CHAPTER IV

THEORETICAL FRAMEWORK

In this chapter, the theoretical model is constructed and then used as a framework to analyze the impact of foreign entry in banking sector on economic growth in various perspectives. As stated in the previous chapter, the assumption that cost of foreign banks is lower than that of domestic banks is also applied to our model. Transmission channel embedded in this model is of overall cost reduction in banking sector which provides access to cheaper financial resources for firms and thus encourages economic growth. The basic structure is discussed in general first and followed by the analytics in which we try to normalize parameters complying with Thai economy. Recovering Thai economy parameters are discussed in the Appendix A.

4.1. Basic Structure of the Model

Our model is an economy consisting of three optimizing agents: households, firms and banks classified into domestic or foreign banks. Three markets are deposit, loan and interbank markets where households supply savings to banks, banks supply loans and banks borrow or lend to others respectively. Each bank has to deposit their cash to the Central Bank. A diagram of the economy is shown in Figure 6.

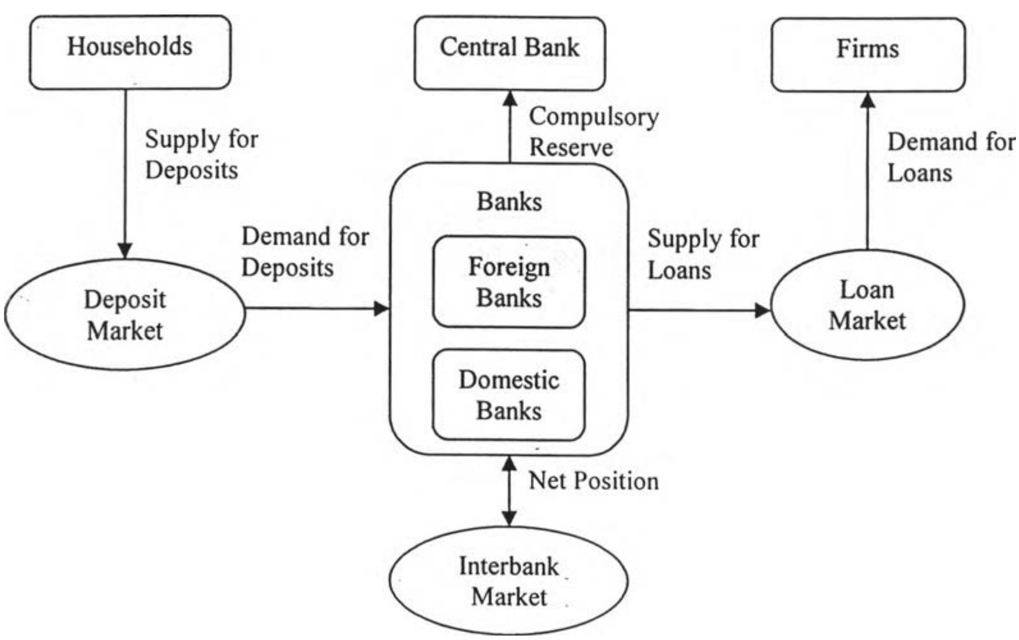

Figure 6 Diagram of the theoretical model

There is one homogenous product in the economy whose aggregate quantity at time t is denoted by Q_t. The population consists of overlapping households living for two periods. All are endowed with a unity of labor at their first period and supply them to firms in exchange for wage ω_t. In their second period they cannot operate any productive activity so that they spend their saving deposited in banks at the first period. Households have preference over consumption in both periods. Hence, their objectives are to maximize the utility,

$$U(c_t, c_{t+1}) = \sqrt{c_t} + \beta\sqrt{c_{t+1}}, \tag{1}$$

with subject to

$$\begin{aligned} \omega_t &= c_t + s_t \\ s_t r_{t+1}^D &= c_{t+1} \end{aligned}, \tag{2}$$

where c_t, s_t, and r_t^D are consumption, saving and interest rate on deposits at time t and β is the rate of time preference. The Cobb-Douglas utility function is normalized to facilitate the analysis. Households will plan their consumption based on their expected interest rate on deposit. So, from the household's objective, the consumption schedules for both periods are shown in the following equations,

$$c_t\left(\omega_t, E\left(r_{t+1}^D\right)\right) = \frac{\omega_t}{1+\beta^2\left(1+E\left(r_{t+1}^D\right)\right)} \text{ and} \tag{3}$$

$$c_{t+1}\left(\omega_t, E\left(r_{t+1}^D\right)\right) = \frac{\beta^2 r_{t+1}^D\left(1+E\left(r_{t+1}^D\right)\right)\omega_t}{1+\beta^2\left(1+E\left(r_{t+1}^D\right)\right)}. \tag{4}$$

However, the expectation of households is irrelevant to our analysis. We therefore assume that the households have rational expectations, or $E\left(r_t^D\right) = r_t^D, \forall t$. Thus, a Life-time consumption LC_t and savings S_t of the generation t are written as the following equations,

$$LC_t\left(\omega_t, r_{t+1}^D\right) = \frac{\omega_t\left(1+\beta^2\left(1+r_{t+1}^D\right)^2\right)}{1+\beta^2\left(1+r_{t+1}^D\right)}, \tag{5}$$

$$S_t\left(\omega_t, r_{t+1}^D\right) = \frac{\beta^2 \omega_t \left(1 + r_{t+1}^D\right)}{1 + \beta^2 \left(1 + r_{t+1}^D\right)}. \tag{6}$$

In the real sector, a production technology is a normalized Cobb-Douglas function,

$$Q_t = f(K_t, L_t) = A\sqrt{K_t L_t}\ . \tag{7}$$

According to the perfectly competitive and full employment conditions with a unity labor supply, the wage is equal to the labor productivity,

$$\omega_t = \frac{A}{2}\sqrt{K_t}\ . \tag{8}$$

Perfectly competitive firms produce goods using one factor of production, namely loans K which are borrowed from banks at interest rate r_t^K as we assume that firms pay back interests in the same period. Hence, the objective of firms is to maximize their profit by choosing amount of loans it takes into manufacturing,

$$\max_{K_t} \pi_t^q(K_t) = \max_{K_t} f(K_t) - \left(1 + r_t^K\right)K_t. \tag{9}$$

From the profit maximization, the demands for loans,

$$K_t^-\left(r_t^K\right) = \frac{1}{4}\left(\frac{A}{1 + r_t^K}\right)^2, \tag{10}$$

is negative function of an interest rate on loans. In words, if the cost of borrowing loans is cheaper, firms can borrow more loans that will result in a higher firms' output.

In the banking sector, we adopt oligopolistic version of Monti-Klein model, simplified by Freixas and Rochet (1997), which considers banking activity as the production of deposit and loan services. In our model, there are N domestic banks indexed by i = 1,...,N and M foreign banks indexed by $i = N+1, \ldots, M+N$. Each bank collects deposits $d_{i,t}$ at interest rate r_t^D from households and grants loans $k_{i,t}$ to firms at price r_t^K. Banking technology is exhibited through a per unit managerial cost function,

$$C_i(d_i, k_i) = \gamma_{D,i} d_i + \gamma_{K,i} k_i, \quad i = 1, \ldots, M + N. \tag{11}$$

$\gamma_{D,i}$ and $\gamma_{K,i}$ is bank i's management cost of deposits and loans, respectively, which are assumed to be constant over time and $0 < \gamma_{D,i}, \gamma_{K,i} < 1$. To facilitate the analysis, we assume that domestic banks are homogenous, so are foreign ones. However, domestic and foreign banks are distinguished by parameters of the per unit managerial management cost function. That is, we give that

$$\gamma_{K,i} = \gamma_{K,d}, \quad i = 1, \ldots, N \tag{12}$$

$$\gamma_{K,i} = \gamma_{K,f}, \quad i = 1, \ldots, M \tag{13}$$

$$\gamma_{D,i} = \gamma_D, \quad i = 1, \ldots, M + N \tag{14}$$

In words, there is a difference between managerial cost per loans of foreign and domestic firms, while, to facilitate the analysis, the management cost per deposit is the same for both types of banks.

In each bank's balance sheet, its assets consist of reserves $R_{i,t}$ and loans while its liabilities is deposits. Bank's reserves are divided into cash reserves $C_{i,t}$, transferred to its accounts at the Central Bank and bank's net position $m_{i,t}$ on interbank market at a given interbank rate r_t. The proportion of cash reserves of deposits μ are served as a policy instrument for the Central Bank. So the net position of each bank is equal to

$$m_{i,t} = (1 - \mu) d_{i,t} - k_{i,t}, \quad i = 1, \ldots, M + N. \tag{15}$$

Competition in the banking sector is assumed to be Cournot type, says banks compete by quantity. All banks face downward demand for loans and upward supply for deposits as shown above. Therefore, profit functions of banks are given as

$$\pi_{i,t}(k_{i,t}, d_{i,t}) = r_t^K\left(\sum_j k_{j,t}\right) k_{i,t} + r_t m_{i,t} - r_{t+1}^D\left(\sum_j d_{j,t}\right) d_{i,t} - C_i(k_{i,t}, d_{i,t}), \quad i = 1, \ldots, M + N. \tag{16}$$

It should be noted that banks prudently deduct the interest expense on the next period from the presence profit in order to technically avoid intertemporal optimization for banks. Plugging the equation (15) into (16), the banks' objective can be written as following equation,

$$\max_{k_{i,t},d_{i,t}} \pi_{i,t}\left(k_{i,t},d_{i,t}\right) = \left[r_t^K\left(k_{i,t}+\sum_{j\neq i}k_{j,t}^{*}\right)-r\right]k_t+\left[r_t(1-\mu)-r_t^D\left(d_{i,t}+\sum_{j\neq i}d_{j,t}^{*}\right)\right]d_{i,t}-C_t\left(k_{i,t},d_{i,t}\right). \quad (17)$$

The objective of each firm is to maximize its profits by choosing quantity of loans and deposits. The first order conditions for each bank are

$$\frac{\partial \pi_{i,t}}{\partial k_{i,t}} = k_{i,t}\frac{\partial r_t^K\left(\sum_j k_{j,t}^{*}\right)}{\partial k_{i,t}}+r_t^K\left(\sum_j k_{j,t}^{*}\right)-r_t-\gamma_{K,i}=0, \quad i=1,\dots,M+N \text{ and} \quad (18)$$

$$\frac{\partial \pi_{i,t}}{\partial d_{i,t}} = -d_{i,t}\frac{\partial r_t^D\left(\sum_j d_{j,t}^{*}\right)}{\partial d_{i,t}}-r_t^D\left(\sum_j d_{j,t}^{*}\right)+r_t(1-\mu)-\gamma_{D,i}=0, \quad i=1,\dots,M+N. \quad (19)$$

From the first-order conditions above, by assuming linear cost function which absence of cross term, the problem of banks can be considered two-sided: to maximize their profit of deposit and loan businesses separately.

According to the assumption of homogenous domestic (foreign) banks, their choices of loans $k_{d,t}$ ($k_{f,t}$) will be identical. Besides, the identical per unit cost of deposits between domestic and foreign firms will equate their amount of deposits d_t. Therefore an aggregate demand for deposits and supply for loans can be written as following equations,

$$K_t^{+} = \sum_{i=1}^{N}k_{d,t}+\sum_{i=1}^{M}k_{f,t} = Nk_{d,t}+Mk_{f,t} \text{ and} \quad (20)$$

$$D_t^{-} = \sum_{i=1}^{N}d_{d,t}+\sum_{i=1}^{M}d_{f,t} = (N+M)d_t. \quad (21)$$

First, from the first-order condition of loans side in the equation (18), inverse function of the firms' demand for loans in the equation (10), and equation (20), the equilibrium supply for loans of each type of banks can be derived as following equations,

$$k_{d,t}^{*}=\frac{A^{2}(2M+2N-1)^{2}\left((1+r_{t})+2M\gamma_{K,d}+(1-2M)\gamma_{K,f}\right)}{16\left((M+N)(1+r_{t})+N\gamma_{K,d}+M\gamma_{K,f}\right)^{3}} \text{ and} \tag{22}$$

$$k_{f,t}^{*}=\frac{A^{2}(2M+2N-1)^{2}\left((1+r_{t})+2N\gamma_{K,d}+(1-2N)\gamma_{K,f}\right)}{16\left((M+N)(1+r_{t})+N\gamma_{K,d}+M\gamma_{K,f}\right)^{3}}. \tag{23}$$

Combining the equation (20), (22) and (23), the equilibrium supply for loans can be rewritten as

$$K_{t}^{+}=\frac{A^{2}(2M+2N-1)^{2}}{16\left((M+N)(1+r_{t})+N\gamma_{K,d}+M\gamma_{K,f}\right)^{2}}. \tag{24}$$

On the deposits side, using the inverse function of households supply for deposits in the equation (6) and the first-order condition of the deposits side in the equation (19), the amount of deposits for each bank can be written as following equation[5],

$$d_{i,t}=\omega_{t}\left[\frac{2(M+N)^{2}(2\phi(r_{t})-1)-1+\sqrt{1+(M+N)^{4}+2(M+N)^{2}(1-2\phi(r_{t}))}}{2(M+N)^{3}(\phi(r_{t})-1)}\right]. \tag{25}$$

where $\phi(r_{t})=\beta^{2}(\gamma_{D}-1-r_{t}(1-\mu))$. Therefore, an aggregate demand for deposits is simply a sum of all banks' deposit,

$$D_{t}^{-}=\omega_{t}\left[\frac{2(M+N)^{2}\phi(r_{t})-1+\sqrt{1+(M+N)^{4}+2(M+N)^{2}(1-2\phi(r_{t}))}}{2(M+N)^{2}(\phi(r_{t})-1)}\right]. \tag{26}$$

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[5] The first-order condition of banks' profit on deposits side has two solutions,

$$d_{i,t}=\omega_{t}\left[\frac{2(M+N)^{2}\phi(r_{t})-1\pm\sqrt{1+(M+N)^{4}+2(M+N)^{2}(1-2\phi(r_{t}))}}{2(M+N)^{3}(\phi(r_{t})-1)}\right].$$

However, the first root is chosen because the second one produces irrelevant result. That is, the demand for deposits is higher than household income.

At this point, all supply demand for loans and deposits markets are derived. The competitive equilibrium will be characterized by following loans and deposits market clearing conditions,

$$K_t^-\left(r_t^K\right)=\sum_i k_{i,t}\left(r_t^K,r_t\right), \tag{27}$$

$$D_t^-\left(r_{t+1}^D\right)=\sum_i d_{i,t}\left(r_{t+1}^D,r_t\right) \text{ and} \tag{28}$$

$$\sum_i k_{i,t}\left(r_t^K,r_t\right)=\left(1-\mu\right)\sum_i d_{i,t}\left(r_{t+1}^D,r_t\right). \tag{29}$$

To facilitate our analysis, we assume that the Central Bank can influence the money circulating in the economy through the interbank market in which an interbank rate is served as a policy instrument and the interbank market clearing condition disappears.

From the market-clearing conditions above, the equilibrium interest rate[6] on loans and deposits can be rewritten as following equations,

$$r_t^K=\frac{1+2(M+N)(1+r_t)+2N\gamma_{K,d}+2M\gamma_{K,f}}{2M+2N-1} \text{ and} \tag{30}$$

$$r_{t+1}^D=\frac{\sqrt{\left(1+(M+N)^2\right)^2-4\beta^2(M+N)^2\phi(r_t)}-\left((M+N)^2+2\beta^2+1\right)}{2\beta^2}. \tag{31}$$

4.2. Analytics of the Model

At this point, we arrive at the main research question what the relationship between number of foreign banks in domestic market and economic growth is. Taking Thailand as a case study, we try to normalize parameters to reflect situation of Thailand in 2005. The detail how we determine value of parameters is discussed in the Appendix A. It should be noted that in order to clearly exhibit the relationship we loosely apply differentiation to analyze relationships though the model is discrete.

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[6] There is another solution of this condition,

$$r_t^K=\frac{1-4(M+N)-2(M+N)(1+r_t)-2N\gamma_{K,d}-2M\gamma_{K,f}}{2M+2N-1},$$

which is irrelevant because it is always negative.

By plugging the equilibrium interest rate on loans into the aggregate supply function, we can determine the relationship between aggregate output and a number of banks as following equation,

$$Q_t^* = \frac{A^2(2M + 2N - 1)}{4((M+N)(1+r_t) + N\gamma_{K,d} + M\gamma_{K,f})}. \tag{32}$$

We further assume, by the fact that foreign bank efficiency is higher than otherwise, per unit managerial cost of foreign banks, a proxy for efficiency, is less than that of domestic banks as we investigate this issue in our conceptual framework. The gap between per unit managerial cost of loans of domestic and foreign banks is denoted by

$$\theta = \gamma_{K,d} - \gamma_{K,f}, \qquad \theta > 0. \tag{33}$$

Plugging the equation (33) into (32), the aggregate output can be rewritten as following,

$$Q_t^* = \frac{A^2(2M + 2N - 1)}{4((M+N)(1+r_t) + (M+N)\gamma_{K,d} - M\theta)}. \tag{34}$$

The equation (34) has many parameters so that we will provide several cases with various normalizations of the parameters focusing on the relationship between output and managerial cost gap of loans as well as a number of foreign banks.

Depicted in Figure 7, equation (34) is normalized by giving $A = 0.195$, $N = 8$, $r_t = 1.66$ % and $\gamma_{K,d} = 0.5$[7]. These parameters are determined from Thai situation in the fourth 2004. The higher the managerial cost gap and number of foreign banks, the greater the aggregate output as we expected in the first place. Intuitively, if the lower-cost banks enter the market, the average cost in domestic banking sector as well as an interest rate on loans will be depressed. Consequently, firms could get cheaper financial resources as a factor of production and hence increase their production.

[7] Details how these parameters are normalized are in the Appendix A.

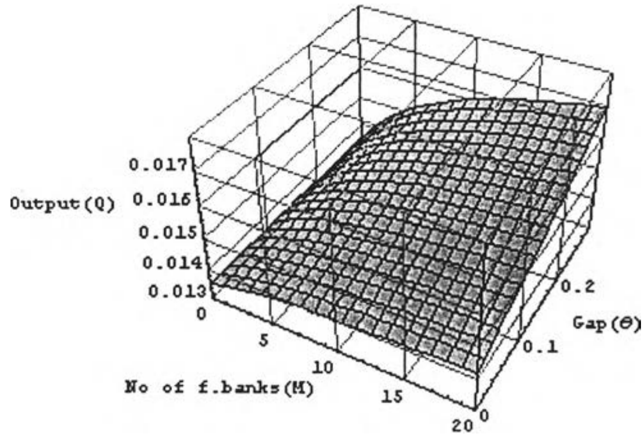

Figure 7 The relationship between aggregate output and managerial cost gap as well as a number of foreign banks in case of normal situation

In the case that there are relatively large number of domestic banks in the market, the surface will be flatter than that of the previous case as depicted in Figure 8 in which the equation (34) is normalized by giving N = 30. In other words, the more the domestic banks in the market, the less the effect of a foreign entry on aggregate output.

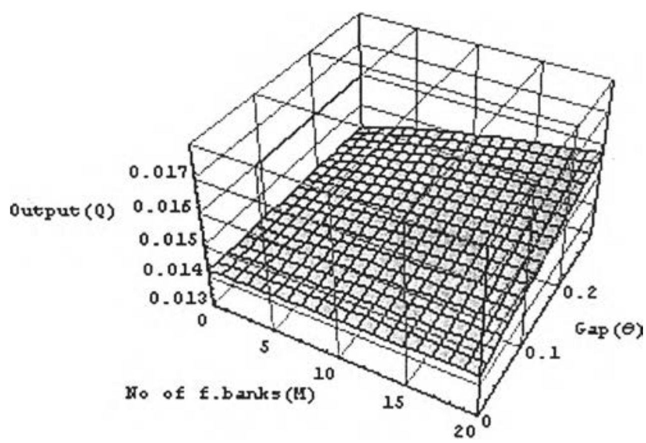

Figure 8 The relationship between aggregate output and managerial cost gap as well as a number of foreign banks in case of domestic-pervaded banking sector

In the case that domestic banks' per unit managerial cost of loans is high, $\gamma_{K,d} = 0.9$, the aggregate output is relatively lower and the surface is also flatter than the first case as illustrates in Figure 9. It can be said that low managerial cost of banks is beneficial to economic growth.

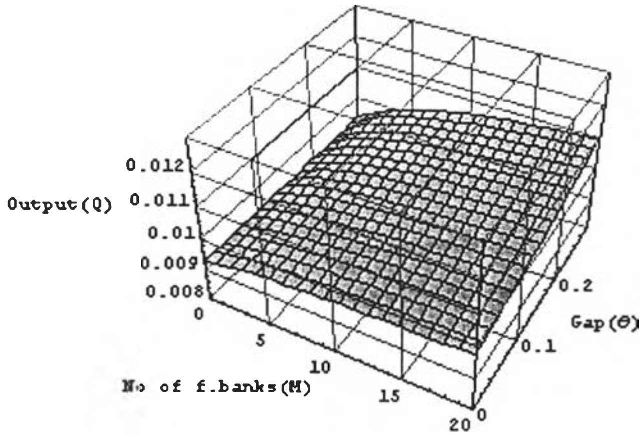

Figure 9 The relationship between aggregate output and managerial cost gap as well as a number of foreign banks in case of high managerial cost

By taking partial differentiation onto the equation (34) with respected to a number of foreign banks, the relationship between a number of foreign banks and output is always positive as long as the managerial cost gap is unambiguously positive as shown in the following equation,

$$\frac{\partial Q_t^*}{\partial M}=\frac{A^2\left(1+r_t+(2N-1)\theta+\gamma_{K,d}\right)}{4\left((M+N)(1+r_t)+(M+N)\gamma_{K,d}-M\theta\right)^2}>0\,. \tag{35}$$

It should be noted that this equation is not the growth function and that M, in sense, must be discrete, but this equation is intended to exhibit the sign of the relationship between a number of foreign banks and growth. Shown in Figure 10 the equation (35) which is normalized by giving A = 0.18, N = 8, r_t = 1.66 %, $\gamma_{K,d}$ = 0.3 show that a number of relatively lower-cost banks will raise output. By taking a partial differentiation with respected to a number of a number of foreign banks to the equation (35), we see that a number of foreign banks encourage output at diminishing rate as the following equation,

$$\frac{\partial^2 Q_t^*}{\partial M^2}=-\frac{A^2\left(1+r_t-\theta+\gamma_{K,d}\right)\left(1+r_t+(2N-1)\theta+\gamma_{K,d}\right)}{2\left((M+N)(1+r_t)+(M+N)\gamma_{K,d}-M\theta\right)^3}<0\,. \tag{36}$$

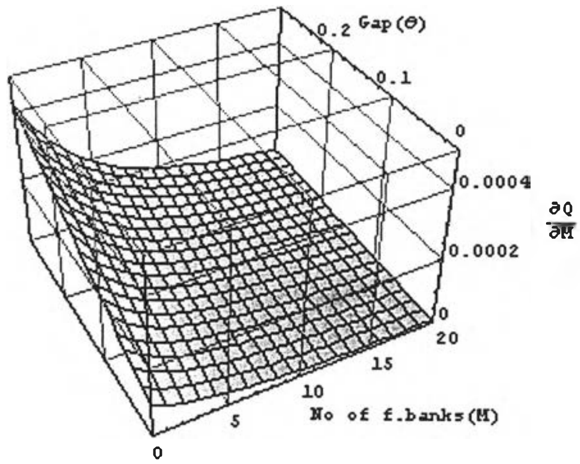

Figure 10 The relationship between a change in output and managerial cost gap as well as a number of foreign banks

In addition, transmission channel of interest rate reduction is investigated by taking the partial differentiation to an interest rate on loans with respected to a number of foreign banks,

$$\frac{\partial r_t^K}{\partial M} = -\frac{2(1 + r_t + (2N - 1)\theta + \gamma_{K,d})}{(2M + 2N - 1)^2} < 0 . \tag{37}$$

As expected, an entry of foreign banks will lower an interest rate on loans. In addition, the equation (37) suggests that the magnitude of change in interest rate depends on the managerial cost gap as shown in Figure 11 where the equation (37) is normalized by giving $A = 0.18$, $N = 8$, $r_t = 1.66$ %, $\gamma_{K,d} = 0.3$. Increasing in managerial cost gap and a number of foreign banks results in decreasing in interest rate on loans.

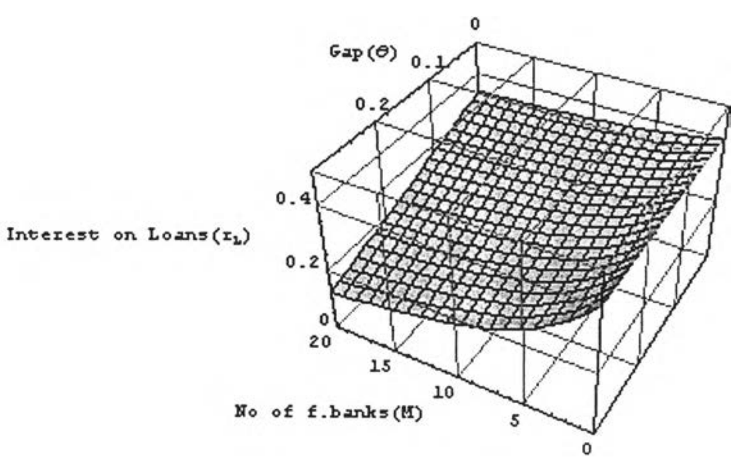

Figure 11 The relationship between an interest rate on loans and managerial cost gap as well as a number of foreign banks

From the equation (34), we can also derive the relationship between aggregate output and other variables in a form of discrete function as the following equation,

$$\%Q_t = \frac{(N_t + M_t)r_t - (N_{t-1} + M_{t-1})r_{t-1} - \theta\Delta M_t + (1+\gamma_d^K)(\Delta M_t + \Delta N_t)}{(2M_{t-1} + 2N_{t-1} - 1)((M_t + N_t + \gamma_d^K)(1+r_t) - M_t\theta)} + \frac{2(\theta - \Delta r_t)(M_t N_{t-1} - M_{t-1}N_t) - 2(M_{t-1}M_t + N_{t-1}N_t)}{(2M_{t-1} + 2N_{t-1} - 1)((M_t + N_t + \gamma_d^K)(1+r_t) - M_t\theta)} \tag{38}$$

This equation is plotted in Figure 12 in which equation (38) is normalized by giving $A = 0.195$, $N = 8$, $r_t = 1.66$ %, $\gamma_{K,d} = 0.3$, $\theta = 0.25$. The figure below suggests that the higher the increasing in a number of foreign banks in a single period, the greater the economic growth.

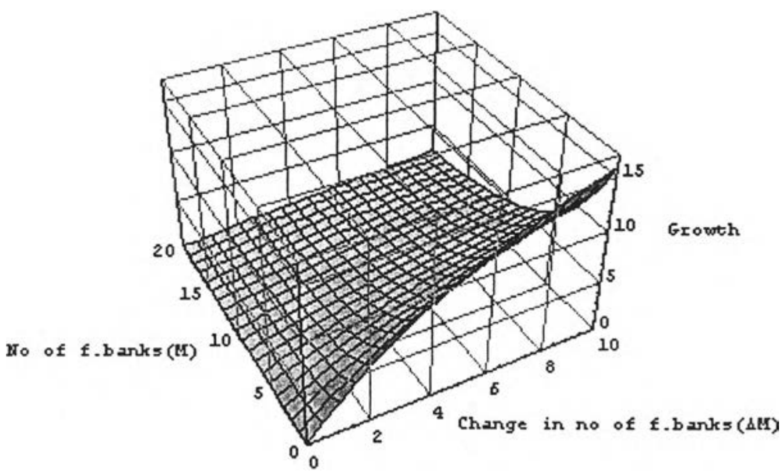

Figure 12 The relationship between economic growth and a number of foreign banks as well as change in a number of foreign banks

On the other side, whether an entry of domestic banks encourage output is ambiguous as shown in the following equation,

$$\frac{\partial Q_t^*}{\partial N} = \frac{A^2(1 + r_t + \gamma_{K,d} - 2M\theta)}{4((M+N)(1+r_t) + (M+N)\gamma_{K,d} - M\theta)^2}. \tag{39}$$

In a situation that $M > \frac{1 + r_t + \gamma_{K,d}}{2\theta}$, an entry of domestic banks can discourage economic growth as shown in Figure 13.

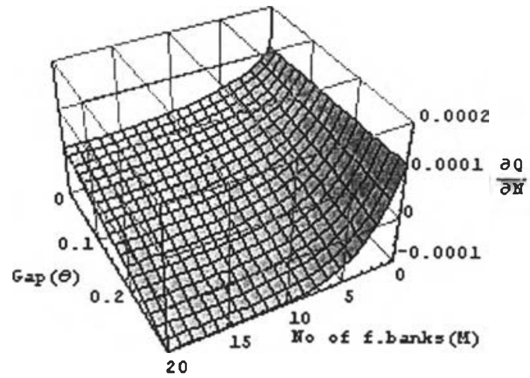

Figure 13 The relationship between a change in output with respected to a number of domestic banks and managerial cost gap as well as a number of foreign banks

This may be the case because entry of domestic banks has two opposite effects: (1) entry of a new higher-cost bank would raise overall cost of banking sector thrusting interest rate on loans; (2) entry of a new bank would increase a supply for loans depressing interest rate on loans. Therefore, the direction of a change in output depends on magnitude of two effects. If the former effect is greater, output will increase and vice versa.

In the microeconomic perspective the managerial cost gap will create the vacuum between profits of domestic and foreign banks. In other words, due to the higher managerial cost of loans of domestic banks which means competitive disadvantage in loans activity, hardly could domestic banks compete with lower cost banks and, for some situations, suffer from negative profit. In the other case, the similar result could also exist in a foreign-pervaded market. As discussed above that the banks' loans and deposits activities are separable, the critical condition of the managerial cost and a number of foreign banks can be determined. By plugging the equilibrium amount of loan for domestic banks and interest rate on loans into the loan-sided profit function, the loan-sided profit of domestic banks can be rewritten as following.

$$\pi_{d,s}^{L} = \frac{A^2(2M+2N-1)(2M+2N+r_t+\gamma_{K,d}-2M\theta)(1+r_t+\gamma_{K,d}-2M\theta)}{16((M+N)(1+r_t+\gamma_{K,d})-M\theta)^3} \qquad (40)$$

Figure 14 shows the relationship between domestic banks profit with respond to managerial gap and a number of foreign banks when $N = 8$, $r_t = 1.66\%$, $\gamma_{K,d} = 0.3$ and $A = 0.195$. If there are a relatively large number of foreign banks and a managerial cost gap is wide, domestic banks can face a negative profit on loan business.

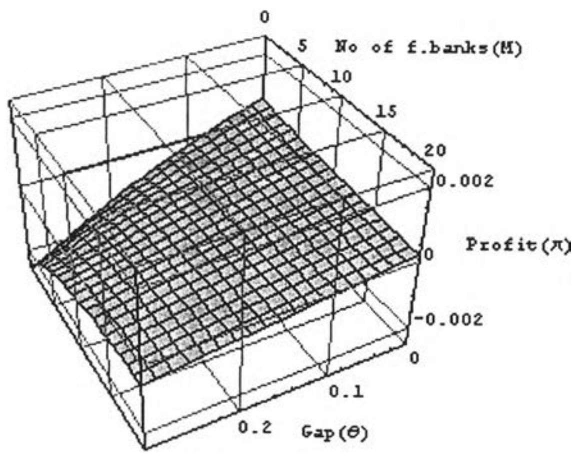

Figure 14 The relationship between domestic banks' profit and managerial cost gap as well as a number of foreign banks

Giving the loan-sided profit function greater than zero, we can derive the critical number of foreign banks M^C as the following equation[8],

$$M \leq M^C = \left\lfloor \frac{1 + r_t + \gamma_{K,d}}{2\theta} \right\rfloor. \tag{41}$$

If a number of foreign banks are higher than the right-handed side of the equation, two possible adverse consequences that could occur: (1) domestic banks face negative profits and are consequently bailed out of the loans business restructuring the credit sector; (2) Even though domestic banks are able to compensate their losses by deposit-sided profits and survive in the competition, further entry of domestic banks will deter economic growth as discusses in the equation (38). It should be noted that

$$\lim_{\theta \to 0} M^C = \infty \text{ and } \lim_{\theta \to 1} M^C = \frac{1 + r_t + \gamma_{K,d}}{2}. \tag{42}$$

In words, if domestic banks possess the same technology in managerial cost as foreign ones, domestic banks will not be bailed out from the market by an entry of foreign banks and an entry of new banks in the market will have little, if no, effect on

[8] There are other solutions which are:

$$2M + 2N > 1 \text{ , } \theta < \frac{2M + 2N + r_t + \gamma_{K,d}}{2M} \text{ and } \theta < \frac{(M + N)(1 + r_t + \gamma_{K,d})}{M}$$

However, both solutions are irrelevant because they are of tautologies.

economic growth. Besides, in the extreme case if per unit managerial cost gap of loans and an interbank rate are closed to one, the critical number of foreign bank is equal to zero[9] that means the banking sector is not prompted for liberalization.

This critical number of foreign banks for the case that r_t = 1.66 % is located at the surface of Figure 15. A number of foreign banks must be below the surface in order to prevent domestic banks from losses in a loans business. According to our analysis that the higher is the number of foreign banks, the greater is the output, one had better encourage economic growth by allowing foreign banks to enter domestic banking sector up to this optimum number of foreign banks.

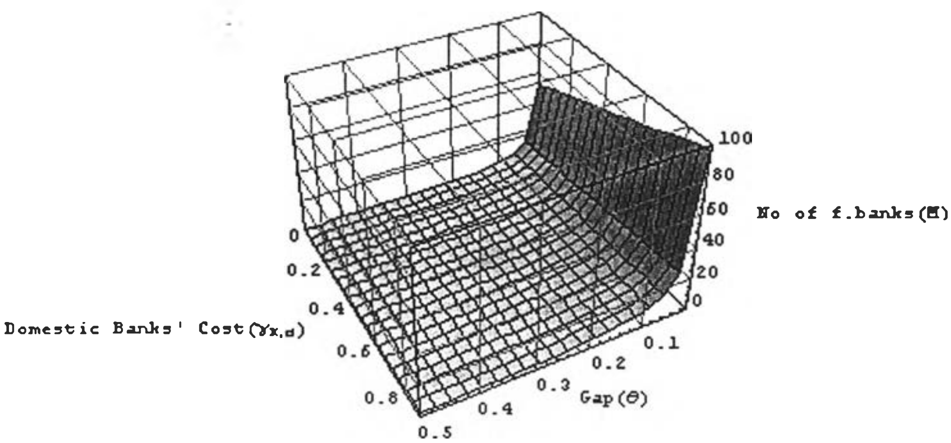

Figure 15 The critical number of foreign banks

In the deposit side whereby foreign and domestic banks possess the same technology, an impact of the entry of new banks on deposit is ambiguous because there are two transmission channels. First, an entry of new competitors, either domestic or foreign banks, will raise a demand for deposits because deposits can be lent to an interbank market to make profits. Consequently, an interest rate on deposits will rise as shown in the following equation,

$$\frac{\partial r_t^D}{\partial M} = \frac{\partial r_t^D}{\partial N} = \frac{(M+N)\left(1+(M+N)^2 - 2\beta\phi(r_t) - \psi(r_t)\right)}{\beta^2\psi(r_t)} > 0, \qquad (43)$$

[9] Because $0 < r_t, \gamma_{K,d} < 1$ and a number of foreign banks must be integer, the M_c in this case which little less than two is truncated to zero.

where $\psi(r_t)=\sqrt{\left(1+(M+N)^2\right)^2-4\beta^2(M+N)^2\phi(r_t)}$ and $\phi(r_t)=\beta^2(\gamma_D-1-r_t(1-\mu))$. It should be noted that an entry of foreign and domestic banks has the similar effect on an interest rate on deposits because their managerial costs of deposit are equal.

Second channel is through a household income. An entry of foreign banks will spur output and result in increasing in household income as well as saving. Besides, whether domestic banks increase income and saving depends on the critical condition. Combining the equations (6), (8) and (31), we can derive the aggregate deposits as the following equation,

$$D^{*}=\frac{A^2(2M+2N-1)\left(-1+(M+N)^2(2\phi(r_t)-1)+\psi(r_t)\right)}{16(M+N)^2(\phi(r_t)-1)\left((M+N)(1+r_t)-N\theta+(M+N)\gamma_{K,d}\right)}. \qquad (44)$$

From the equation (44), the quantity of deposits also depends on loan side, specifically the managerial cost on loans. If the critical condition is not satisfied, entry of domestic banks will have a negative effect on output and household income. As a result, an entry of domestic banks will deterred household saving when there are a higher number of foreign banks as shown in the twisted surface of Figure 16 which normalized by giving A = 0.195, r_t = 1.66 %, $\gamma_{K,d}$ = 0.3, $\gamma_{K,f}$ = 0.05, μ = 0.06, γ_D = 0, β = 1. The critical number of foreign banks in this case is two.

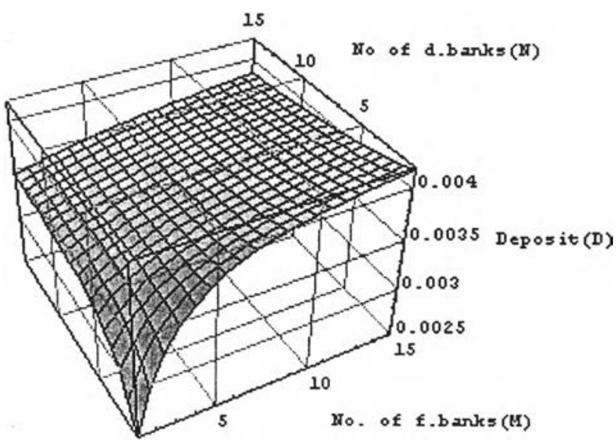

Figure 16 The relationship between deposits and a number of domestic as well as foreign banks

The similar effects also apply to the household consumption. From the equation (5), the relationship between life-time consumption and an interest rate on loans is positive as follows,

$$\frac{\partial LC_t^H}{\partial r_{t+1}^D} = \frac{W_t \beta^2 \left(1 + 2r_{t+1}^D + \beta^2 \left(1 + r_{t+1}^D\right)^2\right)}{\left(1 + \left(1 + r_{t+1}^D\right)\beta^2\right)^2} > 0 . \tag{45}$$

Using chain rule with the equations (43) and (45), an entry of either domestic or foreign banks will increase an interest rate on deposits and then life-time consumption. It is obvious that household incomes will increase the consumption, but whether household incomes increase is ambiguous as does the relationship between deposit and an entry of domestic banks. In other words, foreign banks certainly raise household incomes while domestic entry may not when the critical condition is not satisfied and vice versa.

We extend our analysis. to an impact on an interest margin, a difference between interest rate on loans and interest rate on deposits. From to the equation (37) and (43) that foreign entry reduces an interest rate on loans and raises an interest rate on deposit, an interest margin will be depressed accordingly as depicted in Figure 17 which normalized by giving A = 0.195, r_t = 1.66 %, $\gamma_{K,d}$ = 0.3, $\gamma_{K,f}$ = 0.05, μ = 0.06, γ_D = 0, β = 1.

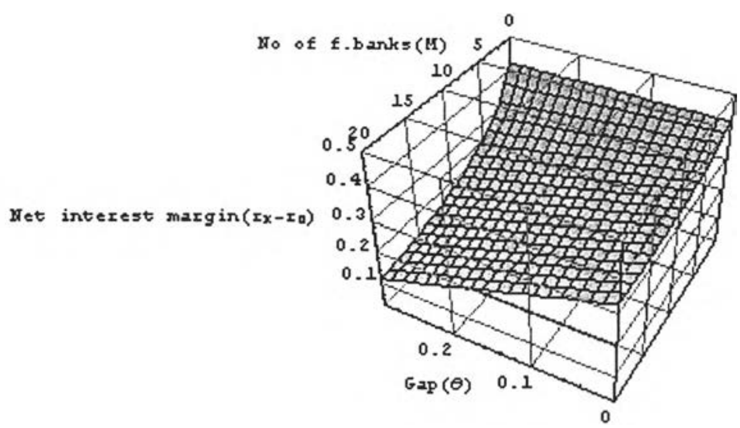

Figure 17 The relationship between net interest margin and managerial cost gap as well as a number of foreign banks

In this chapter, we construct a theoretical model with oligopolistic banking sector to explore the relationship between foreign entry and economic growth. Our analytics indicate that, on one hand, an entry of foreign banks, whose managerial costs of loans are assumed to be lower than that of domestic banks, will reduce an interest rate on loans. As a result, firms are able to obtain cheaper funding and thereby increase their productions which results in economic growth. On the other hand, under circumstances that a number of foreign banks exceed a critical value, domestic banks would face negative profits and are hence bailed out from the market. Even if the domestic banks can compensate their losses and remain in the market, economic growth is still deterred. In addition, foreign entry will increase deposits along with household welfare in terms of life-time consumption while net interest margin is also reduced.