The implications of increasing credit balance and banking competition to both mainland economy and Hong Kong

Drafted by Zhijun Zhao

Economics Institute, Chinese Academy of Social Sciences

Research Project Group:

Yue Ma,	Associate Professor, Economics Dept, Lingnan University
Yak-yeow Kueh,	Chair Professor, Economics Dept, Lingnan University
Shu-ki Tsang,	Professor, Economics Dept, Hong Kong Baptist University
Matthew Yiu,	Manager, Hong Kong Institute for Monetary Research
Shucheng Liu,	Director, Economics Institute, & Director, Chinese Academy of Social Sciences (CASS)
Zhijun Zhao,	Associate Professor, Economics Institute, CASS

I. Introduction

A wide range of problems including a large part of bad assets, incomplete supervisory system, low skill level of banking management, etc. exists, in the banking system on the Mainland of China. Those problems can be investigated from different point of view. We will, however, just begin our research from an important phenomenon, which deals with the co-existence of the expanding gap between deposits and loans on the one hand, and the difficulties encountered by medium- and small-sized enterprises in financing worthwhile investment projects on the other hand.

In second part, besides the fact of continuing credit balance expanding, we also list some other financial as well as macroeconomic facts related to the problems to study, so that readers can easily understand the background of the issue.

In third part, we will develop a three sector theoretical model including consumer; enterprise and banks. This model may let us know what would happen if China's opens her banking sector to foreign banks such as banks from HK to allow them to compete for both deposits and loans with the four state-owned commercial banks. This model may also prepare a fundamental framework for further analysis of behavior of state owned banks and macroeconomic implications. It is clearly that Chinese economy is far from market system, but using the model, we can see what would happen if all of the sectors make economic decision rationally and what differences exist between traditional system and market system.

In the fourth part, we will use the theoretical framework to compare the behavior of state owned firms and banks with their counterpart under fully market system, and find various possible reasons that cause the expanding gap of deposit and loan. At same time, we will give some empirical data to support our pionts.

In the last part, we will conclude the implication of increasing competition among banks and other findings in this paper, and submit some solutions to the problem and its implications to both of mainland and Hong Kong.

II.   Some stylized facts in Chinese economy.

1.   expanding credit balances

Before 1993, especially during 1988-1993, there had always been a negative credit balance in china's banking system. With the reform of banking system, the situation has always being changed gradually. By 1994, the gap between deposits and loans in china's banking system almost disappeared and the deposits and loans seem to reach their balanced path. However, with the time going, the opposite phenomenon, namely, positive credit balances, occurred and become more and more serious. Starting from 1995 when positive credit balances occurred at first time in the history of china's financial sector and has continued expanding (table 1). At the end of 1998, credit balances is over RMB 900 billion, one year later, that is, by the end of 1999, The gap between deposits and loans reached RMB1500 billion, increasing 600 billion by about 64%. Another one year later, by the end of 2000, it rose to 2443 billion, an

increase of 62%. However, the balances of both deposits and loans only increase by 13% or so for the same period.

Table 1: credit balances in all financial institutions (100 million)

year	deposit	loan	Credit balance	Balance to deposit ratio	deposit Increase	loan increase	The gap Increase to deposit increase ratio	
1987	8117	10307	-2190	-27.0%				
1988	9475	12255	-2780	-29.3%	1358	1948	-590	-43.4%
1989	10786	14360	-3574	-33.1%	1311	2105	-794	-60.6%
1990	14013	17681	-3668	-26.2%	3227	3321	-94	-2.9%
1991	18079	21338	-3259	-18.0%	4066	3657	409	10.1%
1992	23468	26323	-2855	-12.2%	5389	4985	404	7.5%
1993	29623	32943	-3320	-11.2%	6155	6620	-465	-7.6%
1994	40473	40810	-337	-0.8%	10850	7867	2983	27.5%
1995	53862	50538	3324	6.2%	13389	9728	3661	27.3%
1996	68571	61153	7418	10.8%	14709	10615	4094	27.8%
1997	82390	74914	7476	9.1%	13819	13761	58	0.4%
1998	95698	86524	9174	9.6%	13308	11610	1698	12.8%
1999	108778	93734	15044	13.8%	13080	7210	5870	44.9%
2000	123804	99371	24433	19.7%	15026	5637	9389	62.5%

Resources: china's financial statistics, 1952-1996, 1997-1999; and people's bank of china quarterly, 2001-1.

Table 1 shows that Up to year 2000 deposit balances in Chinese financial institution reached 1238.4 billion-yuan, 15 times as many as that of year 1987, loan balances arrived at 993.7 billion yuan, increasing only 9.6 times more than year 1987. It is obvious that the growth rate of deposit balances through 1987-2000 is much faster than that of loan balances. The gap between deposit and loan balances increase from –21.9 billion yuan to 244.3 billion yuan, amplitude by –27% to 19.7%. In the case of increment of deposit and loan, the fluctuation is much larger. In 1988, new increment of loan is 43.4% more than deposit, and in 1989, 60.6%. But in 1999 and

3

2000, the gaps of increment part are respectively 44.9% and 62.5%. The inefficiency of utilisation of resources is very important.

The change of credit balances in state owned banks has similar trend (table 2).

Table 2: credit balances in state owned special banks

year	Deposit(D)	Loan (L)	borrow from PBC(B)	B/D	(D-L)/L
1988	6686	10245	3322	49.7%	-34.7%
1989	7982	12064	4163	52.2%	-33.8%
1990	10459	14759	5044	48.2%	-29.1%
1991	13299	17595	5867	44.1%	-24.4%
1992	17484	21082	6710	38.4%	-17.1%
1993	21400	25778	9612	44.9%	-17.0%
1994	26434	27310	9538	36.1%	-3.2%
1995	35036	32279	6668	19.0%	8.5%
1996	44940	37983	8015	17.8%	18.3%
1997	51220	40424	5717	11.2%	26.7%
1998	60379	41578	5293	8.8%	45.2%
1999	69325	42582	4923	7.1%	62.8%

Notes: before 1997, special banks including communication bank and china credit bank, after 1997 it denotes four state owned commercial banks

Table 2 shows that the changes of the gap between deposit and loan in state owned banks are similar to those in all financial institutions. Up to 1999, deposit balances in Chinese state owned banks is 6932.5 billion-yuan, 10.4 times as much as that (668.6) of year 1988, loan balances Issued arrived at 4252.8 billion yuan, increasing only 4.2 times more than year 1987. It is obvious that the growth rate of deposit balances through 1988-1999 is 2 times as much fast as that of loan balances. The gap between deposit and loan balances increase from –34.7% to 68.2%. Most of the credit balances goes into central bank in the form of deposits in PBC and borrowing bonds from government.

2. Firm's financing is mainly in the form of banking loan

Table 3: Financing resources of China's enterprises

year	banking loan	Equity share	bonds	commercial bill
1995	88	1	2	9
1996	83	3	2	12
1997	77	9	2	13
1998	83	6	1	10

3. banking loans are mainly lent to state owned enterprises

At the time of credit balance expanding, however, many medium and small-sized enterprises, especially private enterprises, have found it difficult to get loans for investment (table 3), even though larger and larger part of GDP is produced by non-state owned sectors (table 4). They have

Table 4: The Share of loan lending to non-state owned sector in china's financial institutions

year	village and town's enterprises		private and individuals		three capital enterprises		agriculture		lending ratio in total loan	Lending ratio in short term loan
	quantity	ratio	quantity	ratio	quantity	ratio	quantity	ratio		
1989	821	5.7%	33	0.2%			1955	13.6%	19.6%	
1990	977	5.5%	40	0.2%			2413	13.6%	19.4%	
1991	1136	5.3%	49	0.2%			2976	13.9%	19.5%	
1992	1518	5.8%	68	0.3%			3868	14.7%	20.7%	
1993	1963	6.0%	109	0.3%			4839	14.7%	21.0%	
1994	2071	5.1%	156	0.4%	792	1.9%	4644	11.4%	18.8%	28.4%
1995	2146	4.2%	196	0.4%	999	2.0%	3019	6.0%	12.6%	19.1%
1996	2833	4.6%	280	0.5%	1346	2.2%	7123	11.6%	18.9%	28.8%

1997	5036	6.7%	387	0.5%	1891	2.5%	8350	11.1%	20.9%	28.3%
1998	5580	6.4%	472	0.5%	2487	2.9%	4444	5.1%	15.0%	21.4%
1999	6161	6.6%	579	0.6%	2986	3.2%	4792	5.1%	15.5%	22.7%
2000	6060	6.1%	655	0.7%	3050	3.1%	4889	4.9%	14.7%	22.3%

Resources: china's financial statistics, 1952-1996, 1997-1999; and people's bank of china quarterly, 2001-1.

Table 5: industrial output share of SOE and Non-SOE (%)

Year	SOE	Non-SOE		
		total	collective	others
1978	77.63	22.37	22.37	
1979	78.47	21.53	21.53	
1980	75.97	24.03	23.54	0.49
1981	74.78	25.22	24.61	0.61
1982	74.46	25.54	24.82	0.72
1983	73.36	26.64	25.74	0.9
1984	69.08	30.92	29.71	1.21
1985	64.86	35.14	32.08	3.06
1986	62.26	37.74	33.52	4.22
1987	59.73	40.27	34.62	5.65
1988	56.81	43.19	36.14	7.05
1989	56.06	43.94	35.69	8.25
1990	54.6	45.4	35.63	9.77
1991	52.94	47.06	35.7	11.36
1992	48.09	51.91	38.04	13.87
1993	43.13	56.87	38.36	18.51
1994	40.8	59.2	38.8	20.4
1995	33.97	66.03	36.59	29.44
1996	31	69	35	34

Resources: Zhang Jie, institution, gradualist transition and financial reform in china, 2001,1.

We can use what is called credit output indicator to explain the inefficiency of Credit allocation.

Table 6: Credit output indicator [1]

	1990	1991	1992	1993	1994	1995	1996	1997
Non-SOE	2.7	2.61	2.84	3.06	4.46	4.98	5.51	6.18
SOE	0.66	0.68	0.62	0.57	0.43	0.39	0.33	0.29

Resources: Wu jian, monetary policy and economic growth, 1999 PhD dissertation

It is obvious from above table that the financial support to state owned economy not only couldn't save the fate of state owned economy, but also constrain the development of non-state economy.

4. Economic growth continuing slow down and deflation trend is forming

Figure 1: the growth of GDP and inflation rate
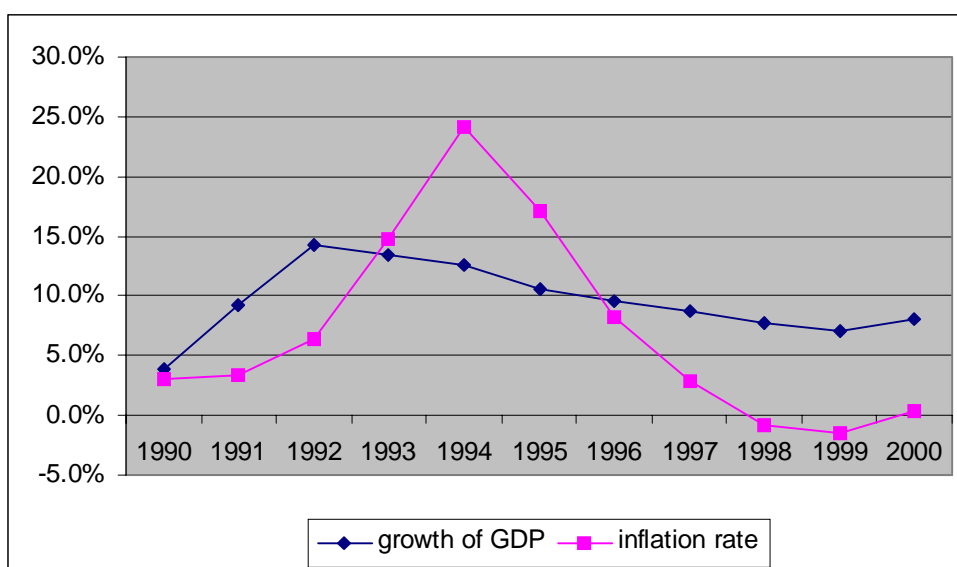
5. Banking system facing challenges from WTO

The economic reform is being carried out steadily and will continue the trend or more quickly after accession to WTO. In the banking sector many reforming measures have taken into effect since 1998. Among them includes reducing reserve requirement ratio, injecting capital into the state-owned commercial banks (SOBs) and carrying out asset-liability ratio management instead of directive ending plan and regulations, setting up asset management companies (AMCs) and the organisational reform of the PBC, etc. Foreign currencies lending rates and large scale of deposit rate were liberalised in September of last year.

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[1] Credit output indicator is the ratio of output share of an economic sector in total

After WTO, increasing banking competition and interest rate liberalisation is inevitable, to see its impacts, let us develop a general equilibrium model at first.

III. A three sector's general equilibrium model

Our model uses the idea of intermediate sector to construct a general equilibrium model. It has following characteristic.

Considering the character of China's economy, our model has following assumptions that may distinguish from other economic model. (1) All household savings is deposited in banks, no security investment; (2) all loan is issued to enterprises; (3) all of the household income is in the forms of labour income and interest income; (4) all of the banking profit is paid to government; (5) increasing banking competition is introduced. (6) Both short run equilibrium and long run equilibrium can be explained. (7) The effects of banking monopoly or competition can also be analysed.

1. The behaviour of a firm

Assume that a representative firm has a production function with neo-classical Cobb-Douglas form:

$$Y_t = (A+u)K_{t-1}^{\alpha}H_t^{1-\alpha} \tag{1}$$

Where, Y_t, K_{t-1} and H_t are respectively denoting output at time t, capital investment at time t-1, and labour input at time t. (A+u) denotes the technological level of the production function. Where A is a constant and u is a random shock with Probability of distribution and represent the uncertainty knowledge or information about firm: P (u=1)=q is successful probability of an investment project, and P (u=0)=1-q is probability of an investment project failed.

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social output to its credit share in total social credit.

At normal market economy condition, firm and banks decide how much to produce and how much to invest on the expected level of output.

$$EY_t = (A + Eu)K_{t-1}{}^{\alpha}H_t{}^{1-\alpha} = (A+q)K_{t-1}{}^{\alpha}H_t{}^{1-\alpha} \qquad (2)$$

In the discussion below, we omit symbol "E".

We also assume, For the simplicity's sake, that both consumption goods and capital goods used in production are used up in production; similar assumptions can be seen in other related articles (see, Frank Hahn and Robert Solow, 1997; and Barro, 1995). Like what Barro (1995). Like what Barro indicated, This simplified assumption usually may not change the conclusion produced in other more complicate cases in which capital can be used repeatedly. Capital investment demand play a double role, on one hand, it is intermediate capital goods coming from goods market and used up in the production, on the other hand, it is also debt of firm. here we assume all of the capital investment is in the form of bank loan.

The investment and consumption goods price P_t is also assumed to be the same as that of output, so investment and loan is linked through price as $K_t P_t = L_t$.

If we further assume that a firm is levied output tax under rate τ, a profit maximisation firm should be solve for problem:

$$\text{Max } profit = (1-\tau)P_{t+1}(A+q)K_t{}^{\alpha}H_{t+1}{}^{1-\alpha} - L_t R_L - H_{t+1}w_{t+1} \qquad (3)$$

$$\text{s.t. } K_t P_t = L_t$$

Where R_L represents the nominal interest rate of loan plus one. representing that a firm has to pay back its principal and interest at given loan rate after one period. It is obvious that R_L is usually greater than one.

The first order condition of the problem (3) is

$$\frac{\partial profit}{\partial L_t} = \alpha(1-\tau)P_{t+1}(A+q)P_t{}^{-\alpha}L_t{}^{\alpha-1}H_{t+1}{}^{1-\alpha} - R_{L_t} = 0$$

$$\frac{\partial profit}{\partial H_{t+1}} = (1-\alpha)(1-\tau)P_{t+1}(A+q)P_t{}^{-\alpha}L_t{}^{\alpha}H_{t+1}{}^{-\alpha} - w_{t+1} = 0 \qquad (4)$$

From equations in (4), we can obtain the firm's demand function for loan

$$L_t^{\ d} = \left[\frac{\alpha(1-\tau)P_{t+1}(A+q)}{P_t^{\ \alpha}R_{Lt}} \right]^{\frac{1}{1-\alpha}} H_{t+1} \qquad (5)$$

Let above formula put one period backward, it will be

$$L_{t-1}^{\ \ d} = \left[\frac{\alpha(1-\tau)P_t(A+q)}{P_{t-1}^{\ \ \alpha}R_{Lt-1}} \right]^{\frac{1}{1-\alpha}} H_t \qquad (5)'$$

Or rewritten (5) as reverse form of loan demand function:

$$R_{Lt} = \alpha(1-\tau)P_{t+1}(A+q)P_t^{\ -\alpha}L_t^{\ \alpha-1}H_{t+1}^{\ \ 1-\alpha}$$

It is easy to see that the demand for loan is increasing function of price of next period, employment and probability of success, but decreasing function of current price, loan interest rate and tax rate. Combining (2) and (5), we can obtain the goods supply function of a firm

$$Y_t = (A+q)^{\frac{1}{1-\alpha}}[\alpha(1-\tau)]^{\frac{\alpha}{1-\alpha}} R_{Lt-1}^{\frac{-\alpha}{1-\alpha}}(P_t/P_{t-1})^{\frac{\alpha}{1-\alpha}} H_t \qquad (6)$$

We can see from (6) that the output supply is negatively related to last period interest rate and positively related to current inflation rate and employment. The output reaction to interest rate is lag behind one period.

For traditional Chinese economy, especially before 1998, full employment is one of the most important objectives of government policy. Government is responsible for supplying every person who is of working ability with working position. Even in recent three-year state owned enterprise reform beginning in 1998, that workers were laid off are called temporarily leaving working position instead of unemployment. So we think that it is feasible to assume that the labour supply is always inelastic as an exogenous variable. This means labour supply and total wage should determine labour demand. At first we assume that the wages of workers are perfectly flexible and equals

$$H_t w_t = (1-\alpha)(1-\tau)P_t Y_t$$

$$= \frac{1-\alpha}{\alpha}[(A+q)\alpha(1-\tau)]^{\frac{1}{1-\alpha}} r_{Lt-1}^{\frac{-\alpha}{1-\alpha}}(P_t/P_{t-1})^{\frac{\alpha}{1-\alpha}} P_t H_t$$

$$= \frac{1-\alpha}{\alpha}[(A+q)\alpha(1-\tau)]^{\frac{1}{1-\alpha}} r_{Lt-1}^{\frac{-\alpha}{1-\alpha}} P_{t-1}^{\frac{\alpha}{1-\alpha}} P_t^{\frac{1}{1-\alpha}} H_t \qquad (7)$$

2. The behaviour of banks

We regard banking as intermediate sector that absorb deposit D_t from household and issue loan L_t to firms. Its final objective is to search for maximum profit, even though it may adopt different ways to arrive its final objectives and sometimes looks like its behaviour is far from its final objectives. In China, since the four biggest state owned banks are of monopoly power, they have the most powerful impact on centre bank's monetary policy, so the assumption that several banks monopoly compete for the deposit of household and borrowing of firm is reasonable. They chose lending rate and lending quantity to maximise their profit. Assume that R_L denotes the loan demand function of firm, L_i is the loan supply of bank i, given L_m ($m \neq I$), and loan cost for banks is deposit rate r_D, in addition, banks must consider the possibility of a loan not being taken back, which is denoted by q, then the objective of bank i is to maximise

$$\pi_i = qL_i R_L - D_i(1 + r_D) \tag{8}$$

Using $L_t = L_i + \sum_{m \neq i} L_m$ Substituting R_L in (5) into (8), and constraint $L_i \leq (1-d)D_i$, then we can get (equality constraint is true for optimal choice of banks)

$$\pi_i = qL_i \alpha(1-\tau)P_{t+1}(A+q)P_t^{-\alpha}(L_i + \sum_{m \neq i} L_m)^{\alpha-1} H_{t+1}^{1-\alpha} - L_i(1+r_D)/(1-d) \text{ , For all i}$$

The first order condition is

$$\frac{\partial \pi_i}{\partial L_i} = qL_i \alpha(\alpha-1)(1-\tau)P_{t+1}(A+q)P_t^{-\alpha}(L_i + \sum_{m \neq i} L_m)^{\alpha-2} H_{t+1}^{1-\alpha}$$

$$+ q\alpha(1-\tau)P_{t+1}(A+q)P_t^{-\alpha}(L_i + \sum_{m \neq i} L_m)^{\alpha-1} H_{t+1}^{1-\alpha} - (1+r_{Dt})/(1-d) = 0$$

Let

$$\sum \frac{\partial \pi_i}{\partial L_i} = 0$$

For all I, we get

$$R_{Lt} = \frac{N(1+r_{Dt})}{q(1-d)(N-1+\alpha)} = \left(1 + \frac{1-\alpha}{N-1+\alpha}\right)\left(\frac{1+r_{Dt}}{q(1-d)}\right) \qquad (9)$$

This is the lending rate under which banks like to supply their loan; it is clear from formula (9) that the lending interest rate determined by banks will decrease when the number of banks increase. When N=1, which represents perfect monopoly case, lending rate equals $\frac{1+r_D}{\alpha q(1-d)}$ and the profit of banks is maximised. This is why banks always want to seek monopoly position. Given deposit interest rate, With the N increase from 1 to ∞, the gap between deposit rate and lending rate will be lower. That is

$$R_L / (1+r_D) = \left(\frac{1}{q(1-d)}\right)\left(1 + \frac{1-\alpha}{N-1+\alpha}\right) \to \frac{1}{q(1-d)}$$

Formula (9) also indicates that the increase of reserve requirement will make lending rate rise, and when the possibility of non-performing loan increase (that is q decrease), the interest rate will increase too.

The loan that banks like to issue is given by

$$L_t^s = \left[\frac{(1-d)(N-1+\alpha)\alpha(1-\tau)P_{t+1}(A+q)}{N(1+r_{Dt})}\right]^{\frac{1}{1-\alpha}} P_t^{-\frac{\alpha}{1-\alpha}} H_{t+1} \qquad (10)$$

This is the loan supply function of banks. Obviously, the supply is decreasing function of deposit rate. Formula (9) not only tell us how much the banks like to supply, but also tell how much deposit for which bank demands.

Formula (10) also indicates that more competition among banks will contribute to the increasing of loan supply to firms (see formula (10)). Total profit of banks is as following

$$\pi = \left[\frac{(N-1+\alpha)\alpha(1-\tau)P_{t+1}(A+q)}{N(1+r_{Dt})/(1-d)}\right]^{\frac{1}{1-\alpha}} P_t^{-\frac{\alpha}{1-\alpha}} H_{t+1} \cdot \left(\frac{1-\alpha}{N-1+\alpha}\right)\left(\frac{1+r_{Dt}}{1-d}\right)$$

$$= [\alpha(1-\tau)P_{t+1}(A+q)]^{\frac{1}{1-\alpha}} \left[\frac{(1-d)(N-1+\alpha)}{N(1+r_{Dt})P_t}\right]^{\frac{\alpha}{1-\alpha}} H_{t+1} \cdot \left(\frac{1-\alpha}{N}\right)$$

$$= (1-d)^{\frac{\alpha}{1-\alpha}}\left[\frac{(N-1+\alpha)}{N}\right]^{\frac{\alpha}{1-\alpha}}\left(\frac{1-\alpha}{N}\right)\alpha[(1-\tau)P_{t+1}(A+q)]^{\frac{1}{1-\alpha}}\left[\frac{1}{(1+r_{Dt})P_t}\right]^{\frac{\alpha}{1-\alpha}} H_{t+1} \cdot$$

To better understand what effects of the competition among banks has on their profit, we assume that banks temporally regards deposit rate and price as given, what we need to do is to consider only how the function of N varies with N:

$$f(N) = \left[\frac{(N-1+\alpha)}{N} \right]^{\frac{\alpha}{1-\alpha}} \left(\frac{1-\alpha}{N} \right)$$

It is obvious that this function has the same maximum or minimum value as $\ln f(N)$. Through simple computation we can get

$$\frac{\partial f(N)}{\partial N} = \frac{\partial \ln f(N)}{\partial N} = 0, N = 1$$

$$\frac{\partial^2 \ln f(N)}{\partial N^2} = \frac{-1}{\alpha} < 0, N = 1,$$

Hence, we have

Proposition 1: from the partial equilibrium view of banking side, given deposit interest rate, perfect monopoly is the best choice for banking sector, more banking competition will cause lending rate and banking profit to go down; hence a bank always try to pursue perfect monopoly position to earn maximum profit.

2. The behaviour of a representative household

We assume that a representative household at time t always has two generations, each generation lives two periods, the young and the old. The generation born at t will be said to be generation t, or G^t. C_t^1 and C_t^2 respectively represent one's consumption at young (denoted by 1) and old of G^t (denoted by 2). All generations have the same utility function:

$$U(c_t^1, c_t^2) = \ln c_t^1 + \beta \ln c_t^2 \tag{11}$$

Which is obviously monotone and concave. Also each young generation or a household at time t is endowed with H_t unit of labour force, which we assume to be supplied in-elastically as before.

The young generation is paid a nominal wage w_t at t. It is then divided into two parts: consumption c_t^1 and savings D_t (also in nominal terms at the deposit interest rate r_D). Let

$$\frac{P_{t+1}}{P_t} = 1 + \pi_{t+1}$$

Where P_t is the money price of the good at time t and P_{t+1} is expected price of next period (already known at time t). We can now write the household budget constraint for t and t+1 (a generation at its young and old) as

$$p_t c_t^1 + D_t = H_t w_t \tag{12}$$

$$p_{t+1} c_t^2 = D_t (1 + r_{Dt}) \tag{13}$$

To maximise utility function (10) with subject to (12), (13), we have

$$c_t^1 = \left(1 - \frac{\beta}{1 + \beta + \gamma}\right) \frac{H_t w_t}{p_t} \tag{14}$$

$$c_t^2 = \frac{\beta}{1 + \beta} \left[\frac{1 + r_D}{g_{p,t+1}}\right] \frac{H_t w_t}{p_t} = \frac{\beta}{1 + \beta} (1 + r_{Dt}) \frac{H_t w_t}{p_{t+1}} \tag{15}$$

$$\frac{D_t}{p_t} = \left[\frac{\beta}{1 + \beta}\right] \frac{H_t w_t}{p_t} \tag{16}$$

Let

$$\phi = \frac{\beta}{1 + \beta}$$

(14)-(15) can be simply rewritten as

$$c_t^1 = (1 - \varphi) \frac{H_t w_t}{p_t} \tag{18}$$

$$c_t^2 = \phi (1 + r_{Dt}) \frac{H_t w_t}{p_{t+1}} \tag{19}$$

$$\frac{D_t}{p_t} = \phi \frac{H_t w_t}{p_t} \tag{20}$$

(18) Indicates a generation at its young will consume constant rate of its real wage. Given wage rate unchanged, higher price means lower consumption, and given price unchanged, consumption will increase with increase of wage. (19) Indicates that a generation at its old will consume more if current deposit rate rise or wage rate is raised, but lower with the rise of price next period. (20) Indicates that real deposit in banks of a household only depends on its real wage rate. To see how interest rate and inflation impact deposit, we substitute (7) into (20) and obtain

$$D_t = \phi \frac{1-\alpha}{\alpha}[(A+q)\alpha(1-\tau)]^{\frac{1}{1-\alpha}} r_{Lt-1}^{\frac{-\alpha}{1-\alpha}} (P_t / P_{t-1})^{\frac{\alpha}{1-\alpha}} H_t$$

Above formula indicates that present deposit is determined by last period interest rate, and current inflation rate, high last period interest rate will increase present deposit. The reason is that last interest rate lead to the increase of corresponding investment demand, then investment demand of last period will increase present output as well as deposit.

3. Walras' law and Equilibrium

We have in the sections above introduced the goods supply function and investment demand function for a firm, consumption function, deposit supply, and money demand function of a household. Bank's loan supply and demand function is also introduced. In the real world, just like what we have discussed above, an economy is usually not freely operated without government interference. Government needs collect tax from firm or household, spend it in both of forms of government consumption or investment. Sometimes government spends more than the taxed, and sometimes less. Thus, it will have to make borrowing from or transfer to household or banks in the forms of government bonds, and in extreme situation, government may fill its deficit by directly issuing paper money. Thus government revenue comes from tax, profit of banks and reserve requirement, that is:

$$G = T + P_B + dD_t \tag{22}$$

Where G is government expenditure that comes from three resources. T is tax from firm's output; P_B is profit from bank; dD_t is required reserve. We assume that the income is to cover part of government expenditure. Household or banks can either

buy B. For the sake of simplicity, we assume that it is bought by banks, because funds of banks are also from household.

In the side of banks, equilibrium is not automatically reached. Central bank's deposit requirement reserve ratio usually limit their loan supply; hence, the loan supply is subject to following formula:

$$L^s = D^d = (1-d)D_t \qquad (25)$$

Where d is ratio of reserve requirement. There are four kinds of equilibrium to think about, labour, goods, deposit and government. For labour market in China, we think it is acceptable to assume that there is always full employment and the wage is equal to marginal product of labour. We first exhibit a version of walras's law for the model. The sum of the excess demand for goods, deposit is always equal to zero. In equilibrium, at least one of them is dependable on others, so we can ignore one of the three, and we will chose to ignore government equilibrium.

We can use walras's law to specify the excess-demand functions for goods and deposit. A full equilibrium of the model is completely determined by setting each of these excess demands equal to zero, and remembering full employment. These equilibrium conditions are difference equations, so that they determine a path for the economy once they are provided with initial conditions. The dynamics of the model come from two sources: the fact that capital goods must be produced and purchased in one period for use in the next, and the fact that household decisions about consumption and savings are made with a two period horizon. Thus expectations about t+1 are an ingredient of decisions in t, and those decisions are an ingredient in outcomes at t.

To discuss the effect of variety of factors on each market's equilibrium, let's begin to derive Walras's law.

At t, the budget constraint of generation t-1 can be obtained by putting forward (13) one time back

$$p_t c_{t-1}{}^2 = D_{t-1}(1 + r_{Dt-1}) \qquad (26)$$

Formula (12)+(26), and then move all the terms to the left of equation, we can get

$$p_t(c_t{}^1 + c_{t-1}{}^2) + D_t - D_{t-1}(1 + r_{Dt-1}) - H_t w_t = 0 \qquad (27)$$

Because

$$L_{t-1}R_{t-1} + H_t w_t = P_t y_d = P_t Y_t - T \qquad (28)$$

Here y_d is income of a firm after tax, which is equal to $y_d = Y_t - T = (1 - \tau)Y_t$,

Using (28), and subtracting and adding L^s as well as subtracting and adding government G in (27), we obtain

$$[p_t(c_t{}^1 + c_{t-1}{}^2) + L_t{}^d + G - P_t Y_t)] + (D_t - L_t{}^d)] + (T - G)$$
$$+ \left[L_{t-1}R_{Lt-1} - D_{t-1}(1 + r_{Dt-1})\right] = 0 \qquad (29)$$

In fact, household is not the only sector to supply firms with financial resource, government also can supply firms with funds by issuing paper money. In addition, a bank must keep certain amount of reserve requirement before issuing loan.

Since $D_t{}^s = (1 - d)D_t$ represents the total bank's loan, substituting it into (29), we can obtain

$$[p_t(c_t{}^1 + c_{t-1}{}^2) + L_t{}^d + G - P_t Y_t)] + (D_t{}^s - L_t{}^d)] + \left[L_{t-1}^d R_{t-1} - D_{t-1}(1 + r_D)\right]$$
$$+ [dD_t + T - G] = 0 \qquad (30)$$

At banking equilibrium, an economy meet market equilibrium condition at both time t-1and t-2, we have

$$P_B = L_{t-1}^d R_{Lt-1} - D_{t-1}(1 + r_{Dt-1})$$

Which is the profit of banks at time t-1.

Then walras's law (30) may be rewritten as

$$[p_t(c_t^{\ 1} + c_{t-1}^{\ 2}) + L_t^{\ d} + G - P_t Y_t)] + (D_t^{\ s} - L_t^{\ d}))$$
$$+ (\pi_t + dD_t + T - G) = 0 \tag{31}$$

According to walras's law (31), general equilibrium frameworks require goods market, deposit market and government income and expenditure meet following conditions:

$$p_t(c_t^{\ 1} + c_{t-1}^{\ 2}) + L_t^{\ d} + G = P_t Y_t \tag{32}$$

$$D_t^{\ s} = L_t^{\ d} \tag{33}$$

$$P_{Bt} + dD_t + T = G \tag{34}$$

It is obvious that above three equations only two of them are independent. To arrive at general equilibrium, only two of them need to be true. Thus we ignore the equilibrium of government sector (34), focus our research on deposit market and goods market and chose (32), (33) to solve for price and interest rate.

1) The short run equilibrium of deposit market

Let

$$z_t = \frac{1-\alpha}{\alpha}[(A+q)\alpha(1-\tau)]^{\frac{1}{1-\alpha}}(1+r_{Dt-1})^{\frac{-\alpha}{1-\alpha}}\left(\frac{N}{(1-d)q(N+\alpha-1)}\right)^{\frac{-\alpha}{1-\alpha}} P_{t-1}^{\frac{-\alpha}{1-\alpha}} H_t \tag{35}$$

$$x_t = \left[\alpha(1-\tau)(A+q)\right]^{\frac{1}{1-\alpha}}\left(\frac{N}{q(1-d)(N+\alpha-1)}\right)^{\frac{-1}{1-\alpha}} P_{t+1}^{\frac{1}{1-\alpha}} H_{t+1} \tag{36}$$

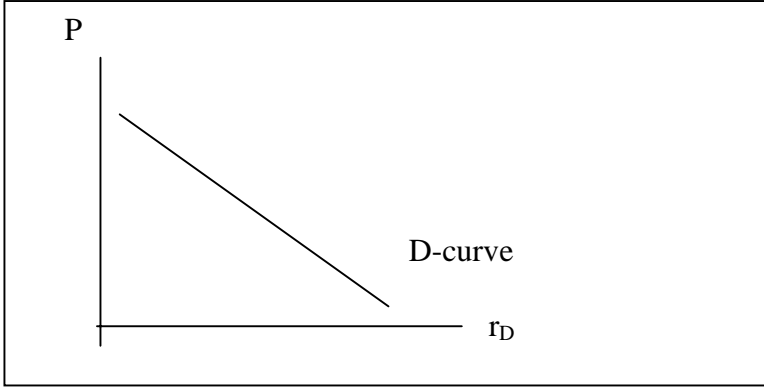Using (35), (36), we can rewrite the deposit market equilibrium condition (33) as

$$(1-d)\phi z_t P_t^{\frac{1}{1-\alpha}} = x_t P_t^{\frac{-\alpha}{1-\alpha}}(1+r_{Dt})^{\frac{-1}{1-\alpha}}$$

$$(1-d)\phi z_t P_t^{\frac{1+\alpha}{1-\alpha}} = x_t (1+r_{Dt})^{\frac{-1}{1-\alpha}} \tag{37}$$

Or

$$1 + r_{Dt} = [(1-d)\phi z_t / x_t]^{-(1-\alpha)} P_t^{-(1+\alpha)} \tag{38}$$

Figure 2

From (37) we can easily obtain the relationship figure of current deposit rate and price (figure, 1) with negative slope. Which can be called D-curve. D-curve represents the condition at which the deposit demand equals its supply.

2) The short term equilibrium of goods market

Like deposit market, using (35), (36), the deposit market equilibrium condition (32) can be rewritten as

$$(1-\phi)z_t P_t^{\frac{1}{1-\alpha}} + \phi z_{t-1}(1+r_{Dt-1})P_{t-1}^{\frac{1}{1-\alpha}} + x_t P_t^{\frac{-\alpha}{1-\alpha}}(1+r_{Dt})^{\frac{-1}{1-\alpha}} + G = \frac{1}{(1-\alpha)(1-\tau)} z_t P_t^{\frac{1}{1-\alpha}} \quad (39)$$

Both sides of Equation (39) multiplied by $P_t^{\frac{\alpha}{1-\alpha}}$ and adjust its terms,

$$\left[\frac{1}{(1-\alpha)(1-\tau)} - (1-\phi)\right]z_t P_t^{\frac{1+\alpha}{1-\alpha}} - [\phi z_{t-1}(1+r_{Dt-1})P_{t-1}^{\frac{1}{1-\alpha}} + G]P_t^{\frac{\alpha}{1-\alpha}} = x_t(1+r_{Dt})^{\frac{-1}{1-\alpha}} \quad (40)$$

This is the relationship of price and deposit interest rate under goods market equilibrium. The price and interest rate forms a curve in the (P_t, r_{Dt}) plane, which can be called G (goods market) curve. If we use $F(P_t)$ represents the left side of equation (40), differentiating $F(P_t)$ and let the derivative equal to zero, we obtain the first order condition of $F(P_t)$:

$$F'(P_t) = \frac{1+\alpha}{1-\alpha}\left[\frac{1}{(1-\alpha)(1-\tau)} - (1-\phi)\right]z_t P_t^{\frac{2\alpha}{1-\alpha}} - \frac{\alpha}{1-\alpha}[\phi z_{t-1}(1+r_{Dt-1})P_{t-1}^{\frac{1}{1-\alpha}} + G]P_t^{\frac{2\alpha-1}{1-\alpha}} = 0$$

The solution of (41) is

$$P_t^0 = \left(\frac{\alpha}{1+\alpha}\right)^{1-\alpha}\left[[\phi z_{t-1}(1+r_{Dt-1})P_{t-1}^{\frac{1}{1-\alpha}}+G]/[1/(1-\alpha)(1-\tau)-(1-\phi)]z_t\right]^{1-\alpha} \quad (42)$$

It is obvious that $1/(1-\alpha)(1-\tau)-(1-\phi)>0$ and hence $P_t^0 > 0$ is meaningful; $F(P_t)$ is increasing with $P_t > P_t^0$ and $F(P_t)$ is decreasing when $P_t < P_t^0$; So that $F(P_t)$ has maximum at P_t^0. Thus r_D is decreasing with the rise of P_t, when $P_t > P_t^0$ and r_D is increasing with the rise of P_t, when $P_t < P_t^0$.

Since the right side of equation (40) is greater than 0, the price P_t must be satisfied with (44):

$$P_t > \left[[\phi z_{t-1}(1+r_{Dt-1})P_{t-1}^{\frac{1}{1-\alpha}}+G]/[1/\alpha(1-\tau)-(1-\phi)]z_t\right]^{1-\alpha} > P_t^0 \quad (44)$$

Thus, $F(P_t)$ must be an increasing function in its well-defined domain and the relationship of price and interest rate is negative.

We can use a curve with negative slope to indicate this relationship (figure 2). Because it represents goods market equilibrium, we call it G-curve.

Figure 3
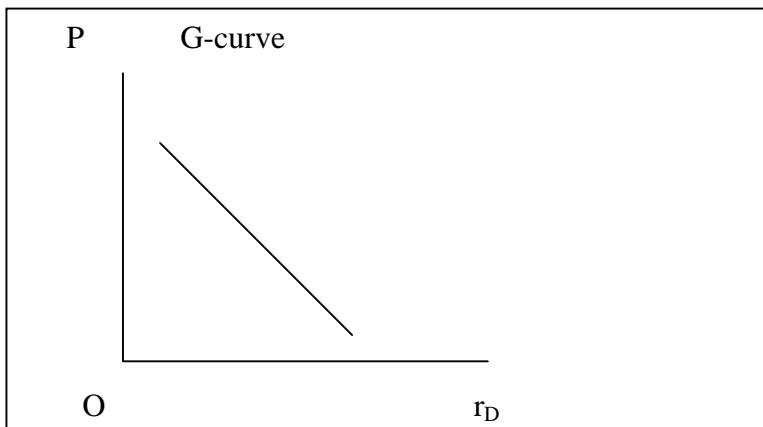
3) General Equilibrium

To get general equilibrium, we solve following equation set:

$$(1-d)\phi z_t P_t^{\frac{1+\alpha}{1-\alpha}} = x_t (1+r_{Dt})^{\frac{-1}{1-\alpha}} \qquad (43)$$

$$\left[\frac{1}{(1-\alpha)(1-\tau)} - (1-\phi)\right] z_t P_t^{\frac{1+\alpha}{1-\alpha}} - [\phi z_{t-1}(1+r_{Dt-1})P_{t-1}^{\frac{1}{1-\alpha}} + G]P_t^{\frac{\alpha}{1-\alpha}} = x_t(1+r_{Dt})^{\frac{-1}{1-\alpha}}$$

$$(44)$$

So we have

$$\left[\frac{1}{(1-\alpha)(1-\tau)} - (1-\phi)\right] z_t P_t^{\frac{1+\alpha}{1-\alpha}} - [\phi z_{t-1}(1+r_{Dt-1})P_{t-1}^{\frac{1}{1-\alpha}} + G]P_t^{\frac{\alpha}{1-\alpha}} = (1-d)\phi z_t P_t^{\frac{1+\alpha}{1-\alpha}}$$

The solution of this equation about price is

$$P_t^e = \left[[\phi z_{t-1}(1+r_{Dt-1})P_{t-1}^{\frac{1}{1-\alpha}} + G] \bigg/ \left[\frac{1}{(1-\alpha)(1-\tau)} + d\phi - 1\right] z_t \right]^{1-\alpha} \qquad (45)$$

$$r_{Dt}^e = [x_t/(1-d)\phi z_t]^{1-\alpha} \left[[\phi z_{t-1}(1+r_{Dt-1})P_{t-1}^{\frac{1}{1-\alpha}} + G] \bigg/ \left[\frac{1}{(1-\alpha)(1-\tau)} + d\phi - 1\right] z_t \right]^{-(1+\alpha)} - 1$$

$$(46)$$

4) How the two curves intersect

By comparing formula (43) and (42), we know that D-curve and G-curve must intersect at equilibrium (r_{Dt}^e, P_t^e) at which both G-curve has negative slope. To know how the two curves intersect, we need to know which slope of the two lines is larger at equilibrium. To answer this problem, differentiate both side of (43) and (44), we can get
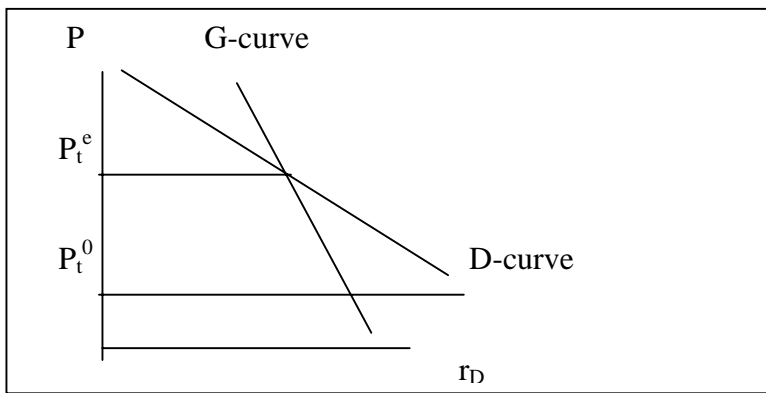
$$\frac{-1}{1-\alpha} x_t (1+r_{Dt})^{\frac{-2+\alpha}{1-\alpha}} \frac{\partial r_{Dt}}{\partial P_t}\bigg|_{D-curve} = (1-d)\frac{1+\alpha}{1-\alpha}\phi z_t P_t^{\frac{2\alpha}{1-\alpha}}$$

$$\frac{-1}{1-\alpha} x_t (1+r_{Dt})^{\frac{-2+\alpha}{1-\alpha}} \frac{\partial r_{Dt}}{\partial P_t}\bigg|_{G-curve}$$

$$= \frac{1+\alpha}{1-\alpha}\left[\frac{1}{(1-\alpha)(1-\tau)} - (1-\phi)\right] z_t P_t^{\frac{2\alpha}{1-\alpha}} - \frac{\alpha}{1-\alpha}[\phi z_{t-1}(1+r_{Dt-1})P_{t-1}^{\frac{1}{1-\alpha}} + G]P_t^{\frac{2\alpha-1}{1-\alpha}}$$

It is easy to show from two formulas above that $\dfrac{\partial r_{Dt}}{\partial P_t}\bigg|_{D-curve} > \dfrac{\partial r_{Dt}}{\partial P_t}\bigg|_{G-curve}$. Using

this character we can plot two curves as in figure 3.

Figure 4

Proposition 2: in short run, we regard the price of last period, next period price expectation, and other non-present period variables as given, we have following conclusion.

1) when government expenditure increase, the price of goods, investment and output of next period will increase and the interest rate will decrease;

2) when reserve requirement ratio increase, the price level will decrease and interest rate increase;

3) When tax rate increase, the price level will decrease and interest rate increase.

5) Long run steady-state equilibrium and impacts of increasing banking competition on the economy

To understand the impact banking competition have on real economy, we let our attentions focus on how the real interest rate is determined and how competition impacts interest rate, investment, bank profit, and firm's output. At first let's introduce a few symbols:

$$1 + \pi_t = \frac{P_t}{P_{t-1}},$$

$$i_{Lt} = \frac{R_{Lt}}{1 + \pi_{t+1}}$$

Where π_t is inflation rate at time t, i_{Lt} is real lending interest rate plus 1, then

Real investment demand of a firm is

$$K_t = [\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}} \left(\frac{1+\pi_{t+1}}{R_{Lt}} \right)^{\frac{1}{1-\alpha}} H_{t+1}$$

The output supply of a representative firm is

$$Y_t = \left(\frac{1}{\alpha(1-\tau)} \right)[(A+q)\alpha(1-\tau)]^{\frac{1}{1-\alpha}} \left(\frac{(1+\pi_t)}{R_{Lt-1}} \right)^{\frac{\alpha}{1-\alpha}} H_t$$

The real consumption of a representative household is

$$C_t = c_t^1 + c_{t-1}^2$$

Where,

$$c_t^1 = (1-\phi)\frac{H_t w_t}{p_t} = \left(\frac{1-\alpha}{\alpha} \right)[\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}} \left(\frac{1+\pi_t}{R_{Lt-1}} \right)^{\frac{\alpha}{1-\alpha}} H_t$$

$$c_t^2 = \phi\left[\frac{1+r_{Dt}}{1+\pi_{t+1}} \right]\left(\frac{1-\alpha}{\alpha} \right)[\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}} \left(\frac{1+\pi_t}{R_{Lt-1}} \right)^{\frac{\alpha}{1-\alpha}} H_t$$

Putting backward above formula one period, we have

$$c_{t-1}^2 = \phi\left[\frac{1+r_{Dt-1}}{1+\pi_t} \right]\left(\frac{1-\alpha}{\alpha} \right)[\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}} \left(\frac{1+\pi_{t-1}}{R_{Lt-2}} \right)^{\frac{\alpha}{1-\alpha}} H_{t-1}$$

The total profit of banks at t is

$$P_{Bt} = [\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}} \left[\frac{1+\pi_t}{R_{Dt-1}}\right]^{\frac{\alpha}{1-\alpha}} H_t \cdot \left(\frac{1-\alpha}{N}\right)$$

According to walras condition

$$[p_t(c_t^{\,1} + c_{t-1}^{\,2}) + L_t^{\,d} + G - P_t Y_t)] + (D_t^{\,s} - L_t^{\,d})]$$
$$+ \left\{[L_{t-1}^d R_{t-1} - D_{t-1}(1+r_D)] + dD_t + T - G\right\} = 0$$

Since the optimum behaviour of banks is subject to $D_t^{\,s} = L_t^{\,d}$, and reserve requirement don't play any role in real economy, in long run, the real interest rate have to adjust so as to clear goods market, thus, we obtain

$$[p_t(c_t^{\,1} + c_{t-1}^{\,2}) + L_t^{\,d} - P_t Y_t)] + \left\{[L_{t-1}^d R_{t-1} - D_{t-1}(1+r_D)] + T\right\} = 0$$

Or

$$[p_t(c_t^{\,1} + c_{t-1}^{\,2}) + L_t^{\,d} - (1-\tau)P_t Y_t] + \left[L_{t-1}^d R_{t-1} - D_{t-1}(1+r_D)\right] = 0$$

A equilibrium is said to be a steady state equilibrium, if it is a perfect foresight equilibrium with the property that, for all t, $i_{Lt} = \dfrac{R_{Lt}}{1+\pi_t} = i_L$, $H_{t+1}/H_t = n$, thus, the equilibrium condition can be written as

$$(1-\phi)\left(\frac{1-\alpha}{\alpha}\right)[\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}} i_L^{\frac{-\alpha}{1-\alpha}} n$$

$$+\phi\left[\frac{q(1-d)(N+\alpha-1)}{N}\right]\left(\frac{1-\alpha}{\alpha}\right)[\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}} (i_L)^{\frac{1-2\alpha}{1-\alpha}}$$

$$+[\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}} (i_L)^{\frac{-1}{1-\alpha}} n^2$$

$$+[\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}} i_L^{\frac{-\alpha}{1-\alpha}} \left(1 - q(1-d) + \frac{(1-\alpha)q(1-d)}{N}\right) n$$

$$=\left(\frac{1}{\alpha}\right)(A+q)\alpha(1-\tau)]^{\frac{1}{1-\alpha}} i_L^{\frac{-\alpha}{1-\alpha}} n$$

Through simple computation, we obtain the equation that determine real lending interest rate:

$$(1-\phi)\left(\frac{1-\alpha}{\alpha}\right)i_L^{\frac{-\alpha}{1-\alpha}} n + \phi\left[\frac{q(1-d)(N+\alpha-1)}{N}\right]\left(\frac{1-\alpha}{\alpha}\right)i_L^{\frac{1-2\alpha}{1-\alpha}} + i_L^{\frac{-1}{1-\alpha}} n^2$$

$$+ i_L^{\frac{-\alpha}{1-\alpha}}\left(1 - q(1-d) + \frac{(1-\alpha)q(1-d)}{N}\right)n = \left(\frac{1}{\alpha}\right)i_L^{\frac{-\alpha}{1-\alpha}} n$$

Or

$$\phi\left[\frac{q(1-d)(N+\alpha-1)}{N}\right]\left(\frac{1-\alpha}{\alpha}\right)i_L^2 - \left[\phi\left(\frac{1-\alpha}{\alpha}\right) + \frac{(N+\alpha-1)q(1-d)}{N}\right]ni_L + n^2 = 0$$

From this equation, we can obtain

$$\left(i_L\right)_1 = \frac{n}{\left[\dfrac{q(1-d)(N+\alpha-1)}{N}\right]},$$

$$\left(i_L\right)_2 = \frac{n}{\phi\left(\dfrac{1-\alpha}{\alpha}\right)},$$

Following is discussion of the two kinds of cases:

1). $\left(i_L\right)_1 = \dfrac{n}{\left[\dfrac{q(1-d)(N+\alpha-1)}{N}\right]}.$

It is obvious that real lending rate decreases with the increase of N and q, but increase with d.

For production sector, since

$$i_L = \frac{N(1+r_{Dt})}{q(1-d)(N-1+\alpha)} = \frac{Ni_D}{q(1-d)(N-1+\alpha)}$$

Per capita investment

$$k = \left[\alpha(1-\tau)(A+q)\right]^{\frac{1}{1-\alpha}}\left[\frac{q(1-d)(N+\alpha-1)}{N}\right]^{\frac{1}{1-\alpha}} n^{\frac{-\alpha}{1-\alpha}}$$

Per capita output

$$y = \left(\frac{1}{\alpha(1-\tau)}\right)\left[(A+q)\alpha(1-\tau)\right]^{\frac{1}{1-\alpha}}\left(\frac{q(1-d)(N+\alpha-1)}{Nn}\right)^{\frac{\alpha}{1-\alpha}}$$

For consumption sector, real deposit rate

$$i_D = 1 + r_D = n$$

Per capita consumption

$$c = c^1 + c^2 = \left(1 - \phi + \phi n\right)\left(\frac{1-\alpha}{\alpha}\right)\left[\alpha(1-\tau)(A+q)\right]^{\frac{1}{1-\alpha}}\left(\frac{q(1-d)(N+\alpha-1)}{Nn}\right)^{\frac{\alpha}{1-\alpha}}$$

Per capita deposit

$$D/H = \phi\frac{1-\alpha}{\alpha}\left[(A+q)\alpha(1-\tau)\right]^{\frac{1}{1-\alpha}}\left(\frac{q(1-d)(N+\alpha-1)}{Nn}\right)^{\frac{\alpha}{1-\alpha}}$$

For banking sector, profit is

$$P_{Bt} = \left[\alpha(1-\tau)(A+q)\right]^{\frac{1}{1-\alpha}}\left[\frac{q(1-d)(N-1+\alpha)}{N}\right]^{\frac{\alpha}{1-\alpha}} H_t \cdot \left(\frac{1-\alpha}{N}\right)$$

Increasing competition will cause the profit of banks to go down.

2) $(i_L)_2 = \dfrac{n}{\phi\left(\dfrac{1-\alpha}{\alpha}\right)}$.

This formula concludes that real lending rate is independent of N, but decrease with the increase of deposit preference ϕ and with increase with the increase of α.

However, due to

$$i_L = \frac{N(1+r_{Dt})}{q(1-d)(N-1+\alpha)} = \frac{Ni_D}{q(1-d)(N-1+\alpha)}$$

We can write real deposit rate as

$$i_D = \frac{q(1-d)(N-1+\alpha)}{N}\left(\frac{\alpha n}{\phi(1-\alpha)}\right)$$

Per capita investment

$$k = \left[\alpha(1-\tau)(A+q)\right]^{\frac{1}{1-\alpha}}\left[\frac{\alpha n}{\phi(1-\alpha)}\right]^{\frac{-1}{1-\alpha}}$$

Per capita output

$$y = \left(\frac{1}{\alpha(1-\tau)}\right)[(A+q)\alpha(1-\tau)]^{\frac{1}{1-\alpha}}\left(\frac{\alpha n}{\phi(1-\alpha)}\right)^{\frac{-\alpha}{1-\alpha}}$$

Per capita consumption

$$c = c^1 + c^2 = (1-\phi)\left(\frac{1-\alpha}{\alpha}\right)[\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}}\left(\frac{\alpha n}{\phi(1-\alpha)}\right)^{\frac{\alpha}{1-\alpha}}$$

$$+ \phi\left[\frac{q(1-d)(N+\alpha-1)}{N}\right]\left(\frac{1-\alpha}{\alpha}\right)[\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}}\left(\frac{\alpha}{\phi(1-\alpha)}\right)^{\frac{2\alpha-1}{1-\alpha}}\left(\frac{1}{n}\right)^{\frac{2-\alpha}{1-\alpha}}$$

Per capita deposit

$$D/H = \phi\frac{1-\alpha}{\alpha}[(A+q)\alpha(1-\tau)]^{\frac{1}{1-\alpha}}\left(\frac{\alpha n}{\phi(1-\alpha)}\right)^{\frac{\alpha}{1-\alpha}}$$

For banking sector, profit is

$$P_{Bt} = [\alpha(1-\tau)(A+q)]^{\frac{1}{1-\alpha}}\left[\frac{n\alpha}{\phi(1-\alpha)}\right]^{\frac{-\alpha}{1-\alpha}}H_t\cdot\left(\frac{1-\alpha}{N}\right)$$

We once again show that the more competition causes the profit of banks to go down. From above computations, we can easily obtain following proposition.

Proposition 3: to guarantee real return to capital assets not to be negative, we assume that α and ϕ are satisfied with $\phi\left(\frac{1-\alpha}{\alpha}\right) < 1$, or $\alpha > \frac{\phi}{1+\phi}$, then, we have following conclusions:

Firstly, if the condition $(i_L)_1 = \dfrac{n}{\left[\dfrac{q(1-d)(N+\alpha-1)}{N}\right]}$ is right, we have

(1) Increasing banking competition will lower real lending interest rate and promote investment, GDP, consumption, and deposit.

(2) When increasing reserve requirement ratio (d), real lending rate will increase, and investment, GDP, consumption, deposit will decrease;

(3) When the possibility of investment success (q) increase, the lending rate will decrease, hence, high bad asset ratio will lead interest rate to rise and investment, GDP, consumption, deposit will decrease;

(4) When tax rate increase, investment, GDP, consumption, deposit will decrease; tax rate has no impacts on interest rate. (Note: because total demand of consumer sand government remains unchanged).

(5) The growth rate of employment increase lead corresponding per capita variable decrease. (NB: Because capital becomes relatively scarce, the marginal productivity of capital increases, lending interest rate increase too)

(6) Increasing competition will lower profit of banks

Secondly, when $(i_L)_2 = \dfrac{n}{\phi\left(\dfrac{1-\alpha}{\alpha}\right)}$, we have

(1) More competition means more per capita consumption. (Note: deposit rate increase, interest income increases, deposit increase).

(2) But more competition, real deposit interest will increase.(demand of deposit increase.)

(3) Real lending interest rate is negatively related to time preference parameter ϕ. The less patient a consumer (ϕ decreases), the higher the real lending rate is. (NB. Because supply of deposits fall).

(4) Similar to first case, increasing competition will lower profit of banks

The policy implications of this outcome for Chinese economy is that under the circumstance that banking system is monopolised by state owned banks, it is necessary to introduce more competition, more competition will produce two possible out come. One is lowering real lending interest rate, and therefore investment and GDP growth. The other is heightening real deposit rate, and therefore consumer's revenue and consumption.

If policy maker pay more attention to economic growth as well as consumption growth, because real deposit rate at equilibrium is not related to competition in the first cases, the real deposit interest rate can be adjusted at a fixed low level. Increasing competition will promote economic growth, consumption, investment and

deposit through income effect. Monetary authority should keep real deposit interest the same as employment growth.

If policy maker pay more attention to consumer welfare, because real lending rate at equilibrium is not related to competition in the second cases, the real lending rate should adjusted at fixed level, increasing competition will increase consumer's interest income, and hence increase consumption of second generation consumption.

In any case, with increase of the number of banks, the profit of banks will be lowered. After all, as intermediate sector, the final role of banks is providing good service to firms and consumers.

At present, Chinese economy is experiencing deflation, our model can explain part of its reasons. Because long run equilibrium requires real interest rate to be in relatively low level, under the condition that nominal interest rate is adjusted by central bank instead of market, lower real interest rate force price to fall. This is one of the channels to form deflation in china. The table below indicates that the relationship of GDP growth, real interest rate and inflation rate is accord with the forecast of long run steady state of our model.

Table 7: correlation among real interest rate, GDP growth and inflation

	GDPG	r_D	r_L	$r_D - r_L$	π
GDPG	1				
r_D	-0.71639	1			
r_L	-0.699	0.982153	1		
$r_D - r_L$	-0.31717	0.472858	0.630145	1	
π	0.642055	-0.95099	-0.98804	-0.70277	1

Because the first case indicate increasing competition lead to both of firm's benefit and consumer's benefit to rise, the second case only benefit to consumers, it is suggested that the authority concerned should try to help to reach the first equilibrium. In addition, currently the most important problem in China is in firm's side not consumer's side, hence a policy that fix deposit rate at relatively low level and free floating lending rate as well as introducing competition is most welcome.

IV.　Some explanations to the changes of credit balances

1. inflation and negative credit balance before 1995

After 1991, what is called <mark>"strong banking and weak government finance</mark>" reform was introduced to state owned economy, in 1993 the subsidy from banking sector first surpassed fiscal subsidy and since then, the credit from banking sector has always been in relatively higher level. According to the estimate of world bank, from 1987 to 1990 banking credit to GDP ratio is 63.44% in average, but from 1993 to 1996 the ratio increase to95.62%. Although the banking support to state owned economy continue to rise, it still going down. If such inefficient allocation of the credit funds can not be changed, normal order of economy may be inevitably affected.

Below is the explanation why there exists long time loan-deposit gap in Chinese banking institutions before 1995, especially before carrying out market oriented banking system reform in 1994. At some extent, we can at least partly explain why there exists continuing inflation from1978-1995.

Before state owned banking system carrying out reform from special banking system toward commercial banking system, both lending interest rate and deposit interest rate are controlled by central government.

Given interest rate and hard budget constraint, the demand function for loan of a representative rational firm who pursues maximum profit can be obtained:

$$L_t^d = \left[\frac{\alpha(1-\tau)P_{t+1}(A+q)}{P_t^\alpha R_{Lt}} \right]^{\frac{1}{1-\alpha}} H_{t+1}$$

At given interest rate, deposit supply for a consumer is determined by its wage income.

$$\frac{D_t}{p_t} = \phi \frac{H_t w_t}{p_t}, \text{ Or } D_t = \left[\frac{\beta}{1+\beta} \right] H_t w_t$$

$$\frac{L_t}{D_t} = \left[\frac{\alpha(1-\tau)P_{t+1}(A+q)}{P_t^\alpha R_{Lt}} \right]^{\frac{1}{1-\alpha}} H_{t+1} \Big/ \phi H_t w_t$$

$$= \left[\frac{\alpha(1-\tau)\pi_{t+1}(A+q)}{R_{Lt}} \right]^{\frac{1}{1-\alpha}} n \Big/ \left[\phi\left(\frac{w_t}{P_t} \right) \right]$$

(1) For state owned banks, since its credit is guaranteed by central government, whether or not to keep reserve requirement or how many reserve requirements to keep is not very important

(2) Due to the asymmetry between benefit and responsibility existed in traditional state owned enterprises. If an investment project is unsuccessful, the loss faced by a stated owned firm is borne by government, but if it is successful, the benefit is usually obtained by internal staff of state owned firms, There has been always a trend that investment risk is underestimated by state owned firms. The probability q of investment success is mistaken as larger than its real value, the demand for investment will be much higher than the supply of consumer's deposit. In reality, because of the bad responsibility and benefit mechanism, soft constraint usually dominates in state owned system. Especially, some state owned firms don't consider any cost, so the demand for loan may be unlimited. Local government intervention combining with soft budget constraint make it possible for state owned banks lending more than deposit, the inadequate part is by borrowing from central banks.

(3) In the process of market oriented reform, Chinese economy has to experience monetization process. This process inevitably releases the compressed price under old system, which contribute to the excessive credit balance.

(4) Another reason of loan surpassing deposit is the higher expected inflation rate. Because of fixed lending interest rate, 20 years lasting inflation experiences make the long run expected inflation be formed, real lending rate is low so much as negative.

Figure 5:
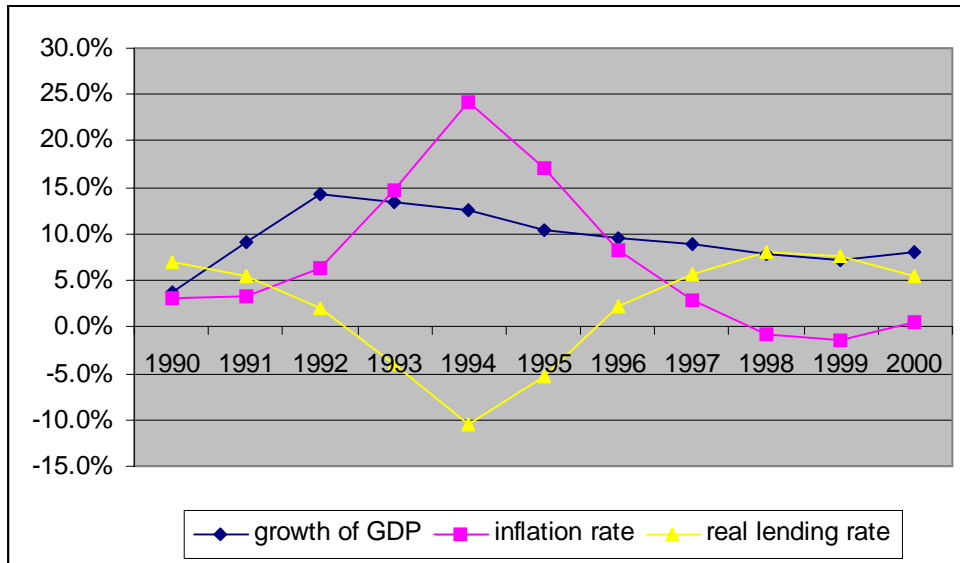
(5) Most importantly, some state owned firms have never considered returning interest let alone principal.

(6) Low salary and hence low deposit.

Of course, in face of too large investment demand, it is impossible for central bank that is responsible for controlling inflation to satisfy with all the demand of firms. Actually, it is most probably that investment demand L may be satisfied with

$$D_t < L_t \leq D_t + B_t$$

The profit of banking system is

$$P_B = q(D + B)r_L - Dr_D = D(qr_L - r_D) + Bqr_L$$

This formula can explain at least three facts that exist in China's banking system: the first is that, at fixed interest rate, each bank has impetus to compete for maximum deposit. The second is that central bank would like to lend more to banks as long as inflation rate is acceptable. The third is that given total deposit, more competition for deposit will lead to underground trade. Some households were often promised to obtain higher interest rate or some other benefit.

From discussion above, we can see that before market oriented banking system reform, Chinese banking system not only used up all the deposit, but also most probably issue more paper money to meet excessive demand, which will lead to inflation. However, it is obvious that traditional financial system has no mechanism guaranteed that loans can be lent to those who use it most efficiently. Even though the

deposit in banks was used up, because of lack of efficient resources allocation system, they must be used inefficiently.

2. the expanding credit balance after 1995

Banking law of china issued in1995 changed the allocation mechanism of financial resources. Although the idea that regards banking loan as fiscal subsidy didn't change completely, because banking law require state owned banks to operate asset liability ratio management, budget constraint in bank side has been becoming harder and harder. Excessive demand for loan combining with limited deposit supply caused two possible situations. One is that constraint is hard and information is symmetry, credit balance is determined by lending interest rate, inflation rate, and tax rate and information uncertainty:

$$L_t^{\ d} = \left[\frac{\alpha(1-\tau)P_{t+1}(A+q)}{P_t^{\alpha}R_{Lt}} \right]^{\frac{1}{1-\alpha}} H_{t+1}$$

$$D_t = \left[\frac{\beta}{1+\beta} \right] H_t w_t$$

$$\frac{D_t}{L_t} = \left[\frac{\beta}{1+\beta} \right] H_t w_t \Bigg/ \left\{ \left[\frac{\alpha(1-\tau)P_{t+1}(A+q)}{P_t^{\alpha}R_{Lt}} \right]^{\frac{1}{1-\alpha}} H_{t+1} \right\}$$

This formula indicates that the extent that deposit over loan is positively related to real wage rate, real lending rate, tax rate and unemployment (negatively related to the growth rate of employment). But it is negatively related to expected inflation rate (or positively related to deflation rate) and investment success rate q. when the probability of investment success is lower or considered lower than it really is by state owned banks, the loan supply may be less than the expected state.

From the point of economic regime, after banking law was put in practice both the budget constraint of firm's and that of bank's become harder. At higher real lending rate, a phenomenon that is called "reluctant to borrow" produced in firm sector; while because the managers of bank worry about that loan can't be paid back,

and therefore being punished, a phenomenon that is called "reluctant to lend" produced in banking sector. This is the main regime reason of large credit balance.

Half-baked historical financial records of middle and small sized enterprises also contribute to credit balance. Half-baked historical financial records of middle and small sized enterprises make it difficult for banks to judge whether or not a loan is profitable.

Large bonds issued by government discourage banks to pursue ideal customers.

Up to now, we have not considered how the asymmetrical information and soft constraint can influence the loan behaviour of firms and banks. In fact, banks and firms usually have different knowledge about the production technology, so they may be have different view on the parameter q. Assuming that firm regards q as q_1, and banks regard it as q_2, then, when $q_1 > q_2$, and other variable constant, the balance will be lower; and $q_1 > q_2$, the balance will be larger.

In addition, under the circumstance of fixed loan and deposit interest rate, the policy maker difficult to make loan rate and deposit rate accord with the relationship inference from model.

3. Credit balance would changes after lending interest rate liberalisation

Now we further consider the case that lending rate is determined by market, but deposit is still fixed by monetary authority and risk management is introduced into banking system. Here, banks have to consider the possibility that some loan become bad asset, which is assumed to be q. under fixed deposit rate and let lending rate determined by demand and supply. The profit of firms is

$$\pi_i = qL_iR_L - D_i(1 + r_D)$$

$$R_{Lt} = \frac{N(1 + r_{Dt})}{q(1 - d)(N - 1 + \alpha)} = \left(1 + \frac{1 - \alpha}{N - 1 + \alpha}\right)\left(\frac{1 + r_{Dt}}{1 - d}\right)\left(\frac{1}{q}\right)$$

Where q is the probability of an investment project succeeding. It is can been seen from the formula that lending rate is determined by the number of banks (competitive degree)，deposit rate, reserve requirement ratio and the probability of investment success. It is positively related to deposit rate and reserve requirement, but negatively related to competition and the probability q.

$$D_t / L_t = \left[\frac{\beta}{1+\beta}\right]\frac{w_t}{P_t} \Bigg/ \left\{(1+n)\left[\frac{\alpha(1-\tau)\pi_{t+1}(A+q)}{R_{Lt}}\right]^{\frac{1}{1-\alpha}}\right\}$$

$$= \left[\frac{\beta}{1+\beta}\right]\frac{w_t}{P_t}\left\{\left(1+\frac{1-\alpha}{N-1+\alpha}\right)\left(\frac{1+r_{Dt}}{1-d}\right)\left(\frac{1}{q}\right)\right\}^{\frac{1}{1-\alpha}} \Bigg/ \left\{(1+n)[\alpha(1-\tau)\pi_{t+1}(A+q)]^{\frac{1}{1-\alpha}}\right\}$$

The expanding credit may be caused by high investment risk, higher reserve requirement ratio, and high degree of monopoly, high deposit interest rate, high employment rate, high tax rate, low technological level, as well as expected deflation.

Table 8: Unreasonable interest rate structure

Time adjust interest	reserve requirement	loans to financial institutions	rediscount	deposit rate	lending rate of flow funds	lending to deposit ratio	fixed investment
1990.1.1				11.34	11.34	1	11.34
1990.4.15				10.08	10.08	1	10.08
1990.8.21				8.64	9.36	1.08333	9.36
1991.4.21				7.56	8.64	1.14285	8.46
1993.5.15				9.18	9.36	1.0196	9.18
1993.7.11				10.98	10.98	1	10.98
1996.5.1	8.82	10.98	*	9.18	10.98	1.19607	11.52
1996.8.23	8.28	1062	*	7.47	10.08	1.34939	10.08
1997.10.23	7.56	9.36	*	5.67	8.64	1.52381	8.64
1998.3.25	5.22	7.92	6.03	5.22	7.92	1.51724	7.92
1998.7.1	3.51	5.67	4.32	4.77	6.93	1.45283	6.93
1998.12.7	3.24	5.13	3.96	3.78	6.39	1.690476	6.12-6.39
1999.6.10	2.07	3.78	2.12	2.25	5.85	2.6	5.58-5.85
2000				2.25	5.85	2.6	

Note: Starting from March 1998, reserve requirement and excess reserve are united into reserve requirement.

Floating by 5-10% lower than the central bank lending rates of corresponding maturity.

Unreasonable interest rate structure. Traditional financial system requires central bank to implement several objectives, including curbing inflation and provoking economic growth. At the end of 1990's, to curb inflation, PBC was forced to increase deposit interest rate up to 11 percent, While for the sake of benefit of state owned firms, the lending interest rate could not too high, therefore, lending rate and deposit rate was set almost equal.

4. at the time of both deposit and lending rate are determined by market

To keep credit market move at equilibrium path or make the market clear, free floating of interest rate is required. At market condition, Credit balances is just equal to required reserve. Interest rate gap is determined by degree of competition and reserve requirement ratio. Here we have

$$D - L = dD$$

With the exception of reserve requirement, all of the deposit is used efficiently.

V.　Summary and some of policy implications

1.　Challenges and opportunity to China's economy and banking sector

In recent years, china has experienced a vicious cycle in the financial reform and SOEs reform. Namely, due to the reform in the management system of the banks, loans become more commercial oriented, making the SOEs difficult to borrow from the banks and thus cause a downturn in output of the SOEs. However, Unlike what some of the foreign governments and specialists on the western side have forecasted that Chinese economy and the banks will collapse after its entry to the WTO, we guess that China is definitely able to overcome the difficulties accompanied with the reform. The general situation will improve in the years to come, china's banking sector is very likely experiencing what Chinese home electric industry has experienced, which is becoming more powerful in the process of competition and learning by doing.

These measures have got some positive outcome such as strengthening competition among banks and will continue to strengthen the management base of SOBs and consolidate the role of market mechanism.

It is quite possible that the reform process may be slightly accelerated after the accession to the WTO, but a suitable speed flexible manner should still be maintained. In fact, the Chinese government has launched a variety of reform measures on an experimental basis, and then expanded steadily up to now. In order to relieve the various possible impacts after the accession, the Chinese government should adopt a practical approach to adjust a speed of the reform in a flexible manner. In case of banking sector, the local banks still do have great advantages over foreign banks on their relationships with domestic clients, in terms of communication and networking

of branches. However, a special attention deserved to pay to the possibility that the rapid and massive deposits shift towards the foreign banks, because the competition with foreign banks would be intensified after the accession. Although accession to WTO will be a big business chance to the foreign banks, and will be a pressing and bitter issue to China's banks, with the effects of learning by doing and spill over effect expanding, as long as china's banks can better use their advantages and avoid their disadvantages, they also may become a positive challenge to foreign banks as well in future.

Firstly, break the old financial system, accelerate the pace of reform, end up the situation of monopoly by the SOBs, introduce competition and accelerate banking business-marketized process.

Secondly, Undoubtedly, the competition will become intensified and the efficient use of financial resources will be enhanced. Boosting faster investment, consumption and economic growth is expected. Opening banking sector can weaken inflation and deflation pressure.

Thirdly, at first the monopoly profit of state owned banks will fall, however, through leaning by doing, skills of financial management of Chinese banks will be improved. In long run spill over effect expanding, as long as china's banks can better use their advantages and avoid their disadvantages, they will definitely become a positive challenge to foreign banks as well in future.

.   Fourthly, some banks may face the risk of collapse, some of the China's local banks may go into bankrupt but after the reshuffling, and a few larger banks may emerge.

Fifthly, Some state owned bank employees who are not skilled in banking business might have to be laid off, but those skilled staff will move to foreign banks due to its high salary.

Sixthly, Great impacts are expected. So far, some foreign banks are admitted to engage in Renminbi business in restricted areas such as Shanghai. Therefore, although people do not trust the local banks, they do not have any options but deposit their money to the local banks. Consequently, local banks are also not worried about the lack of liquidity.

When foreign banks start Renminbi business after the entry, a tremendous amount of individual's deposit may shift to these foreign banks.

Needless to say, local banks still do have many advantages like a wide range of branch network, transportation and communication. Yet these advantages are going to disappear sooner or later.

2.   The possible impact on Hong Kong's banking sector

Generally speaking, As a window of China and a starting point of doing business with China, Hong Kong will definitely be benefited in the short term after the accession of China to WTO. But in the long run, Hong Kong needs to adjust its strategy in the face of incoming challenges.

Opportunities of Hong Kong banking system

Firstly, because it take a long time for China to improve its own infrastructure while it has to attract more foreign capital than before after the accession to WTO, the goods and capital movement through Hong Kong will certainly increase in short run.

Secondly, Hong Kong's local banks, such as HSBC, Hang Seng among others, take more competitive advantages over Mainland State owned banks, because they are acquainted with market mechanism and hence are much more efficient than mainland state banks.

Indicator comparison of China's biggest banks with two Hong Kong's banks

	business and commercial bank	bank of china	agriculture bank	construction bank	HSBC	HANG SENG
	1998	1998	1998	1998	2000	2000
return on average shareholder's funds	0.11	0.21	−0.05	0.08	33.3	23.6
return on average total assets	2.46	4.08	−1.05	1.81	1.77	2.1
cost: income ratio	75.52	100.68	111.68	64.51	37.2	24.4
capital adequacy ratio						
total capital	5.05	5.17	7.85	4.7	13.2	15.3
tier 1 capital					9.4	11.9

Resources: "reconstructing the relationship of banks with enterprises", the numbers of banks in china is1995; HSBC and Hang Seng Bank.

Thirdly, they have much closer relationship with China than other foreign banks, therefore enjoy relatively advantages over the other foreign.

Fourthly, given the inconvertibility of Renminbi, Hong Kong is much less likely to be replaced by Shanghai or others as the international financial centre. Whether and when Shanghai become an international centre depends on when will the Renminbi be convertible. It is difficult for RMB to be fully convertible in 10. Even though RMB become fully convertible, China's GDP will be doubled By then. Now that current economic scale and fast developing east Asian economy can support one financial centre, there will be no reason to doubt that 10 year's later, a doubled china's economic scale are able to support two financial centres, Hong Kong and Shanghai. Either is supported by half of china's economy. Considering the size of China's economy and its possible integration into the world economy after the accession to the WTO, those two cities might become complementary with each other rather than a conflicting one as international financial centre.

Challenges that Hong Kong faces

The first, the higher limits on the asset scale for foreign banks to enter the mainland market may prevent small and medium sized banks in Hong Kong from Mainland. But they still may find some means, such as mergers and acquisitions to enter to china's markets.

The second, because some business of Hong Kong' banks need shift to the mainland due to Hong Kong's higher operation, therefore labour force in banking sector will face more and more competitive pressure.

According to analysis above, we don't think that the position of Hong Kong as a financial and trade centre can be changed in the sighted future. Of course, In the long-term, with China's catching up with its infrastructure, the competitive pressure that Hong Kong face is larger and larger. Hong Kong will have to change its development strategy. Thus, china's accession to WTO is absolutely a good opportunity for Hong Kong' banking sectors and may have side effects on banking sector employment.

Because the banks that go into China's banking market will earlier will earn more profit. It is recommended that the concerned institutions of Hong Kong should discuss with its counterpart on mainland on the issues of entering China's market, to see if Chinese government can make some policies that treat banks in Hong Kong different from those in other countries at the framework of one country two systems. Among the policies include different limits of entry, issuing licenses a head of foreign

39

banks, and strengthening co-operation and human resources training between the banks on mainland and Hong Kong.

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