Impacts of impediments to FDI on banks interest margins：A case study of China

Abstract Banks interest margins have been widely used as an indicator of productivity and competitiveness. This article applies cross-sectional data of 48 countries to estimate the impacts of impediments to FDI on banks interest margins. First, a model of determinants of interest margins is reformulated based on utility-maximizing framework for banks assets. Second, marginal impact parameters of the barriers to FDI and other important economic variables are estimated. Third, the potential reduction of banks interest margin is computed with elimination of major restrictions to FDI in China's banking sector. Our findings indicate that the interest variable- FDI barriers-demonstrates the highest impact. Further relaxing the restrictions on foreign equity in local banks, business scope conglomeration, and marketization of interest rates may lead to much lower bank interest margins in China. Policy suggestions are also drawn from these results.

Key words： banks interest margins, impediments to FDI, China
JEL: F13, F21, L86

Banks interest margins reflects social costs arising from financial services. These costs are directly related to social economic efficiency and often used to measure productivity and competitiveness of the industry. In recent years, people hold different views on openness and productivity of banking sector in China. On the one hand, significant progress has been made in opening up. With the implementation of reform policies related to the WTO commitments, the number of foreign banks and the quantity of funds have grown significantly. China's five major state-owned banks (ICBC, Bank of China, China Construction Bank, Agricultural Bank of China and Bank of Communications) also went public in domestic and foreign stock market after 2004. Foreign strategic investment has flowing in since then in quantity, operation and management of the local banks has been improved, and the NPL ratio has decreased from 20% -30% to 1-2%. On the other hand however, foreign banks are still unable to effectively compete with domestic banks. Take the year 2011 for example: Big Five hold 67% of assets concentration while foreign banks account for only 1.9%. The former own 90% of business outlets compared with only 0.008% for the latter. In the same year, the average net interest margins of domestic banks is also much higher than the average level of developed countries. Therefore, a reasonable estimation of the degree of openness of China's banking sector and an evaluation of the impact of further opening up the industry is of great interest.

Foreign direct investment is one of the most important forms of opening up the banking sector. Development of local industries can be promoted by market competition and technological spillover. In this study, we want to build the index of FDI barriers in the banking sector as a measurement of the degree of openness. Moreover, we will measure the impact of openness on the industry's average net interest margin to further estimate how the degree of openness can influence industrial efficiency. The results showed that openness to FDI is one of the most important causes of the differences in bank competitiveness among countries. China's banking industry continued to hold high FDI barriers in the world, thus, increasing openness will help the banking sector further promote efficiency.

The first section of this article briefly reviews the existing literature; the second section is a discussion of openness and development status of China's banking industry, served as the backgroundof following sections; the third section describes the methodology and discusses related data; the fourth part is the calculation results and analysis; the last section is conclusions and recommendations.

1. A Brief Literature Review

With the emergence of bilateral and multilateral agreements in 1980s, the importanceof liberalization of trade in services on industry competitiveness and economic development has attracted widespread attention (Warren 2000a, Dihel 2003, Jomini, Verikios, Zhang 2003, Dee 2005a, Eby and Maskus 2006, Jensen, Rutherford, and Tarr 2006, Burnham, James B 2007, Francois and Hoakman 2010, Yoo Tae and Soonchan 2011, Feng and Ilan 2011). Studies first focus on how to accurately measure barriers of trade in service among different states, then on building models to estimate the target variable - trade barrier index - and other important control variables and their influence. Hoekman (1995) is the first to calculate the frequency of indicators according to commitments among GATS Member States and frequency was used to measure barriers. Studies after improved the Hoekman index, among them the most influential one was conducted by Australian Productivity Commission (Warren 2000b, Dee 2005b, Dihel and Shepherd 2007, Lim and Chen 2012), which extends the sources of barriers and give weight according to the actual impacts. Results found the existence of barriers significantly reduce the overall productivity of the industry. Conclusions also showed that for developing countries, reducing barriers could largely improve the competitiveness of

the industry. In recent years,most quantitative researches on China's service trade barriers use the frequency index (Sheng Bin, 2002, Tian Xiaogeng, Yan Xiaohong 2008, NI Shi Jia 2010).The basic conclusion is that though entering the WTO has improved the openness of China's finance, telecommunications and other industries, but it is still at a relatively low degree, and government control is still intense.

Model on determinants of bank net interest margin are divided into two categories. One is based on the banking dealer model proposed by Ho and Saunders (1981) (referred to as the HS model), balancing the asymmetry of demand between deposits and loansby setting the deposit and loans rates. The other is the firm level model Klein (1971) put forward. Banks are regarded as intermediaries in a static environment to balance the demand and supply of loans and deposits until they reached market equilibrium. Both models have advantages and disadvantages, but since banks have their own funds, they behave more like dealer in nature. Hence, the dealer model is more generally used in actual researches.

According to the results of the initial HS model, determinants of net interest margin include only two variables:the market structure and the level of interest rate fluctuations, which apparently does not match the actual situation. Saunders and Schumacher (1997), Kalirajan et al. (2000) added FDI barriers, the scale of capital, cash-scale, non-interest expenditures and other variables on the basis of the dealer model, and tested the model using global data from commercial banks in different countries. Results showed there is a significant positive correlation between barriers and net interest margin. However, an important flaw of these studies is that index for barriers is directly added into the model, lack in rigorous derivation and limited to factors on the supply-side, thereby undermined the basic theory of the research. In addition, foreign direct investment is the most important form of opening up the banking sector, but impact studies of entrance barriers on net interest margin are rarely seen. This article would like to focus on these two issues.

2. Initial Analysis of the Degree of Openness of China’s Banking Sector

China's five-year transition period to the WTO ended on December 11, 2006.The State Department's " People's Republic of China Regulations on foreign bank " (the "Regulations") and the CBRC's "People's Republic of China Foreign Banks Regulations Implementing Rules" (hereinafter referred to "Rules") came into effect, marking all rounded opening up of China’s banking sector and unified management standards for foreign and domestic banks.

In April 2007, HSBC, Standard Chartered, Bank of East Asia, Citibank were the first four foreign banks allowed to conduct RMB business in China. By the end of 2011, a total of 35 foreign banks and 45 branches of foreign banks had been allowed to conduct RMB business, 25 foreign banks and 25 branches of foreign banks had been allowed to engage in financial derivatives transactions, and five foreign banks had been allowed to issue RMB financial bonds. Table 1 shows during 2006 to 2011, the number of foreign banks increased from 224to 387, with a 12% annual rate. Total assets increased from 927.9 billion RMB to 2.1535 trillion RMB, with a19% average annual rate. In 2008 and 2009, despite the impact of the global financial crisis, the number and the total assets of foreign banks still remain growing. Especially in 2010 and 2011, while the number of foreign banks grew slowly, the total assets showed a significant increase, indicating the scale of banks had increased. Numerous studies show that the entry of foreign banks has played a significant role in breaking the monopoly of China's banking industry, enhancing the management level and promoting operational efficiency (Su Dan Dan 2006, Yang et al. 2007, Wang Yanqiu 2008，胡元礼 et al. 2011, 2012 Sun Wei, etc.).

Table 1 Number of foreign banks operating in China during 2006 to 2011 and their assets information

Year	2006	2007	2008	2009	2010	2011
Number of foreign banks	224	274	311	338	360	387
Growth Rate	-	22.3	13.5	8.68	6.5	7.5
Assets (100M RMB)	9279	12525	13448	13492	17423	21535
Assets growth rate	-	34.98	7.37	0.33	29.13	23.6

Source: China Finance Yearbook 2011 ,China Banking Regulatory Commission Annual Report 2011

However, as mentioned at the beginning of this article, China's foreign banksare far from forming an effective competitive force in terms of scale and market share. Overall speaking, the industry is highly concentrated and inefficient. In 2011, the average net interest margin of China's banking industry is 2.65%,

while the figure for developed countries like United States, Germany, Sweden, the United Kingdom and Japan over the same period was 1.78%, 1.04%, 1.07%, 1.12% and 1.10% respectively. In the same year,profits of China's banking industry accounted for over 30% of global profits. All these factors combined reflect significant monopoly characteristics of China's banking industry. Net interest margin reflects the bank's net interest income arising fromper unit interest-earning assets, which is the price of bank deposit and lending services. On the one hand the high net interest margin reflects high operating costs, on the other hand, it indicates the presence of monopoly profits, resulting in a lower the industry productivity and social benefits losses. Therefore, the actual effect of opening-up after the five-year transition period is not significant. Through previous studies, we found the following main reasons:

Ownership restrictions on foreign ownership of Chinese banks. After the promulgation of "Regulations" and "Rules", although many multinational financial institutions have established or intended to establish wholly owned corporate banks in China, holding shares of existing commercial Chinese banks is still the most preferred way of investment because foreign banks can escape restrictions on total assets, representative offices, registration and working capital, etc. that are enforced by "Rules" and "Regulations". Furthermore, foreign banks may also expand cooperation with domestic banks in depth in a particular business area, including establishing cooperative business units, setting up joint ventures in the future under the legislation permits, etc. Examples include the Credit Card Center formed by HSBC with Bank of Communications and the private banking unit formed by China CITIC Bank and BBVA. This is such a quick and efficient way to help foreign banks invest in and cooperate with small and medium size domestic banks.They can gain returnor the right to speak with relatively low investment, meanwhile, they can also make full use of the existing network and other infrastructure of domestic banks, greatly reducing the cost of entry. The "Management Approach for Foreign Financial Institutions' Investment in Shares of Chinese Financial Institutions " that China Banking Regulatory Commission promulgated in December 2003make clear and detailed provisions of the qualifications, shares and proportion, and procedures of foreign investors, in particular, it is stated that foreign ownership of Chinese banks can be "no more than 20% of single-investor, no more than a total of 25%" for all foreign investors". CBRC regarded this as "a must followed bottom line," and did not make any adjustments so far. It reflects that Chinese laws and regulations have maintained stability of the level of foreign ownership, but it also constitutes one of the most important restrictions for foreign investors.

The two other factors affecting foreign investors are the government's restrictions on interest rate and operation of different business units. In 2013, the Chinese government lifted restrictions on lending rates, but the deposit interest rate, which is a key element of market liberalization, still remains fixed. On the one hand government regulation of interest rates protects the main industry profits of state-owned banks, but on the other hand foreign banks lose their cost advantages and are unable to develop more competitive prices to attract customers. "CPC Central Committee's Decision on Deepening Reform of the a Number of Major Issues" (the "Decision") have also put forward 'accelerating interest rate marketization' and establishing a complete set of 'deposit insurance system', indicating that the interest rate marketization is an inevitable part of perfecting market economy and completing economic restructuring. In respect of operation on different business units, despite basic banking business, foreign banks can engage in insurance and securities trading, but cannot engage in trust investment and stock business, resulting in business scope compression, making foreign banks unable togive full play of their experiences on mixed business units.

In summary, China still faces a number of important issues on further opening up the banking sector. In the long term, gradually relaxing restrictions on foreign ownership of Chinese banks and on operations of multiple business units, and realizing interest rate marketization will make China's policy on foreign banks effective. It is also in line with the strategic goal of "decision"to promote market-oriented reforms and mixed ownership economy. The following sections will further analyzed and discussed these points.

3. Model and Data

This section firstly introduces the HS model, and then discusseshow this paper improves the model and how impact is estimated. At last there will bea brief description of the data.

(1) H-S model

HS modeldeduces formula for determining the net interest margin of the banking sector on basis of maximizing utility of banks' total assets.The basic assumption is that the main businesses of banks are deposits and loans and their income is from interest margin.

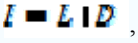
First,assume banks are risk-neutral and the main subject of transactionsis debt.Providing loans is equivalent to purchasing debt and providing deposit services is equivalent to selling debt. Within a specific period of time (hereinafter referred to as "investigation period"), banks reportthe price of loan (ie debt purchasing price) and the price of deposit (ie debt selling price)to the public, and passively accept trading on each price to meet the public demand for deposit and loan services. According to the law of quotes for dealer, deposit and loan price can be expressed as:

$$\begin{aligned} P_D &= p + a \\ P_L &= p - b \end{aligned} \qquad (1)$$

Wherein, P_D and P_L denote price of deposit (debt selling) and loan (debt purchasing) respectively. p is a fixed constantthat describes the intrinsic value of transaction of deposits and loans. a and b are determined by banks and can be regarded as banksservice fees - the price of servicesfor deposits and loans. a + b is the bank's net interest income from per unit of deposit and loan, which is net interest margin. P_D and $P_L$is the opposite of whatwe usually refer to as the concept of deposit and lending rates: the higher P_D is,the more willing the public are to buy debt and the lower the deposit rate is;the higher P_L is, the higher prices thepublic sell debt to banks,and the lower the lending rate is. In reality, deposits and loans generally do not occur simultaneously.It is assumed that only one transaction (deposits or loans) occurs during the review period and the scale are both set to Q. Loan price is determined at the beginning and remains unchanged until the end of the period.New deposits and loans occur after the determination of the deposit and lending rates andexpires at the end of review period. Assume the probability of new loans and deposits are λD and λL, reflecting demand for deposit and loan services. According to the theories of microeconomics, market demand for particular goods or services negatively correlated with price, then λD and λL can be expressed as:

$$\begin{aligned} \lambda_D &= \alpha - \beta a \\ \lambda_L &= \alpha - \beta b \end{aligned} \qquad (2)$$

a and b are the bank deposit and loan services prices respectively. According to equation (1), if b increases,loan price $P_L$will be lower and lending rate rises.The public's demand for loans is suppressed and probability for loans will decrease. Similarly, if a increases, the corresponding deposit price $P_D$increases and deposit rate decreases. People's demand for deposit services fall and the probability ofdeposits will decrease. Assume deposits and loans to banks are homogeneous products withthe same price sensitivity, so the probability of deposits and loans is the same.Then in the above two expressions, constant term (α) and coefficient (β) are equal. The above two formulas indicate that banks can influence the probability of deposits and loans through setting the services price a and b.

Further assume that banks total assets consist of three parts: a bank'sown assets (Y), net loan assets (I), and money market assets (C). Y Reflects assets the bank purchased using its own funds, including fixed assets, stocks, funds, bonds and other investment in the market; netloan assets(Y) reflect the relative size of deposit and loan business, which is the difference between the total amount of loans and deposits and can be expressed as  , where L is the total amount of the loan and D is the total amount of deposit; money market assets reflect the liquid assets a bank hold, including treasury bills, notes, short-term repurchase, inter-bank lending and other high-liquidity assets. The value of bank assets is expressed as follows:

$$\begin{aligned} W &= Y + I + C \\ W_0 &= Y_0 + I_0 + C_0 \\ Y &= (1 + r_Y)Y_0 + z_Y Y_0 \\ I &= (1 + r_I)I_0 + z_I I_0 \\ C &= (1 + r)C_0 \end{aligned} \qquad (3)$$

W and W_0 represent the value of total asset at the end and the beginningrespectively.Y, I, C are abank's own assets, net loan assets and money market assets at the end of the period. Y0, I0, C0 is corresponding value of assets at the beginning of the period.r_Y, r_I and γ are the rate of returnfor the above three assets during the period. z_Y and z_I denote random variables that affect the bank's own assets and net loan assets, reflecting the risk of fluctuations in bank asset returns. It is assumed that they follow a normal distribution with an expected value of zero.

To make full use of resources, every time a bank absorbs a new depositwhile there is no demand for loans, it will invest the deposit to money market to earn risk-free interest rate r, whichmakes net loan assets I_0 decrease andmoney market assets C_0increase; in the event of a new loan occurs without supply of new deposits, the banks will finance fromthe money market with risk-free interest rate r to meet the demand for loans, whichmakes net loan assets I_0 increase andmoney market assets C_0decrease. Based on the above assumptions, a bank's target is to maximize the utility of total assets at the end of the period by setting appropriate deposit and loan service fee a and b at the beginning of the period.

If neither deposits nor loans occurduring the period, value ofa bank's total assets at the end of the period can be expressed as:

$$W = Y + I + C = (1 + r_Y)Y_0 + z_Y Y_0 + (1 + r_I I_0)I_0 + z_I I_0 + (1 + r)C_0 \quad (4)$$

Take the expected utility (EU)of total assets W at the end of the period and launch second-order Taylor formula of the value of total assets at the beginning of the period W_0:

$$\begin{aligned} EU(W) &= E[U(W_0) + U'(W_0)(W - W_0) + \frac{1}{2}U''(W_0)(W - W_0)^2] \\ &= E[U(W_0) + U'(W_0)(r_Y Y_0 + r_I I_0 + rC_0 + z_Y Y_0 + z_I I_0) + \frac{1}{2}U''(W_0)(r_Y Y_0 + r_I I_0 + rC_0 + z_Y Y_0 + z_I I_0)^2] \\ &= U(W_0) + U'(W_0)r_W W_0 + \frac{1}{2}U''(W_0)(\sigma_I^2 I_0^2 + 2\sigma_{IY} Y_0 I_0 + \sigma_Y^2 Y_0^2) \end{aligned} \quad (5)$$

其中 Among them

$$r_W = \frac{r_Y Y_0}{W_0} + \frac{r_I I_0}{W_0} + \frac{rC_0}{W_0}$$

In the event of a new deposit with the scale of Q occurs during the period, the bank's net loan assets is nowI_0-Q, money market assets isC_0+Q+aQ, and the total value of assets at the beginning of the period becomes W_0=Y_0+I_0+C_0+aQ. Add the above changes in equation (5) to get the expected utilityof the new total assets atthe end of the period:

$$EU(W \mid deposit) = U'(W_0)aQ + \frac{1}{2}U''(W_0)(\sigma_I^2 Q^2 + 2\sigma_I^2 Q I_0) + U(W_0) + U'(W_0)r_W W_0 + \frac{1}{2}U''(W_0)(\sigma_I^2 I_0^2 + 2\sigma_{IY} Y_0 I_0 + \sigma_Y^2 Y_0^2) \quad (6)$$

Similarly, if a new loadwith a scale of Q occurs during the period, the bank's net loan assets will beI_0+Q, money market assets will beC_0-Q+bQ, and total value of assets will be W_0=Y_0+I_0+C_0+bQ.Expected utility of total assets after the new loan occurs is:

$$EU(W \mid loan) = U'(W_0)bQ + \frac{1}{2}U''(W_0)(\sigma_I^2 Q^2 - 2\sigma_I^2 Q I_0) + U(W_0) + U'(W_0)r_W W_0 + \frac{1}{2}U''(W_0)(\sigma_I^2 I_0^2 + 2\sigma_{IY} Y_0 I_0 + \sigma_Y^2 Y_0^2) \quad (7)$$

Based on the above assumptions, the occurrence of deposits and loans are mutually exclusive events (because the probability of occurrence of deposits and loans at the same time is zero), and therefore probability of neither loans nor deposits occurs can be expressed as: 1-λ_D-λ_L.According to the theory of probability, a bank's expected utility of total assets during the period can be expressed as:

$$EU(W \mid total) = \lambda_D EU(W \mid deposit) + \lambda_L EU(W \mid loan) + (1 - \lambda_D - \lambda_L)EU(W) \quad (8)$$

According to the maximizing theory, take derivative of formula (8) for a and b respectively and make it equal to 0:

$$\frac{\partial EU(W \mid total)}{\partial a} = -\beta[U'(W_0)aQ + \frac{1}{2}U''(W_0)\sigma_I^2(Q^2 + 2QI_0) + EU(W)] + U'(W_0)Q(\alpha - \beta a) + \beta EU(W) = 0$$

$$\frac{\partial EU(W \mid total)}{\partial b} = -\beta[U'(W_0)bQ + \frac{1}{2}U''(W_0)\sigma_I^2(Q^2 - 2QI_0) + EU(W)] + U'(W_0)Q(\alpha - \beta b) + \beta EU(W) = 0$$

Simultaneous simplification of the equations give us the formula for bank net interest margin:

$$a + b = \frac{\alpha}{\beta} - \frac{1}{2}\frac{U''}{U'} Q \sigma_I^2 \quad (9)$$

Equation (9) indicates thatbank net interest margin is mainly composed of two parts: $\frac{\alpha}{\beta}$ and .α and β were the constant term and the coefficient of service fee(a or b) indeposit and loan probability equation (Equation 2).αindicatesthe probability of loans and depositswhen the service fee is zero. Since the various service providers (ie banks) will split the market, so the higher the α, the smaller the number of deposit and loan service providers is and the more concentrated the market is; β indicates the sensitivity of demand for deposit and loan service costs, the smallerβ is, the less sensitive demand is for deposit and loan service cost and the fewer competitors are, suggesting that service providers can increase fee more freely without having to worry about possible sharp decline in demand. Therefore, α / β reflects the degree of competition of the loan market. The greater the α / β is, which means the larger α is and the smaller β is, the lower the degree of competition in the market is.Banks can charge higher service fees to get more net interest income.

$-U''/2U'$ in $-Q\sigma_I^2 U''/2U'$ reflects the degree of risk aversion of banks. Under the assumption of risk neutral, this value is a constant. Q is the size of the deposit or loan transactions, according to model assumptions, this value is fixed.σ_I^2 is the variance of the random variable for the impact of net loan assets z_I, representing the interest rate volatility. Therefore, this part reflects interest rate volatility in different areas.

(2) **Model Extension**

The original modeltakes into account only the service cost factor in setting the decision formulafor public demand of loans and deposit services,but according to the Marshall demand theory, what influenced the demand of a product include price, income, competitor' prices and other factors. Therefore, assuming that each bank's services and assets are homogeneous, in addition tothe price level of a particular bank compared to the rest of the market, people's income, inflation rate as the opportunity cost of holding the product, and openness to foreign investment will also affect the price of competing products. Specifically, increase in income will drive up the demand for deposits, and as income increases, people will be more motivated to use the loan service to consume or invest in order to maximize return, thereby generating higher loan demand. When inflation is high, in order to avoid devaluation, people's demand for money decrease and consumption will increase, and therefore, demand for deposit goes down. High inflation will lead to a decline in the cost of loans and increase public demand for loans. When openness to foreign capital increases, more foreign banks will join the competition, so the price of services will decrease, reducing the demand for specific bank services. Based on the above conditions, this paper use income growth rate (m), inflation (π) and FDI barriers index (RI) to represent the above three factorsrespectively.Then the probability of occurrence of new deposits and loans adjusted is as follows:

$$\lambda_D = \alpha - \beta a + \gamma m - \phi\pi + \varphi RI$$
$$\lambda_L = \alpha - \beta b + \gamma m + \phi\pi + \varphi RI$$

Take the above two equations into equation (8), and when the derivative of a and bis equal to respectively:

$$\frac{\partial EU}{\partial a} = -\beta[U'(W_0)aQ + \frac{1}{2}U''(W_0)\sigma_I^2(Q^2 + 2QI_0) + EU(W)] + U'(W_0)Q(\alpha - \beta a + \gamma m - \phi\pi + \varphi RI) + \beta EU(W) = 0$$
$$\frac{\partial EU}{\partial b} = -\beta[U'(W_0)bQ + \frac{1}{2}U''(W_0)\sigma_I^2(Q^2 - 2QI_0) + EU(W)] + U'(W_0)Q(\alpha - \beta b + \gamma m + \phi\pi + \varphi RI) + \beta EU(W) = 0$$

Simultaneous simplify the two equations to get:

$$a + b = \frac{\alpha}{\beta} + \frac{\gamma m}{\beta} + \frac{\varphi RI}{\beta} - \frac{1}{2}\frac{U''}{U'} Q\sigma_I^2 \quad (10)$$

It can be seen from equation (10) thatthe bank's net interest margin is composed of four parts: $\frac{\alpha}{\beta}$ and in the original model and the $\frac{\gamma m}{\beta}$ 和 and $\frac{\varphi RI}{\beta}$ that is newly added, because the effects of inflation in demand for deposits and loansare the opposite, so they are offset in the derivation process.According to the above analysis, α / β mainly reflectsthe degree of market competition in the region, mainly reflects interest rate fluctuations in the region.Explanations for the other two parts are as follows:

$\frac{\gamma m}{\beta}$: γ and β are the coefficients ofincome level (m) and service charges (a and b) in the deposits and loans probability formula, representing the sensitivity of demand for deposit and loan service fee and income level respectively. The largerγ is, the greater the impact of income level on deposit and loan demand is.The smaller β is,the less impactthe cost of services on thedemand of loans and deposit is,and the larger γ / β is. Therefore, banks can charge higher service fee because rising income level increases the demand of loan and deposit, resulting in higher net interest margin income. This part mainly reflects impact from income.

$\frac{\varphi RI}{\beta}$: φ and β are the coefficients ofbarriers index (RI) and service charges (a and b) in the deposits and loans probability formula, indicating the sensitivity of deposit and loan service fee and FDI barriers on the demand for deposits and loans. The larger φ is, the greater the impact of FDI barriers on the demand of deposit and loan is. The smaller β is, the less sensitive service fee is to the demand of deposits and loans.In the case of small foreign investment, it reflects there is fewcompetitors in the market, and therefore,banks can increase service fee without having to worry about a substantial decline in demand.Namelywhen the value of φ / β is greater, the impact of FDI barriers on deposits and loans demand is larger.Banks charge higher service fee under the protection of FDI barriers, increasing net interest margin. This section mainly reflects the impact of FDI barriers.

Z (=a + b) stands for bank net interest margin. S is the variable that represents the degree of market competition variable. m is income level. RI is FDI barriers index. i represents regional interest ratefluctuations.The formula of net interest margin can be expressed as:

$$Z = Z(S, m, RI, i) \quad (11)$$

However, in formula (11), Z is "pure interest margin" under the assumption that every bank's service and asset is homogeneous. Therefore determined mainly by macroeconomic factors in the regional or sectoral level, but the actual net interest margin of a bank is also affected by factors such as core capital, cash assets, non-interest expenditures and non-performing loans ratio (Dee 2005a). Core capital isthe most stable and highest quality capital of commercial banks.Banks can permanently hold core capital to fill the loss of long-term management. It includes common shares, preferred shares and retained earnings. However, if the core capital ratio is too high, it will reduce financial leverage and increase financing costs, thereby affecting bank profits, thus the bank willincrease net interest margin to make up for this cost. Cash assets are mainly used to meet a variety of short-term funding needs, including withdrawals and deposits supplement, but because cash itself does not generate any revenue, there will be some opportunity cost for holding cash. Banks will increase net interest margin in order to reduce the opportunity cost of cash holding. Non-interest expenditures reflect the operating costs of banks. Ithas a significant impact on bank profits.In order to make profit, banks with high operating cost will havehigh net interest margin. NPL ratio reflects the credit risk of a bank. Banks will increase net interest margin to compensate for high risk. Therefore, net interest margin (NIM)is determined by five different components:pure interest margin (Z), core capital (K), cash assets (L), non-interest expenditure (NIE) and NPL ratio (IL):

$$NIM = F(Z(S, m, RI, i), K, L, NIE, IL) \quad (12)$$

Studies have shown that (McGuire and Schuele 2001, Kalirajan et al. 2001) the relationship between the actual net interest margin and core capital, cash assets, and non-interest expenditure is nonlinear.Pure net interest margin has an exponential relationship with NPL ratio and net interest margin. The linearized pure interest margin formula is:

$$\ln(NIM) = \mu_1 \ln(K) + \mu_2 \ln(L) + \mu_3 \ln(NIE) + \mu_4 IL + \mu_5 S + \mu_6 m + \mu_8 i + \mu_7 RI \quad (13)$$

FDI barriers is the main target variable in this research, and the others are control variables. Intercept and disturbance are introduced in formula (13).The econometric model is:

$$\ln(NIM_j) = \mu_0 + \mu_1 \ln(K_j) + \mu_2 \ln(L_j) + \mu_3 \ln(NIE_j) + \mu_4 IL_j + \mu_5 S_j + \mu_6 m_j + \mu_7 RI_j + \mu_8 i_j + \varepsilon_j \quad (14)$$

From the above discussion, all eight explanatory variables are positively correlated with the dependent variable.j represents the sample of banks and its value is 1,2,3 .... μ_0 is the intercept. ε_j is the error term and is assumed to follow a normal distribution with an expected (average) value of zero. It should be noted that the sample data of this paper does not contain any explanatory variables that are close to zero, so the model intercept does not have a real meaning.

(3) Measure of the overall impact

This paper use the formula Dee (2005a) proposed to measure the overall impact of FDI barriers on net interest margin. When there are no FDI barriersin a country's banking sector, actual net interest margin (NIM0) can be expressed as:

$$\ln(NIM_0) = \mu_1 \ln(K) + \mu_2 \ln(L) + \mu_3 \ln(NIE) + \mu_4 IL + \mu_5 S + \mu_6 m + \mu_8 i \quad (15)$$

The productivityachieved by elimination of FDI barriersis formula (13) minus formula (15), which is:

$$\ln\left(\frac{NIM}{NIM_0}\right) = \mu_7 RI \quad (16)$$

Take the natural log and then subtract 1 from both sides of the equation and get:

$$\frac{NIM - NIM_0}{NIM_0} = e^{\mu_7 RI} - 1 \quad (17)$$

In which $\frac{NIM - NIM_0}{NIM_0}$ represents net interest margin decline after the elimination of all barriers, e is the natural exponent. Formula (17) shows that with the coefficient of barriers μ_7, and a country's barrier index RI, we can be reasonably estimated that the impactof FDI barrierson the net interest margin of a country's banking sector.

（4）Data

As mentioned above, we use the annual average data of 2011.The sample includes 737 banks in developed countries and less developed countries in order to focus on the important factors causing differences in productivity in this imbalance world economy and in this globalized environment. Macroeconomic data is from the World Bank's official website[4] and the financial indicators are from Bankscope database[5]. The sample includes 737 banks from 48 countries in Asia, Europe, North America, South America, Oceania and Africa (Table 4). Currency unit is converted into US dollars according to the exchange rate on 31 December 2011.

Net interest margin is actual data from different banks. Core capital, cash and non-interest expenditures are used as ratios of total assets. The degree of market competition is the centralization rate of the top five banks in the country. Income is measured using per capita GDP growth rate.Interest rate fluctuations are the standard deviation of changes in interest rates for Treasury bills from 2001 to 2011in the country where each bank located.

FDI barriers index can be referred to Dee (2005a)'s results of the 47 countries (excluding China). It should be noted that the findings are based on situationsbefore 2005. The author tried to searchwebsite of WTO, IMF, the World Bank and central banks of different countriesfor relating policy information to update the index barriers, but because of website re-edition, content changes and other reasons, it is difficult to find the relevant data. However, the Doha Round negotiations, which mainly focus on trade in service, has been deadlocked since 2001, and were broke down because the United States, China, India were unable to reach a consensus on July 29, 2008. Thus it can be assumed that the liberalization process of trade in service has not undergone substantial changes. Therefore,the 2005 results remain representative.

China's barrier index is calculated based on the framework (Table 2) Dee (2005b) proposed. Data sources include the "People's Republic of China Foreign Banks Regulations", "People's Republic of China Foreign Banks Regulations Implementing Rules", "People's Republic of China Commercial Banks Law", " People's Republic of China Company Law "," Law of the People's Republic of China on Control of the Entry andExit of Aliens", " Rules of Implementing the Law of the People's Republic of China on Control of

the Entry and Exit of Aliens ". After adding up the numbers and giving weights the score of FDI barriers of the banking sector is 0.307 (Table 3).

Table 4 is the FDI barriers index sample, China ranked 38 out of 48 countries, which indicates a low level of openness. As it can be seen in Table 3 by factor index scores, the reasons resulting in a higher barrier index aremainly from three aspects: first, foreign ownership cap injoint venture banks, contributing to a 0.15 index, where barriers index is 0.8 and the weight 0.19. The upper limit of foreign ownership of a single investor is 20%. As described above, restrictions on using existing bank branches and other resources discourage foreign banks to invest in China. Second, interest rate controls. The index score is 0.07, including a 0.5 barriers index and the weight is 0.1425. China's marketization reform of interest rates has not been completed.The government controls of interest rates disable foreign banksfrom taking advantage of cost management and attracting customers with competitive prices. Third, separate operation.The index is 0.07. Provision of separate operation limits the business scope of foreign banks, making it difficult to give full play of experience on operation of multiple business units. The index calculation results also confirms the preliminary analysis made by Section II.

4. Results and discussion

This section analyzes the measurement results, including the target variable FDI barriers and the marginal impact of other variables, the overall impact of FDI barriers on productivity of the banking sector. Parameters are analyzed based oninformation of different countries represented by the samples, and therefore, it can be used to measure the impacts of opening up for different countries.

(1) Parameters: marginal effect

This paper used Eviews statistical software to run least squares linear regression on cross sectional data sample of737 banks from 48 different countriesaccording to equation (14) and the results are shown in Table 5. For each variablethe t statistics isabove 99% significant level. F statistic also shows the selected variables has a high overall significance. $R^2$and the adjusted R^2 are 0.644297 and 0.640388respectively, so model fit is acceptable. All coefficients are positive, which is in line with theoretical assumption (see Section III Part I).

Table 2 Scoring Criteria of Barrier

Classification	content	score	Criteria	Weight
Restrictions on entry	Business license	1	Cannot engage in any profit-making business	0.19
		0.75	Can engage in up to three different kinds of business	
		0.5	Can engage in up to six different kinds of business	
		0.25	Can engage in up to ten different kinds of business	
		0	No restriction	
	Entry as joint ventures	1	Not allowed to enter as joint ventures	0.095
		0.5	Can only enter as joint ventures	
		0	Can enter as wholly-owned company	
Ownership and control	Foreign ownership restrictions		Maximum stake is 1. If the highest allowed percentage of foreign ownership in joint ventures is 49%, then the barrier score is 0.51.	0.19
Restrictions on operations	Deposits restrictions	1	Not allowed to obtain deposits from domestic market	0.1425
		0.75	Not allowed to obtain deposits from the domestic capital market	
		0.5	Not allowed to obtain funds from the public or subject to interest rate controls	

		0	No restriction	
	Loan business restrictions	1	Not allowed to provide loans to local customers	0.1425
		0.75	Can only provide loans to local government construction projects	
		0.5	Only allowed to provide credit card and other microfinance services to local customers	
		0.25	Allowed to provide large loans directly to certain sectors such as real estate	
		0	No restriction on subjects of loans	
	Operation on different businessunits	1	Only allow banking business	0.1425
		0.5	Only allow banking business plus some the other businesses	
		0	No restriction	
	New branches	1	Not allowed to open new branches	0.05
		0.75	Restrictions on the number of branches in a region	
		0.25	Strict review procedures of new branches	
		0	No restriction on new branches	
Movement of natural persons	Short-term stay of stuff	1	Foreign directors, senior managers and specialists not allowed to stay	0.0095
		0.75	Foreign directors, senior managers and experts can stay up to 30 days	
		0.5	Foreign directors, senior managers and experts can stay up to 60 days	
		0.25	Foreign directors, senior managers and experts can stay up to 90 days	
		0	Foreign directors, senior managers and experts can stay more than 90 days	
	Long-term stay of stuff	1	Foreign directors, senior managers and specialists not allowed to stay	0.019
		0.8	Foreign directors, senior managers and experts can stay up to one year	
		0.6	Foreign directors, senior managers and experts can stay up to two year	
		0.4	Foreign directors, senior managers and experts can stay up to three year	
		0.2	Foreign directors, senior managers and experts can stay up to four year	

		0	Foreign directors, senior managers and experts can stay up to five year	
	Board of Directors		The highest ration of foreigners in the board of directors is 1. If the board can have up to 20% of foreigners, the score is 0.8.	0.019

Source: Dee (2005b), weight is obtained by factor analysis.

Table 3 Index scores and weights

Index	Index score	Criteria	Weight
Business license	0	China has almost no restrictions on business licenses of foreign banks, so the score is 0	0.19
Enter as joint venture	0	Foreign banks can enter the local market through joint ventures or wholly owned companies, so the score is zero.	0.095
Foreign ownership restrictions	0.8	The highest limit of foreign ownership from a single investor is 20%, so the score is 0.8	0.19
Restrictions on deposit business	0.5	China has fully opened RMB business to foreign banks registered in the country. The can absorb deposit from the public but interest rate is controlled by the government	0.1425
Restriction on borrowers	0	There is no explicit restriction on borrowers of foreign banks, so the score is 0.	0.1425
Operation on different business units	0.5	Besides basic banking operations, foreign banks can only engage in insurance and securities trading business, so the score is 0.5.	0.1425
New branches	0.25	There is no specific restriction on the number of branches of foreign banks, but the approval procedures are very strict, so the score is 0.25.	0.05
Short-term stay of staff	0	According to " Law of the People's Republic of China on Control of the Entry and Exit of Aliens", temporary foreign workers can stay up to one year in China, so the score is 0	0.0095
Long-term stay of staff	0	According to " Law of the People's Republic of China on Control of the Entry and Exit of Aliens", foreign workers can stay up to five year in China and their visa can be further extended, so the score is 0	0.019
Board of Directors	0	There is no specific rules on ratio of nationalities of the Board of Directors, so the score of 0.	0.019

Source: index is calculated by the author according to Chinese laws.

Table 4 FDI barrier index for 48 countries

Ranking	Country	Index	Ranking	Country	Index	Ranking	Country	Index
1	United States	0.002	17	Spain	0.01	33	South Africa	0.129
2	Japan	0.002	18	Greece	0.01	34	Russia	0.136
3	Argentina	0.01	19	New Zealand	0.01	35	Chile	0.149
4	Ireland	0.01	20	Italy	0.01	36	Colombia	0.164
5	Austria	0.01	21	United Kingdom	0.01	37	Thailand	0.212
6	Belgium	0.01	22	Switzerland	0.018	38	China	0.307
7	Denmark	0.01	23	Albania	0.048	39	Turkey	0.315
8	Germany	0.01	24	Estonia	0.05	40	Brazil	0.324

9	France	0.01	25	Croatia	0.05	41	Korea	0.39
10	Finland	0.01	26	Macedonia	0.054	42	Monaco	0.397
11	Netherlands	0.01	27	Moduowaer	0.054	43	Uruguay	0.402
12	Canada	0.01	28	Bulgaria	0.058	44	Vietnam	0.473
13	Luxembourg	0.01	29	Lithuania	0.058	45	Philippines	0.48
14	Peru	0.01	30	Australia	0.069	46	Indonesia	0.489
15	Portugal	0.01	31	Serbia	0.095	47	India	0.537
16	Sweden	0.01	32	Mexico	0.111	48	Malaysia	0.61

Source: Dee (2005b)；China's index is calculated by the author

Table 5 Regression results

Dependent variable: log（NIM）Regression method: Least Squares Sample size：737				
Independent variable	Coefficient	Standard deviation	t statistics	p value
C	2.9689	0.1539	19.289	0
LOG(K)	0.3294	0.0318	10.3488	0
LOG(L)	0.0607	0.0101	6.002	0
LOG(NIE)	0.328	0.0186	17.5982	0
IL	1.3134	0.4503	2.9166	0.0036
S	0.5834	0.1042	5.5991	0
m	0.1973	0.0522	3.7759	0.0002
RI	1.3821	0.0986	14.0189	0
i	0.001	0.0003	3.0686	0.0022
R^2	0.644297		F statistics	164.8311
Adjusted R^2	0.640388		p value of F statistics	0

As mentioned earlier, this article does not contain any explanatory variables that is close to zero, so the intercept (C) has no real meaning. FDI barriers (RI) variable has the highest coefficient value (1.38).Every 1% increase in RI results in a 1.38% increase in net interest margin. This result indicates the opener a country is to foreign direct investment, the higher the increase in productivity of the whole industry due to the introduction of advanced management, the promotion of product innovation, and an increase of the degree of competition. It shows that in thisworld of imbalance economic development, expanding openness of the banking sector is ofgreat significance.

The impact of NPL ratio (IL) ranks second (1.31), which means when the ratio of non-performing loans to total loans increases by 1%, the credit risk pushes up net interest margin by 1.31%. In recent years, financial innovation and diversification of financing channels has promoted the efficiency of the industry, butit also takesthe degree of leverage of economic operation to a higher level. In addition,progress in restructuring and reforming of the financial regulatory system is lagging behind. Therefore,bad loans have become one of the main factors affecting the efficiency of banks.

The degree of market competition (S) also has a big impact on net interest margin. 1% increase of the bank's industry concentration will contribute to a 0.58% increase in net interest margin, indicating that oligopoly is still an important issue many countries faced in the banking industry. As mentioned above, the more concentrated the market is, the less option people have, and the less sensitive the bank's service fee is, giving banks more space for increasing service charges.

Coefficient of core capital (K) is 0.33, which means when the ratio of core capital to total assets increased by 1%, thefinancing costs will increase net interest marginby 0.33%. Core capital mainly consists

of common shares, preferred shares and retained earnings, etc. In today's highly leverage economy, its opportunitycosts is higher than other financing options.

The coefficient of non-interest expenditure (NIE) is 0.33, the same as core capital, which means when the ratio of NIE to total assets increases by 1%, in order to ensure profits the bank will increase net interest margin by 0.33%, reflecting the importance of operational and cost management on the bank's efficiency.

The coefficient of income growth rate (m) is 0.19, indicatingwhen per capita income increased by 1%, net interest margin will increase 0.19%. Income growth pushes up the demand for deposit and loan products,thereby pushes up the price of banking services. As mentioned earlier, this paper uses a sample of high-income and low-income countries.In order to control the impact of income on net interest margin,this variableis added into the regression model for more accurate estimation.

Coefficient of cash assets (L) is only 0.06, which indicates every 1% increase in the ratio of cash assets to total assets results in a 0.06% increase in net interest margin. Aspreviously mentioned, cash assets are primarily used for a variety of short-term funding activitiesand they include cash, treasury bills, bills, short-term repurchase, inter-bank lending and other high-liquidity assets.Becauseof their return they have high opportunity cost. The reasons why their impact is weak include: the increasing options in short-term financing decrease the cost of cashing holding, and commercial banks'cash / total assets ratio is relatively alike and stable. Descriptive statistics show thatthe mean for this variable is 0.06 and the variance is0.006.

Interest rate fluctuations (i) has the minimum coefficient (0.001). It means when the difference of interest rate among countries increased by 1%, net interest margin caused by the difference in financing risks is only 0.001%. The impact is primarily from the changes of interest earning frombanks highly liquid assets in the money market.One possible reason why it does not have a real impact on net interest margin is the development and innovation of financial derivatives provides a number of effective tools to avoid interest rate risk, and therefore reduces banks' administrative costs of managing interest rate risk.

(2) The Overall Impact: China as an Example

The discussion above includes the marginal impactof various economic variables of FDI barriers on net interest margin, and can be used to analyze the situation of different countries. This section estimates the productivity of the industry after the removal of barriers in the banking sector.

The index of barriers RI = 0.307 (Table 4) and the coefficient of barriers is 1.3821 (Table 5). Take them into equation (17) and we can get that FDI barriers increasenet interest margin by 53%, that is to say the cancellation of barriers can be reduce 53 % of NIM.According to Table 3, restrictions on foreign ownership accounts for 26%, interest rate controls and controls on operation of different business units account for 12%. The actual level of net interest margin (NIM0) that can be achieved can be calculated by Equation (17) and be converted to:

$$NIM_0 = \frac{NIM}{e^{\mu_7 RI}} \qquad (18)$$

Where μ_7 is the coefficient on barriers (see equation 14). Take that into 2011 data, the results show that if China abolish restrictions on major FDI policies (Table 3), the average net interest margin of the banking sector will be reduced from 2.65% (NIM) to 1.73% (NIM0). This means holding other variables constant, further liberalization of policies will expand the scale of foreign capital, bring advanced management and product innovation, together with increase in market competition and other effects can reduce net interest margin by one third ((2.65% -1.73%) / 2.65%) and therefore get close to the level of developed countries. Reducing the cost of banking products and services can have a profound impact on the entire economic development and restructuring process.

It should be noted that any predictions involveerrors. Other economic variables will also change over time. However, as mentioned at the beginning of Section II of this paper, after going public in 2004, China's five major state-owned banks have attracted a large number of domestic and overseas strategic investments. Bank management level and net interest margin as an indicator of operating efficiency are improved significantly. In order to avoid bias in the estimation, the model adds in other major economic variables based on the theory of demand for banking services.The regression result is consistent with the preliminary analysis in Section II. Therefore, the above analysis has an important reference value on the effects of further opening up the industry. Specifically, the restrictions of foreign ownership, interest rate controls and restrictions on operation of different business units are major factors influencing foreign investment, and should be the main focus areas in opening up China's banking industry.

Conclusions

This paper estimates the impact of FDI barriers on net interest margin of the banking sector, and estimate the potential increase in production efficiency if further opening up the industry. This paper is based on the utility function of bank dealer model and has made several improvements in order to strengthen the theoretical basis of econometric analysis. We use data from 2011 to estimate the impact of FDI barriers, and further calculate the impact of eliminating of FDI barriers onnet interest margin, with a view to understand and provide a reference for effects of further opening up the industry. The estimated results of this paper may also be used to analyze the situation for other countries. The main conclusions are as follows:

(1) The degree of openness to foreign direct investment is one of the key reasons for differences in bank efficiency among different countries today. Barriers index is closely correlated with net interest margin.To some extent it demonstrates that in the current global economy, increasing openness of the banking sector play an important rolein improving efficiency and promoting transformation.

(2) The actual extent of openness of China's banking industry is still at a low level compared with the rest of the world. The complete opening in 2006 attracted a lot of foreign investment and promoted the development of the industry, but the restrictions on foreign ownership of Chinese banks, controls on interest rate and operation of different business units still constitute major obstacles. Holding other factors constant, eliminating these barriers can reduce the average net interest margin of the banking industry for more than one third.

(3) Non-performing loans is also an important factor causing the high cost of banks. Main reasons include: various financing options has made the economic highly leveraged, social credit system is not perfect, and other financial regulatory reform is lagging behind.

(4) Low degree of competition in the market results in industry oligopoly. This remains an important factor affecting the efficiency of the banking sector.

A few suggestions can be drawn from the results. First, balance the relationship between stability and development and pilot relaxing the upper limit of foreign ownership restriction. Foreign ownership cap is designed to protect China's control of the local banks. This measure is necessary in the early stages of development, but after years of reform and practice, China's banking industry has formed a multi-level framework with large commercial banks, diverse ownership banks, city commercial banks and rural commercial banks, and therefore we can select some city commercial banks and rural commercial banks to pilot of relaxing the upper limit of foreign ownership restriction.

Second, establish and perfect the banking insurance system early, and speed up the process of marketization ofinterest rates on deposits.The market, industry price and key international standards determine interest rate for deposit. Interest rate control is equivalent to government price control. Itnot only restricts the entry of foreign banks, but also makes our banking market unable to achieve market equilibrium, resulting in unnecessary loss of social welfare.

Third, encourage foreign investment to enter in the form of financial cooperation and pilot setting up a unified brand in banking, securities, insurance, trust and other types of subsidiaries. Operations of different business units area long-standing policy of China's financial industry. The legal and institutional set up has basically taken shape. In the short term, transiting to mixed units operations is not conducive to the stability of our financial system. Considering stability as well as development, we suggest allowing foreign banks enter domestic market as a comprehensive financial group. China has a number of financial institutions that have formed powerful groups, such as Hong Kong, China Ping An Insurance Group and China Merchants Group, etc.

Fourth, strengthen deleveraging as one of the priorities of the financial regulatory transform and accelerate the construction of social credit rating system that began since the 1990s to prevent occurrences of non-performing loans. One of the major reasons for the 2008 financial crisis in the United States was subprime loans, whichhas a direct relationship with financial regulation. The state-owned banks dominant system, lack of financial regulators, and the lack of social credit evaluation system allprovidebreeding grounds for bad loans.

Finally, in the mean time of expanding openness, China should also actively promote the development of private banks, and improve the overall competitive market environment.

Appendix The potential impact of eliminating FDI barrier on net interest margin for 48 sample countries

Ranking	Country	Index	Ranking	Country	Index	Ranking	Country	Index
1	United States	0.00276	17	Spain	0.01	33	South Africa	0.19517
2	Japan	0.00276	18	Greece	0.01	34	Russia	0.20679

3	Argentina	0.01391	19	New Zealand	0.01	35	Chile	0.22867
4	Ireland	0.01391	20	Italy	0.01	36	Colombia	0.2544
5	Austria	0.01391	21	United Kingdom	0.01	37	Thailand	0.34045
6	Belgium	0.01391	22	Switzerland	0.018	38	China	0.52852
7	Denmark	0.01391	23	Albania	0.048	39	Turkey	0.54552
8	Germany	0.01391	24	Estonia	0.05	40	Brazil	0.56486
9	France	0.01391	25	Croatia	0.05	41	Korea	0.71432
10	Finland	0.01391	26	Macedonia	0.054	42	Monaco	0.73099
11	Netherlands	0.01391	27	Moduowaer	0.054	43	Uruguay	0.74299
12	Canada	0.01391	28	Bulgaria	0.058	44	Vietnam	0.9227
13	Luxembourg	0.01391	29	Lithuania	0.058	45	Philippines	0.94139
14	Peru	0.01391	30	Australia	0.069	46	Indonesia	0.96569
15	Portugal	0.01391	31	Serbia	0.095	47	India	1.10052
16	Sweden	0.01391	32	Mexico	0.111	48	Malaysia	1.32351

Source: Calculated by the authors

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