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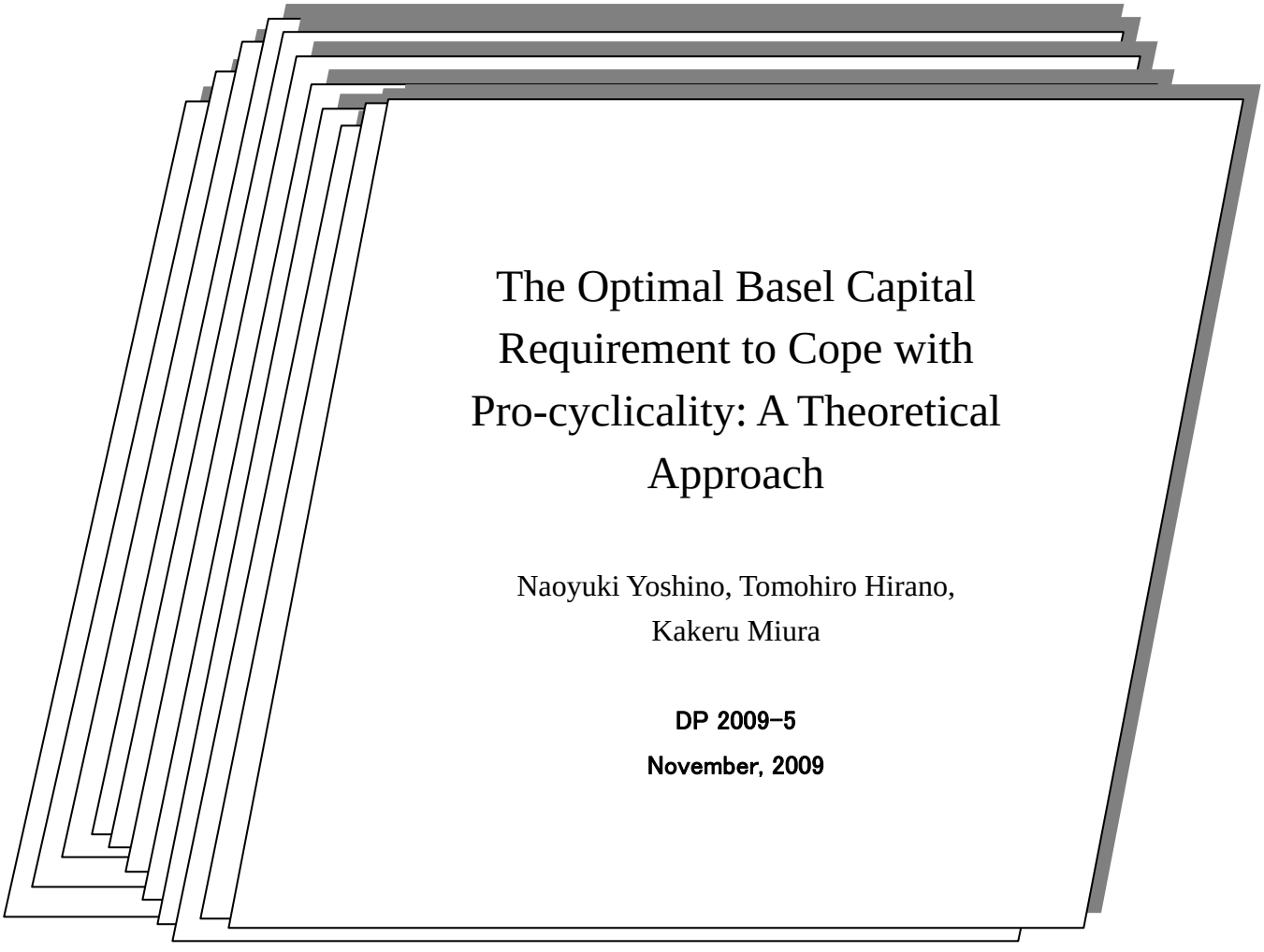

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The Optimal Basel Capital Requirement to Cope with Pro-cyclicality: A Theoretical Approach*

Naoyuki Yoshino†, Tomohiro Hirano‡, Kakeru Miura§

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Abstract

This paper focuses on the role of the Basel capital requirement and proposes a new counter cyclical measure by use of a simple general equilibrium model.

This paper will address the following issues.

(i) The Basel capital requirement ratio should depend on various economic factors such as GDP, stock prices, interest rates and land prices, based on a simple general equilibrium model in order to cope with pro-cyclicality. Otherwise expansion of bank loans will be enhanced during boom period and they will face with credit crunch in sluggish period. Previous papers do not show any specific model and conclude that the capital requirement ratio would be better if adjusted based on stock price or economic growth, etc..

(ii) The Basel minimum capital requirement rule should be different from country to country, since the economic structures and bank behaviors are different from each other.

(iii) The Basel capital requirement ratio should vary during the period of economic boom and during the period of economic downturn since the coefficient obtained from the theoretical model varies.

(iv) Cross-border bank operation should follow the minimum capital requirement ratio where bank lending activities are going on rather than the origin of the source of fund.

Empirical estimations are now underway. Some restricted cases of empirical results are reported in this paper.

Keywords : The Basel minimum capital requirement, Counter cyclicality of capital adequacy ratio, Optimal capital requirement

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Bank regulators have focused on the health of individual financial institutions. Macro stabilization policies were handled by the Central bank and fiscal authority instead of bank regulators. The central bank uses monetary policy for price stability and macro economic growth instead of focusing neither on financial institutions' stability nor asset price stability.

The Recent subprime loan crisis taught us various lessons. At first, when bank loans are securitized in the financial market, they could lead to macro instability in the financial system and damage the entire macro economy. Therefore bank examination and bank regulations are quite important to prevent the spread of financial instability throughout the entire system. Secondly, the question arises as to whether bank supervisors focus not only on bank regulations but also on macro prudence. Thirdly, the pro cyclicality of the Basel capital requirement is strongly recognized and caused Japan to suffer for so long after the burst of the bubble in 1991. When the economy is faced with downturn, banks tend to lend less since their capital declines. Credit crunch was one of the causes of the slow recovery of the Japanese economy in the 1990s. Fourth, by extensively utilizing credit guarantee, banks are encouraged not to reduce their loans to SMEs (small and medium sized enterprises) during economic recess. For Asian countries, SMEs form quite an important sector. They are mainly financed through the banking sector and are vulnerable to financial crises.

This paper focuses on the role of the Basel capital requirement and proposes a new counter cyclical measure by use of a simple general equilibrium model.

How should we make the Basel II counter-cyclical policy work better ?

Some propose to raise the level of minimum requirement from 8% to 10 % for example. Others propose to raise minimum capital requirements in good times and reduce them in times of recession, according to regulatory discretion. However, all the various economies do not move in a parallel manner. Some economies will be booming while others may be facing recession. Should the regulator raise the capital requirements for those banks situated in booming economies and reduce those for banks situated in slow growth countries?

There are different proposals to apply an adjustment factor to the Basel capital requirement ratio thereby eliminating discretion by regulators. The factor can be based on various macro indicators, such as GDP growth, credit growth, a real estate price index or credit default swap spreads. Alternatively, a composite index could also be constructed.

Ryozo Himino (2009) proposes a stock price index as an adjustment factor. The proposed is closely related to the thinking of market participants. Stock data are available in various countries and are based on an actively traded market which can be extensively used in most of the countries.

Banks generally do not need to raise capital during good times. On the other hand, they need to do so during economic downturns. However in recession, stock prices are low and raising capital requires enormous efforts. Therefore, a bank should raise capital in good times so as to prepare for bad times. However, the current capital adequacy standards do not encourage banks to employ foresight and raise capital during good times.

By reflecting the increased risk of lending in bad times, the Basel capital adequacy standards foster the decline of bank credit due to a lower capital level. Basel II employs statistical data; however, the data usually does not cover the entire credit cycle. Risk metrics based on statistical data covering only part of a credit cycle tend to underestimate the risk in good times and overestimate it in bad times, which makes it necessary to cover various business cycles.

Previous proposals for the Basel capital requirement are based on a partial equilibrium model rather than on a general equilibrium model of the entire economy analyzed in this paper. Most of the existing papers do not show any theoretical model.

The model explained in this paper addresses the optimal Basel capital requirement ratio not only at the binding point where the bank's capital hit its minimum capital requirement but also at the internal point where bank's capital is greater than minimum required capital level.

This paper will address the following issues.

(v) The Basel capital requirement ratio should depend on various economic factors such as GDP, stock prices, interest rates and land prices, based on a simple general equilibrium model. Previous papers do not show any specific model and conclude that the capital requirement ratio would be better if adjusted based on stock price or economic growth, etc.

(vi) The Basel minimum capital requirement rule should be different from country to country, since the economic structures are different from each other. A simple general equilibrium model suggests that the optimal minimum capital requirement ratio does depend on the structure of the economy and the behavior of the bank.

(vii) The Basel capital requirement ratio should vary during the period of economic boom and during the period of economic downturn since the coefficient obtained from the theoretical model varies.

Empirical estimations are now underway. Some restricted cases of empirical results are reported in this paper.

This paper is organized as follows. Section 1 presents a profit maximization behavior of banks. Section 2 presents a simple macroeconomic model which includes land prices, stock prices and GDP etc. Section 3 develops two cases of bank behavior based on the theoretical model. One is the corner solution, whereby a bank is faced with the binding condition for the Basel minimum capital requirement ratio. Namely, a bank faced with a capital/risk asset

ratio of 8%. The other case is that the Basel capital requirement ratio is not binding and a bank's capital is kept within the limit of the Basel capital requirement ratio. However, a bank has to pay higher interest rate to absorb fund from the market if its capital becomes closer to the binding minimum capital requirement ratio, since the market participants expect the bank will face difficulty if it hits with the binding condition for minimum capital requirement. The lending behavior of the bank will be restricted when its capital requirement ratio becomes 8 %. Section 4 concludes our main results.

1 Bank behavior

Each bank is assumed to maximize its profit as is shown in the following equation.

Each bank lends money to a risky sector and invests in risky securities. They are denoted by L. certain fraction of the risky loans and investments (denoted L) turn out to default and the default ratio is expected to be a ρ^e fraction of the total risky investment, as shown in Equation (1). The expected default ratio depends on macro economic variables such as land prices, stock prices, GDP and interest rates.

A bank also invests in safe assets, such as government bonds which are shown as B in equation (1).

A bank is funded by deposits and from short term money market, as denoted by (D), where interest rate (i_m) will rise according to its proximity to the Basel capital requirement of 8%.

A bank pays the costs for lending, asset management and fund raising activities through payment for employees and computers, etc. (C(….)).

$$\underset{L,B}{Max} \quad \pi^e = i_l \times L + i_B \times B - \rho^e(q_1, q_2, Y, i_B) \times \mathrm{L} - i_m \times D - C(L, B, q_1, q_2), \qquad (1)$$

where $i_m = i_m(\bar{L} - L)$. i_m is the market rate of interest when banks raise their borrowing from the money market. The market interest rate is assumed to depend on whether banks have enough capital or not. If the banks become closer to the corner solution, where their capital is very close to the Basel capital requirement, the interest rate (i_m) they pay to the market goes up, since the market becomes skeptical about those banks regarding their profitability.

π^e : Expected profit of Bank

i_l : interest rate on risky asset

L: Risky assets

i_B: interest rate on safe assets

B: safe assets (such as government bond)

ρ^e: ratio of the expected default loan losses
D: deposits and funds absorbed from the short term market by banks
i_m: the rate of interest charged to deposits or short term borrowing from the market
$C(L,B,q_1,q_2)$: various costs accrued to banks such as personal costs and equipment costs, which depend on the amount of risky bank loans, government bond investment, stock prices and land prices.
q_1: land price
q_2: stock price
Y: GDP
L^m: maximum amount of loans
θ: minimum required capital-asset ratio
$A(q_2)/K(F(\rho))$＝Ratio of capital/credit risk asset

Banks are maximizing their profits based on the following budget constraints, where K(.) denotes the default risk asset

$$L + B = D + A(q_2) \tag{2-1}$$

$$\frac{A(q_2)}{K\left\{F\left[\rho^e(q_1, q_2, Y, i_B)\right]\right\} \times \mathrm{L}} \geq \theta \tag{2-2}$$

$$\bar{L} \equiv \frac{A(q_2)}{\theta \times K\left\{F\left[\rho^e(q_1, q_2, Y, i_B)\right]\right\}}, \tag{2-3}$$

where $K = F(\rho^e)$, $F' > 0$

Equation (2-1) denotes the banks' balance sheet where banks make loans and invest in safe assets, by absorbing funds from deposits and the short term money market. $K(q_1, q_2, Y, i_B)$ in Equation (2-2) denotes the default risk asset
The bank capital is shown as $A(q_2)$ which is assumed to depend on stock price.

Equation (2-2) shows that banks must keep enough capital ($A(q_2)$) and their "capital/credit risk asset" must be greater than θ(Basel minimum capital requirement). Equation (2-3) shows the binding condition when the bank's capital hits the Basel capital requirement of say 8%.

When banks are bounded by the Basel capital requirement ratio, the banks' loans are set to equation (3), where banks cannot lend beyond the vertical bank supply curve in Figure 1.

$$L = \bar{L} = \frac{A(q_2)}{\theta \times K(q_1, q_2, Y, i_B)}.$$

=Capital/(Basel minimum capital requirement ratio) x (Risk Assets) (3)

Risk capital ratio K depends on macro economic factors, such as land prices, stock prices, GDP and the interest rate. When the land prices and stock prices are rising, banks are faced with a lower default risk ratio for loans. When the economy is booming and GDP (Y) is rising, banks will be faced with a lower default risk ratio. When the interest rate i_B is rising, banks tend to invest more in the safe asset, which reduces the default risk. Therefore the default risk ratio of K is denoted as K= K(q_1, q_2, Y, i_B).

2 Macroeconomic behavior of the economy

In a simple macroeconomic model, land price (q_1), stock price (q_2), bond rate (i_B) and GDP (Y) are determined by the following equations:

$$q_1 = f(Y, i_B, \alpha) \quad \text{Land price} \quad (4)$$

$$q_2 = g(Y, i_B, \beta) \quad \text{Stock price} \quad (5)$$

$$Y = \varphi(L, i_B, q_1, q_2, \delta) \quad \text{Output (GDP)} \quad (6)$$

$$i_B = h(q_1, q_2, Y, i_m, M, \gamma). \quad \text{Interest rate on bond} \quad (7)$$

These are the structural equations which will determine the four endogenous variables, namely, land price (q_1), stock price (q_2), GDP (Y) and bond interest rate (i_B).

Equation (4) is the determination of land price where land price fluctuates based on GDP (Y), stock price movement, the interest rate and the shock to the land market such as the subprime loan crisis. Similarly, the stock price moves according to land price, GDP (Y), the interest rate and the shock to the stock market. GDP (Y) and market interest rates are also determined by various economic conditions. α, β、γ、δ、are exogenous shock variables which affect each market. Different version of Japanese macroeconomic model can be seen in Yoshino and Mizoguchi (2010).

Suppose land price is affected by some shock (α). According to this land market shock,

stock price, interest rate on bond and GDP will change. What is the value for θ where banks aim to stabilize their bank loans in response to the land price shock (α)?

3 The optimal value for the Basel minimum capital requirement ratio by use of numerical example

This section presents how to obtain the optimal Basel capital requirement in order to stabilize bank loans. Two cases are analyzed. Section 3-1 is the binding case, where a bank is hit with the binding condition for Basel capital requirement. Section 3-2 is the internal solution, where banks are not faced with the binding case.

3-1 Binding case and its numerical example

What is the value for θ when banks aim to stabilize their bank loans in response to an economic shock, such as a sudden rise in land price (α)?

When banks are faced with the corner solution in Equation (3), the optimal value for θ (Basel capital requirement ratio) can be obtained by totally differentiating Equation (3) with respect to all the macro economic variables in the model as follows.

Changes in macroeconomic variables affect the risk asset ratio so that the Basel capital requirement ratio has to be adjusted so as to keep the level of bank lending constant.

Therefore θ should vary based on land price, stock price, GDP and the market interest rate since the default risk ratio is depending on all these macroeconomic factors.

$$d\theta = -\frac{\theta}{K}\times\frac{\partial K}{\partial q_1}dq_1^* + \left[\frac{1}{K\times\bar{L}}\frac{\partial A}{\partial q_2} - \frac{\theta}{K}\times\frac{\partial K}{\partial q_2}\right]dq_2^* - \frac{\theta}{K}\times\frac{\partial K}{\partial Y}dY^* - \frac{\theta}{K}\times\frac{\partial K}{\partial i_B}di_B^*. \quad (8)$$

$$\mathbf{-1.447524 = -0.0533}\, dq_1^* + \mathbf{\{0.5162 - 0.00172\}}dq_2^* \quad \mathbf{-0.041427}dY^* \quad \mathbf{-0.01910}di_B^*$$

A numerical example based on Japanese preliminary quarterly data (1985Q1-2008Q4) is as follows: The value θ can be computed by estimating the equation for the default risk ratio. The first term in Equation (8) is the magnitude of adjustment for the minimum capital requirement ratio when the land price rises (namely -0.0533), the second term is the impact from the stock price fluctuations (0.5162-0.00172), the third term is the impact from GDP (Y) (-0.041427) and the last term is the impact from the market interest rate. The second term, which is the impact of stock prices on the minimum capital requirement ratio in Equation (8), is divided into two parts, i.e. its impact on capital (A) (0.5162) and its impact on risk ratio (K) (-0.00172).

The preliminary estimates show that the biggest impact comes from the impact from the stock price on banks' capital (A), which is 0.5162.

To what extent should the minimum capital requirement be adjusted in total?

If we take the fourth quarter of 2007 as an example, the Basel minimum capital requirement ratio should be lowered 1.447524% to ensure that bank lending does not contract.

Changes in land price, stock price, GDP and interest rate will all affect the expected default risk of banks and the banking behavior. Thus the minimum capital requirement has to be adjusted in order to stabilize bank loans.

Of course the impact of various shocks will differ according to which market created the initial shock in the economy. Sometimes the shock arises from the property market (α), as the case of the recent subprime loan problem. Then it can be computed as is in Equation (9):

$$\frac{d\theta}{d\alpha} = -\frac{\theta}{K}\times\frac{\partial K}{\partial q_1}\frac{dq_1^*}{d\alpha} + \left[\frac{1}{K\times L}\frac{\partial A}{\partial q_2} - \frac{\theta}{K}\times\frac{\partial K}{\partial q_2}\right]\frac{dq_2^*}{d\alpha} - \frac{\theta}{K}\times\frac{\partial K}{\partial Y}\frac{dY^*}{d\alpha} - \frac{\theta}{K}\times\frac{\partial K}{\partial i_B}\frac{di_B^*}{d\alpha}. \tag{9}$$

A similar calculation can be obtained when the shock comes from a different market, such as the stock market (β) in equation (5), by replacing α into β in Equation (9).

3-2 The case where the amount of loans is determined by the internal solution.

The amount of bank loans supplied is obtained from the profit maximization behavior of banks (Equation (1)).

The bank loan supply becomes as follows:

$$i_l = \rho^e(q_1, q_2, Y, i_B) + i_m(\bar{L} - L) - i_m'(\bar{L} - L)\times D + \frac{\partial C}{\partial L}(L, B, q_1, q_2). \tag{10}$$

The bank loan supply is determined such that the banks' marginal rate of return for additional loan supply becomes equal to the marginal costs associated with the additional increase in bank lending, which is Equation (10).

The demand for government bonds (safe asset) is obtained from the profit maximization by banks as follows:

$$i_B = i_m(\bar{L} - L) + \frac{\partial C}{\partial B}(L, B, q_1, q_2). \tag{11}$$

Equation (11) also shows that the marginal rate of return from an additional increase of safe assets by banks become equal to the additional costs of banks. Equation (7) is obtained from the banks' demand for government bonds and other demand for government bonds together with the supply of government bonds. A detailed analysis can be seen in Yoshino and Mizoguchi (2010).

The demand for loans by firms is simply assumed to be dependent on the loan interest

rate, for simplicity. A more complicated case can be seen in Revankar and Yoshino (2008). In this paper, we assume

$$i_l = a_0 - a_1 \times L. \tag{12}$$

The loan market equilibrium can be obtained by the intercept of loan supply and the demand for bank loans. Namely, equations (10) and (12) determine the equilibrium for the loan market where q_1, q_2, Y, i_B are exogenously given. A more rigorous analysis of bank behavior which captures both the micro behavior of banks and its relation to macro demand for loans can be seen in Revankar and Yoshino (2008).

$$a_0 - a_1 \times L = \rho^e(q_1, q_2, Y, i_B) + i_m(\bar{L} - L) - i'_m(\bar{L} - L) \times [L + B(i_B) - A(q_2)] + \frac{\partial C}{\partial L}[L, B(i_B), q_1, q_2]. \tag{13}$$

When banks would like to stabilize their bank loans in response to various economic shocks, the Basel capital requirement ratio should be adjusted according to the impact on land price, stock price, GDP and the market interest rate as follows. This equation looks much more complicated than the case when the minimum capital requirement is binding. However, the story is very similar. (i) The land price shock will affect the bank loan behavior and the expected default risk ratio is also affected. Banks' costs will also change due to their changes in credit analysis etc. In order to keep the bank loans stabilized, the Basel capital requirement has to be adjusted to cope with the macroeconomic shock that comes from the land price. Figure 3 indicates how the bank loans would change in case of economic shock (for example a rise in land price). Banks expand their loans when they are faced with rising land price since the collateral value rises. The supply of bank loans shifts to the right and the total amount of bank loans increases. If bank regulators would like to reduce their loans in order to cope with a future increase of risky assets held in banks, the Basel minimum capital has to be adjusted so as to reduce banks' aggressive lending behavior. The amount of θ, which is the Basel capital ratio is theoretically obtained in Equation (14) in the Appendix.

During the period of economic recess, the demand for bank loans will also decline which can be shown as a decline in a_0 in equation (13) which can be shown as a shift of demand curve to the left. In order to keep the bank loans unchanged, the minimum capital requirement ratio θ has to be lowered much further to cope with sluggish demand for loans.

4 Case of Cross-border Banks

Figure 4 presets the case where a bank is operating its business in two countries (namely country A and country B). Let assume that the country A is in boom and the country B is in recession. Base on Section 3, Basel minimum capital requirement ratio in county A (say A%) should be set higher than that of country B (say B%) in order to keep bank loans in a stable manner.

A % > B %

A bank prefers to set up its main office in the country B since its minimum capital requirement ratio is smaller than the country A. As is shown in Figure 4, a bank sets up its main headquarter in country B and expand its bank lending lend from country B to country A.

In this case, this bank should apply its minimum capital requirement ratio based on the country A's minimum standard rather than the one in originating country (B). Its bank lending in country B denoted by arrow 2 should follow minimum capital requirement ratio of country B. If the lending in Country A comes from Country B denoted by arrow 3 in figure 5, it should follow the minimum capital requirement ratio in Country A even though the original fund comes from Country B. If the bank lending originated from Country B would follow the minimum capital requirement ratio of Country B. the lending in country A would have expanded much more than desired and would have caused bubble in Country A.

Regulator has to monitor a bank's lending behavior carefully monitoring where the origin of the fund is. Easier way to monitor will to force banks to separate its bank account into two based on the origin of the source. One account whose the origin of fund is its own country denoted by arrow 1 in Figure 3 and another account is the fund comes from country B denoted by arrow 3. Both funds which are lending in country A should be applied the minimum capital adequacy ratio of country A.

Figure 4 Two country model (Cross-Border)

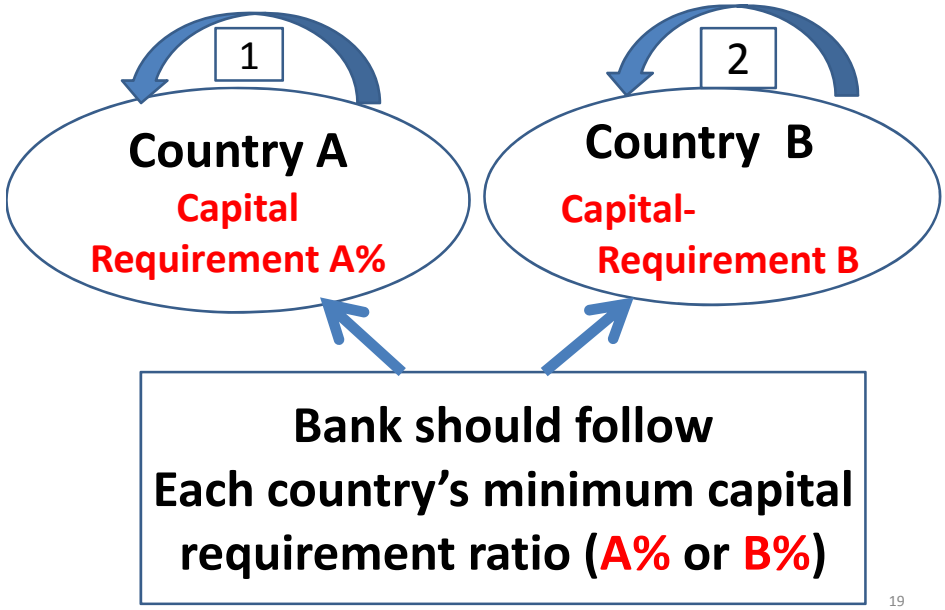
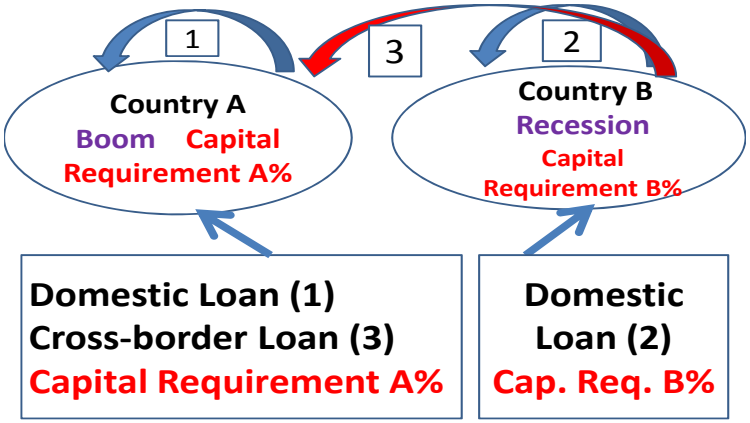


Figure 5 Two country model (Cross-Border)



Conclusion

This paper presented the adjustment of the Basel capital requirement ratio in response to economic shocks, when banks would like to keep their bank loans in stable manner.

The optimal Basel capital requirement ratio depends (i) how banks behave (profit maximization or share maximization etc.) (ii) How macro economic factors, such as land price, stock price, GDP and the market interest rate, react to each other and how they are influenced by economic shocks.

This paper concludes that the optimal Basel capital requirement should depend on the banking behavior, macroeconomic structure in each country, and the impact of economic shocks on each economy.

Since economic structure and banking behavior are different from country and country, this paper obtained the optimal value for the Basel capital requirement by use of a simple general equilibrium model for the banking sector. It concludes that the optimal minimum capital requirement should depend on various economic variables, such as land price, stock price, GDP and the market interest rate. A numerical example was provided and shows how to adjust the Basel capital requirement in order to keep the lending unchanged in times of economic shock.

Cross-border bank operation should follow the minimum capital requirement ratio where bank lending activities are going on rather than the origin of source of fund.

This model is a very simple version, but other cases are being considered and the econometric models are also under estimation.

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Appendix 1 : Assumptions for banks' cost function

Banks' cost function is assumed to follow the following conditions in order to satisfy the stability condition.

$$\text{Assumptions} \quad \begin{cases} \dfrac{\partial C}{\partial L} > 0, \dfrac{\partial^2 C}{\partial L^2} > 0, \dfrac{\partial C}{\partial B} > 0, \dfrac{\partial^2 C}{\partial B^2} > 0 \\ \dfrac{\partial^2 C}{\partial L \partial B} > 0, \dfrac{\partial^2 C}{\partial L \partial q_1} < 0, \dfrac{\partial^2 C}{\partial L \partial q_2} < 0 \\ i'_m < 0, i''_m > 0, i'_m(0) < \infty \end{cases} \tag{3}$$

Appendix 2, The optimal Basel capital minimum requirement ratio in the case of internal solution

$$\frac{d\theta}{dx} = \left[\frac{\dfrac{\theta}{\bar{L}} \dfrac{\partial \rho^e}{\partial q_1} + (-i'_m + i''_m D) \dfrac{\theta}{\mathrm{K}} \dfrac{\partial \mathrm{K}}{\partial \mathrm{q_1}} + \dfrac{\theta}{\bar{L}} \dfrac{\partial^2 C}{\partial L \partial q_1}}{-i''_m D + i'_m} \right] \frac{\mathrm{dq_1^*}}{\mathrm{dx}}$$

$$+ \left[\frac{\dfrac{\theta}{\bar{L}} \dfrac{\partial \rho^e}{\partial q_2} + (i'_m - i''_m D)\left(\dfrac{1}{\mathrm{K} \times \bar{\mathrm{L}}} \dfrac{\partial \mathrm{A}}{\partial \mathrm{q_2}} - \dfrac{\theta}{\mathrm{K}} \dfrac{\partial \mathrm{K}}{\partial \mathrm{q_2}}\right) + i'_m \dfrac{\theta}{\bar{L}} \dfrac{\partial A}{\partial q_2} + \dfrac{\theta}{\bar{L}} \dfrac{\partial^2 C}{\partial L \partial q_2}}{-i''_m D + i'_m} \right] \frac{\mathrm{dq_2^*}}{\mathrm{dx}}$$

$$+ \left[\frac{\dfrac{\theta}{\bar{L}} \dfrac{\partial \rho^e}{\partial Y} + (-i'_m + i''_m D) \dfrac{\theta}{\mathrm{K}} \dfrac{\partial \mathrm{K}}{\partial \mathrm{Y}}}{-i''_m D + i'_m} \right] \frac{\mathrm{dY^*}}{\mathrm{dx}}$$

$$+ \left[\frac{\dfrac{\theta}{\bar{L}} \dfrac{\partial \rho^e}{\partial i_B} + (-i'_m + i''_m D) \dfrac{\theta}{\mathrm{K}} \dfrac{\partial \mathrm{K}}{\partial \mathrm{i_B}} + (-i'_m + \dfrac{\partial^2 C}{\partial B \partial L}) \dfrac{\theta}{\bar{L}} \dfrac{\partial B}{\partial i_B}}{-i''_m D + i'_m} \right] \frac{\mathrm{di_B^*}}{\mathrm{dx}}. \tag{14}$$

The first term in Equation (14) shows the economic shock to the land price, the second

term denotes the impact of the shock to the stock price, the third term is the shock to GDP and the fourth term is the shock to the market interest rate. Block variables in Equation (14) are identical with Equation (9), where the optimal Basel minimum requirement in binding case is stated since the binding case (9) is a special case of the internal solution to Equation (14). Case of Equation (9) is shown in block letter in Equation (14) which proves the corner solution is a special case of general case.

Figure 1, Loan market when the Basel minimum capital ratio hits bank's lending behavior (i.e. case of the corner solution)

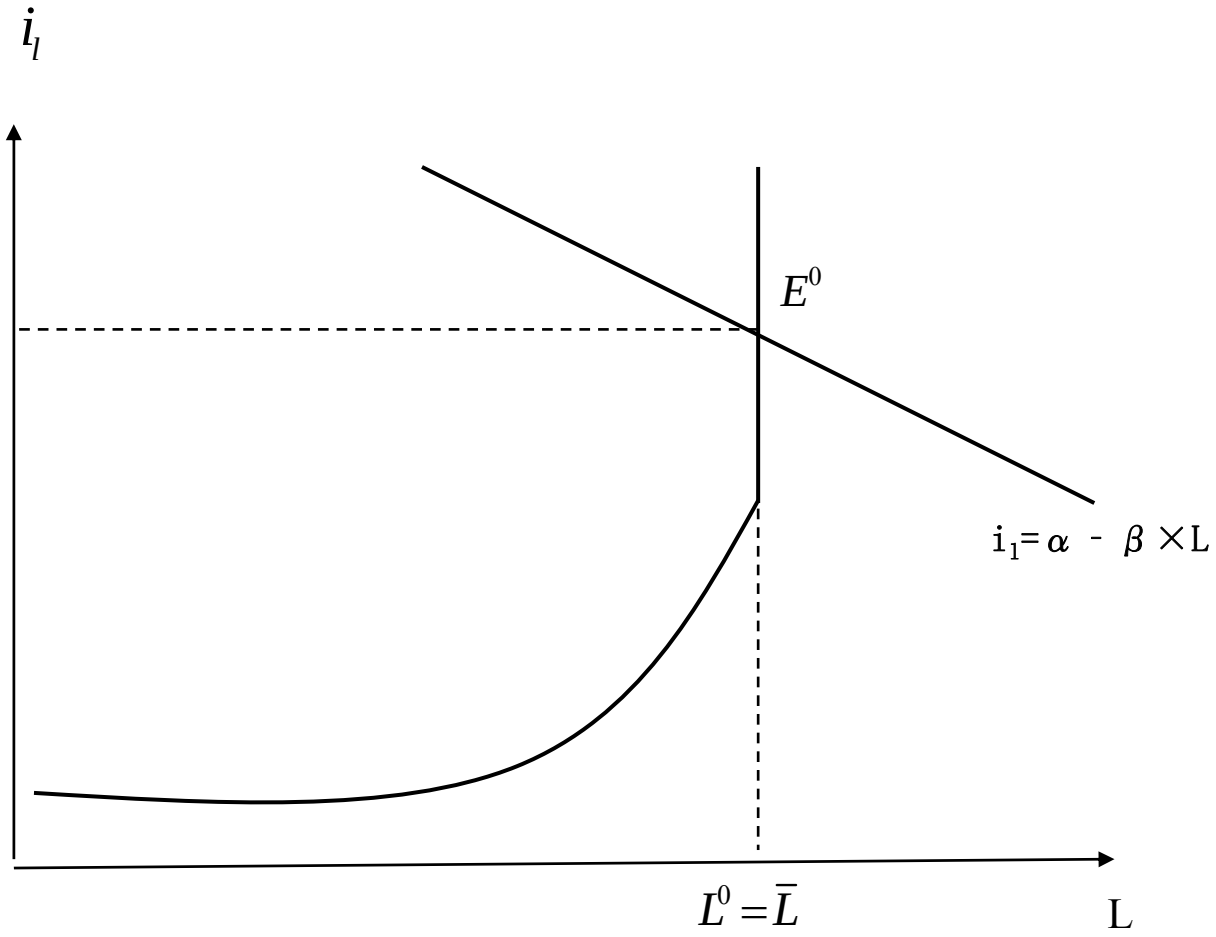


Figure 1 shows the binding case where banks' capital is faced with Basel minimum capital requirement ratio.

The vertical axis is the lending rate of interest by a bank and the horizontal axis is the amount of loans, which represents the risk asset. L^0=L denotes that the Basel capital requirement is binding, so that banks cannot lend beyond L. Bank loans are upward sloping: however they become vertical when they hit the Basel capital requirement point. The downward curve is the demand for loans by firms and it crosses at the vertical supply curve where the minimum capital requirement is binding. .

Figure 2

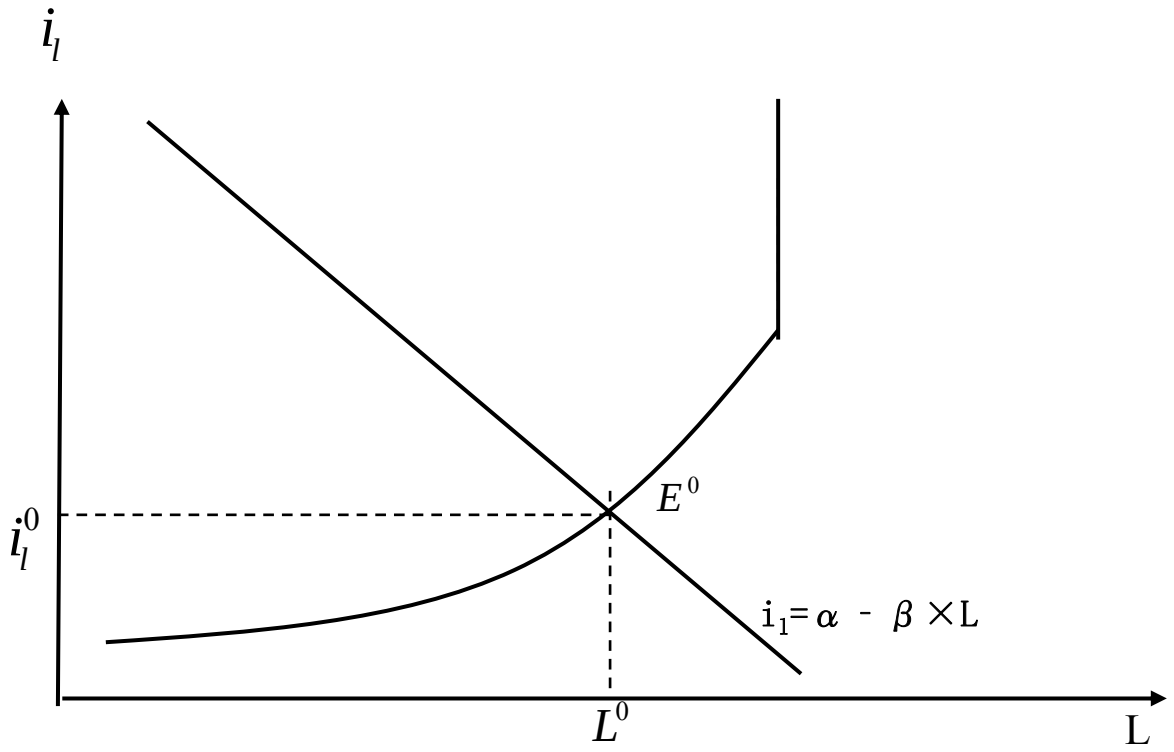
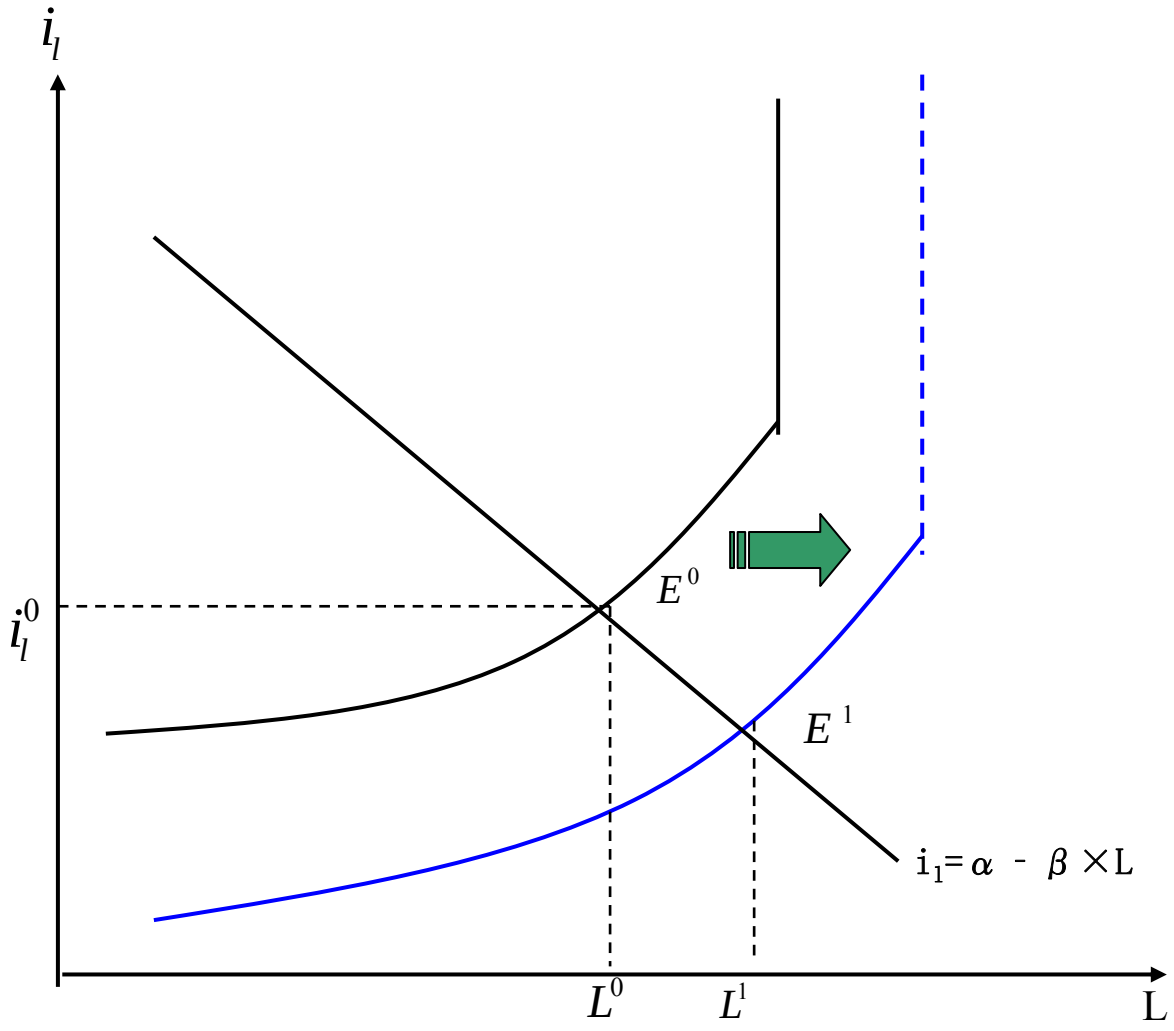


Figure 2 is the case where bank loans are determined at the intercept of supply of loans by banks and the demand for loans from firms. In this case, the Basel minimum capital requirement ratio is not binding.

Figure 3 The impact of land price hikes to the loan market



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