear</i>					
<i>Constant, σ</i>	0.150 (0.446)	0.150 (0.446)			
<i>Pfee, α</i>	-159.4 (66.69)*	-159.4 (66.69)*	<i>J statistic</i>	11.2335	11.2335
<i>Demand - Dummies</i>					
<i>Province</i>	<i>Yes</i>	<i>Yes</i>	<i>P-value(J statistic)</i>	0.05	0.05
<i>Time</i>	<i>Yes</i>	<i>Yes</i>			
<hr/>					
<i>Observations: 828 for demand and 828 for pricing.</i>					
<i>Dependent variable: Mean utility $\delta_{jmt}(s_{jmt})$ for demand; marginal revenue for supply</i>					
<i>Estimated standard error are in parentheses; * significant at 5% level; ** significant at 10% level</i>					
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