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Transmission of Shocks Through International Lending of Commercial Banks to LDCs

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by

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Abstract

We analyze the transmission of shocks through international bank lending, as is suggested in Kaminsky and Reinhart [6], by examining the bank's international lending behavior. We develop a portfolio selection model, which explicitly includes the economic condition of the bank's home county. This model is estimated using data from the banks of the six largest international creditor countries over the 1989-99 period. Our results clarify the interrelationship between the condition of banks' home country and international bank lending. This finding demonstrates two types of transmission of shocks through international bank lending: [i] transmission from a creditor country to debtor countries and [ii] transmission from a debtor country to other debtor countries via a creditor.

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1 INTRODUCTION

The International Lending of Commercial Banks

This study focuses on financial links across countries through the international lending of commercial banks to less developed countries (LDCs), and on the transmission of shocks through these links.

The international lending of commercial banks is an important source of capital inflow to LDCs. According to Global Development Finance (World Bank, 2001), during the period 1995 to 2000, about 20% of total long-term debt of LDCs came from commercial banks. The amount of bank loans surpassed those of bonds and other private loans during this period. Moreover, the total debt stock of LDCs was US$ 2,338 billion in 1997 (World Bank) and total commercial bank loans to LDCs reached US$ 987 billion in the same year (Bank for international Settlements, BIS). Although these figures cannot be compared directly because the data sources are not exactly the same, it gives an indication of how large the share of bank loans in the capital flows to LDCs was.

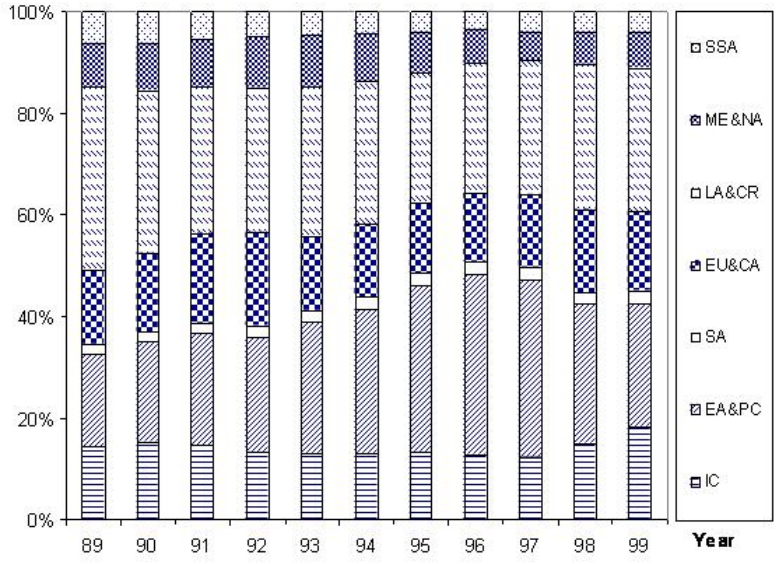
There are some distinct patterns in bank lending to LDCs. First, a large part of the total international claims of all reporting banks was distributed to East Asia and Latin America [1] while claims on East Asia decreased continuously after the Thai crisis in June 1997. Figure 1 shows the regional distribution of total international claims of all reporting banks from 1989 to 1999.

Second, more than 75% of total international claims came from the largest six creditor countries during 1989 - 99; France, Germany, Japan, the Netherlands, the UK, and the U.S. Table 1 shows the share of major creditor country's banks in total international claims on all regions from 1989 to 1999.

Third, the pattern of banks' international lending seems different by nationality during 1989-99. German banks steadily increased their total international claims during this period. The total claims of Japanese banks increased the least in percentage terms among these bank groups and decreased rapidly after 1997. The patterns of the total international claims of French, Dutch, the UK and the US banks were relatively similar to each other, increasing steadily until 1997 or

[1] We did not include offshore centers: Aruba, Bahamas, Bahrain, Barbados, Bermuda, Cayman Islands, Gibraltar, Guernsey, Hong Kong, Isle of Man, Jersey, Lebanon, Macau SAR, Mauritius, Netherlands Antilles, Panama, Singapore, Vanuatu, and West Indies UK. This is because legal aspects have a large influence on bank lending in these centers and we do not examine the aspects in this study.

Figure 1: Regional Distribution of International Lending of Commercial Banks



Source:BIS International Banking Statistics
Note: IC: Industrialized Countries, EA&PC: East Asia & Pacific, SA: South Asia
EU&CA: Europe & Central Asia, LA&CR: Latin America & Caribbean
ME&NA: Middle East & North Africa, SSA: Sub-Saharan Africa

1998 and then remaining at a more or less constant level. In addition, banks from each country distributed their claims across regions in different ways. For example, Japanese bank exposure is concentrated in EA&PC, while that of the U.S. banks is concentrated in LA&CR. German banks emphasize EU&CA much more than do other banks. This study emphasizes the third characteristic in international bank lending as a possible cause of common creditor effects [2]. That is, one basis for regional spread of financial difficulties is the transmission of problems via creditors who have concentrated loan exposure in that area.

Previous Studies

There are three channels of transmission of shocks through international lending. One is transmission from a debtor to a creditor. For example, in Mexican crisis of 1982, contagion effects on US banks from debtor countries via LDC debt were observed (Kyle and Sachs [9], Kyle and Wirick [10],

[2]See next subsection.

Table 1: Share of Major Creditor Country's Banks (%)

Nationality	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Austria	2.46	2.29	2.17	2.10	2.00	1.88	2.00	2.09	2.09	2.35	2.02
Belgium	2.06	2.07	1.99	1.92	2.31	2.30	2.50	2.70	2.47	2.05	5.70
Canada	2.63	2.29	2.11	2.00	1.98	1.82	1.91	2.12	2.58	2.83	2.64
Denmark	0.34	0.58	0.45	0.52	0.42	0.40	0.35	0.48	0.53	0.65	1.07
Finland	0.53	0.64	0.57	0.37	0.43	0.39	0.31	0.29	0.24	0.25	0.55
France	11.04	11.19	10.78	10.57	9.61	9.71	10.33	11.03	11.31	11.56	12.94
Germany	11.12	13.94	15.67	16.33	16.47	17.31	19.17	20.74	20.67	23.30	25.91
Ireland	0.11	0.10	0.08	0.05	0.05	0.06	0.07	0.08	0.12	0.15	0.64
Italy	3.41	3.95	4.68	5.21	4.65	4.32	3.89	3.87	3.61	3.53	4.31
Japan	40.63	39.89	39.46	38.82	37.11	36.96	35.06	28.38	26.05	20.10	15.65
Netherlands	2.36	2.73	2.79	2.98	2.98	3.20	3.39	4.21	4.58	6.19	7.69
Spain	1.26	1.39	1.65	1.86	2.22	2.22	2.25	2.66	3.54	4.38	3.06
Sweden	0.81	0.86	0.90	0.98	0.74	0.67	0.63	0.76	0.64	0.78	1.32
the UK	8.11	7.20	6.44	6.17	8.63	8.46	8.40	9.25	10.54	11.22	8.75
the U.S.	13.12	10.87	10.25	10.02	10.39	10.31	9.73	11.34	11.03	10.68	7.74

Source: BIS International Banking Statistics

and Sachs and Huizinga [16]). Another channel is from a creditor to a debtor since changes in a creditor's lending behavior may affect debtors. Kaminsky and Reinhart [6] suggested that common creditors (banks) might be an important factor in transmitting crises across debtor countries in the same region (common creditor effect). They showed that the debtor countries in the Japanese bank cluster (in the US bank cluster) were damaged by the Thai crisis (the Mexican crisis) more than other countries in other bank clusters in Asia (in South America) [3]. The third channel is from a debtor to another debtor. Kaminsky and Reinhart [7] [4] suggested three possible ways that debtor countries can be affected by the transmission of shocks;[i] transmission from a creditor country to debtor countries, [ii] transmission from a debtor country to other debtor countries via a creditor country, and [iii] direct transmission from a debtor country to another debtor country. Our empirical results demonstrate the possibility of the transmission of types [i] and [ii] above.

To justify the transmission of shocks through international bank lending, this study examines the determinants of international bank lending. There are three perspectives in the studies on banks' international lending behavior. The first emphasizes the condition of debtor countries, arguing that

[3]This argument implies that there is the variation in the international lending behavior among creditors by nationality. In fact, commercial banks' lending behavior was very different by nationality.

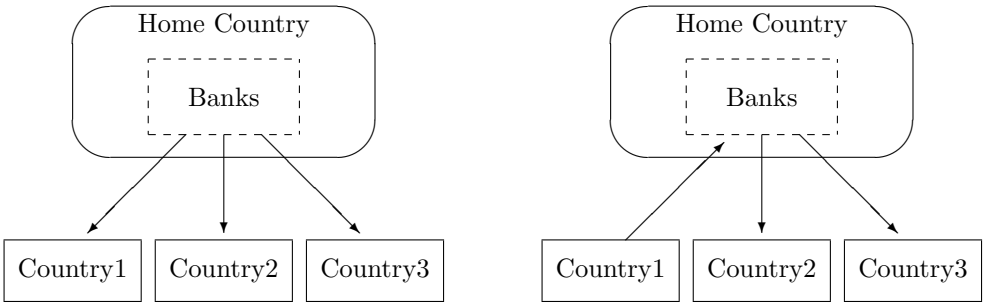
[4]Kaminsky and Reinhart use financial center for a creditor country and periphery countries for debtor countries.

international bank lending depends on the ability of debtor countries; such as, degree of financial stability (Terrell [18]), and repayment history (Ozler [12]). The second perspective emphasizes bilateral conditions. Using a gravity model framework, Portes and Rey [14] and Kawai and Liu [8] showed the importance of bilateral conditions. Portes and Rey [14] concluded that geography of information is the main determinant of cross-border equity flows between 14 OECD countries. Kawai and Liu [8] showed the importance of bilateral trade flows and bilateral ODA and FDI stocks for commercial bank's international loans to LDCs. Another possible perspective is that emphasizing the condition of creditor countries, though this has been much less emphasized in the literature.

This study focuses more on the condition of creditor countries than do previous studies. The condition of creditor countries seems an important determinant for the variation in bank's international lending behavior by nationality, given the widely different economic conditions in major creditor countries. The determinants of the variation will be crucial in examining banks' international lending behavior.

We investigate the determinants of international bank lending and then interprets the results in the context of the transmission of shocks across countries. This approach allows the demonstration of two types of transmission of shocks: [i] transmission from a creditor country to debtor countries and [ii] transmission from a debtor country to other debtor countries via a creditor (banks).

Figure 2: Transmission of Shocks through International Bank Lending



[i] Transmission from a creditor country to debtor countries

[ii] Transmission from a debtor country to other debtor countries via a creditor (banks)

Paper Organization

Section 2 develops a portfolio selection model for the international lending behavior of commercial banks. Section 3 derives a simultaneous equation system from the model and introduces a method to estimate the system. Section 4 applies the estimation method and presents empirical results. These results clarify the interrelationship between important determinants of international bank lending and demonstrate two types of transmission of shocks. Section 5 presents conclusions.

2 MODEL

To model the international lending behavior of commercial banks, this study employs a portfolio selection model that uses risk and return as criteria. Parkin [13] and Pyle [15] introduced the most basic style of this model, and Santomero [17] introduced and reexamined this model as an approach to asset selection. Molyneux and Remolona [11] applied this approach to the lending behavior of foreign banks in the US.

The main difference between our model and those in the previous studies is the form of the profit function. In the previous studies, the profit function consists of the income from assets and the cost of deposits. Although the basic concept is the same, this study explicitly divides the profit function into two parts: a domestic part and an international part. Because this study focuses on how commercial banks made the choice between international and domestic assets, the difference between international and domestic lending is significant. Furthermore, this modification makes it possible to explicitly include the conditions of banks' home country economy in the model.

We start with a utility function with constant absolute risk aversion [5],which is a function of profits,

$$U(\Pi_{t+1}) = -\exp(-R * \Pi_{t+1}) \tag{1}$$

where Π_{t+1} is profit at period t+1 and R is a coefficient of absolute risk aversion.

[5]This utility function has constant risk aversion, $r_A = \frac{U_t^{"}}{U_t^{'}} = R$, and increasing relative risk aversion, $r_R = \frac{U_t^{"}}{U_t^{'}} * \Pi_{t+1} = R * \Pi_{t+1}$

We assume that banks maximize their expected utility function,

$$V_{t+1} = E[U_t] = E[\Pi_{t+1}] - \frac{R}{2} * Var[\Pi_{t+1}] \tag{2}$$

where $E[\Pi_{t+1}]$ and $Var[\Pi_{t+1}]$ are the expectation and the variance of profits at period t+1, respectively.

The profit function for banks is

$$\Pi_{t+1} = Pr_{t+1} * L_t + \beta * HC_{t+1} \tag{3}$$

where $Pr_{t+1} = pr(X_{BT,t}, X_{DT,t}, W_{BT,t}, W_{DT,t}, L_t, HC_{t+1}) + \mu,$ (4)

$$HC_{t+1} = hc(X_{CR,t}, W_{CR,t}, L_t, Pr_{t+1}) + \epsilon, \tag{5}$$

X_t : a vector of known variables at period t that predict the return at period t+1,

W_t : a vector of known variables at period t that predict the cost at period t+1,

Z_t : a vector of known variables at period t that predict the risk at period t+1,

(the subscripts BT, DT, and CR indicate that the variables are classified as bilateral, debtor, and creditor conditions, respectively.)

and μ , ϵ : error terms with zero means.

This profit function consists of two parts: an international part and a domestic part. The former part of this function represents the profit from international lending and the latter part represents the profit from bank activity in the home country. For simplification, we assume that international loans are the only international activity of banks. Pr_t is the profitability of international loans in period t. L_t is the level of banks' international loans in period t. β is the effect of home country's economy on the bank's total profit [6] and is constant. HC_t represents the economic condition of the bank's home country in period t, which is closely related to the profitability of bank activities in the home county. Pr and HC are assumed to be stochastic (equations (4) and (5)). This is because these factors are uncertain for banks and are beyond their control (the profitability of international loans and the economic condition of home country). All they can control is the level of their international

[6] This β can be interpreted as a bank's beta.

loans.

From equation (3), the expectation and variance of profits are

$$E[\Pi_{t+1}] = pr_t * L_t + hc_t * \beta \tag{6}$$

$$Var[\Pi_{t+1}] = \sigma^2_{Pr,t} * L_t^2 + \sigma^2_{HC,t} * \beta^2 + 2 * L_t * \beta * Cov[Pr, HC] \tag{7}$$

where $E[Pr_{t+1}|X_{DT,BT,t}, W_{DT,BT,t}, L_t, HC_{t+1}] = pr_{t+1}$, (8)

$E[HC_{t+1}|X_{CR,t}, W_{CR,t}, L_t, Pr_{t+1}] = hc_{t+1}$, (9)

σ^2_{Pr} and σ^2_{HC} are variances of Pr and HC respectively and are constant,

while Cov[Pr,HC] is the covariance of Pr and HC and is also constant.

Substituting equations (6) and (7) into equation (2),

$$V = pr * L + hc * \beta - \frac{R}{2} * (\sigma^2_{Pr} * L^2 + \sigma^2_{HC} * \beta^2 + 2 * L * \beta * Cov[Pr, HC]) \tag{10}$$

From the first order condition for the optimization of expected profits (V) with respect to L, the optimal level of international loans must satisfy

$$L^* = \frac{pr}{R * \sigma^2_{Pr}} + C \tag{11}$$

where L^* is the optimal level of L,

and $C = \frac{\beta}{\sigma^2_{Pr}} * Cov[Pr, HC]$ [Constant]

Since equation (10) is concave in L, the first order condition is necessary and sufficient for the optimization. In equation (11), pr is the only variable that varies across time. Thus, the level of L^* depends on pr. For convenience, we focus on the first term in equation (11) because the second term is constant and does not involve the changes in L^*.

3 ESTIMATION METHOD

We derive a simultaneous equation system (SES) from our model to investigate important determinants for international bank lending during the period 1989-99. We choose the SES method because our main interest is the relationship between the economic condition of banks' home country and international lending via the profitability of international loans.

Simultaneous Equation System

We assume log linearity. Then, equation (6), (8), (9), and (11) can be expressed as

$$E[\Pi] = a_0 + a_1 * pr + a_2 * hc + a_3 * L + \varepsilon_1 \tag{12}$$

$$\begin{aligned} pr &= b_0 + b_1 * E[\Pi] + b_2 * hc + b_3 * L + b_4 * fGdp + b_5 * fExc + b_6 * exDebt\_gdp \\ &\quad + b_7 * exDebt\_exp + b_8 * debtServRatio + b_9 * intServRatio + b_{10} * res\_exDebt \\ &\quad + b_{11} * diffInt + \varepsilon_2 \end{aligned} \tag{13}$$

$$\begin{aligned} hc &= c_0 + c_1 * E[\Pi] + c_2 * pr + c_3 * L + c_4 * hGdp + c_5 * hExc + c_6 * laRatio \\ &\quad + c_7 * tCost + \varepsilon_3 \end{aligned} \tag{14}$$

$$\begin{aligned} L &= d_0 + d_1 * pr + d_2 * hExc + d_3 laRatio + d_4 * fExc + d_5 * exDebt\_gdp \\ &\quad + d_6 * exDebt\_exp + d_7 * debtServRatio + d_8 * intServRatio \\ &\quad + d_9 * res\_exDebt + +d_{10} * diffInt + \varepsilon_4 \end{aligned} \tag{15}$$

where $a_0 - a_3$, $b_0 - b_{11}$, $c_0 - c_7$, and $d_0 - d_{10}$ are coefficients,

$\varepsilon_1 - \varepsilon_4$ are error terms,

and all variables are in logarithmic forms,

From (6), the equation for $E[\Pi]$ consists of pr, hc, and L (equation (12)). From (8), the equation for pr consists of the variables classified as debtor and bilateral conditions that relate to return and cost (equation (13)). From (9), the equation for hc consists of the variables classified as creditor conditions that relate to return and cost (equation (14)). From (11), the equation for L consists of pr and the variables that relate to risk (equation (15)).

The variables $E[\Pi]$, pr, hc, and L are assumed to be endogenous. The other variables are assumed to be exogenous. All variables are expressed in logarithmic forms. Table 3 lists the definition and data sources of all variables.

The above simultaneous equation system (SES) represents the following cycle,

$$\cdots \rightarrow \ [(pr,\ hc) \rightarrow E[\Pi]] \ \rightarrow \ L \ \rightarrow \ [(pr,\ hc) \rightarrow E[\Pi]] \ \rightarrow \ L \cdots$$

In this cycle, banks form an expectation of the profitability of international loans and the economic condition of their home country in the same stage. Then, they form an expectation of the total profit. Following the expectations, they decide the quantity of international loans they will supply. The change in their international loans affects the expectation of next period profits. Banks repeat this cycle sequentially. Although it is not obvious how long a cycle takes, we can reasonably assume that banks repeat this cycle several times during a year. Thus, annual data used in this study represent only the end outcome of numerous cycles. Therefore, this study assumes that the above four endogenous variables are determined simultaneously and employs a simultaneous equation system approach [7].

The order and rank conditions are satisfied in all equations. Thus, the above simultaneous equation system can be identified.

Estimation Issues

There exist no data that directly represent the profitability of international loans (Pr) [8]. Thus, the expectation, variance, and covariance of Pr (pr, σ^2_{Pr}, and Cov[Pr,HC]) cannot be calculated. This study derives these values from observed variables using the model in section 2.

First, express pr and σ^2_{Pr} by observed variables solving equations (6) and (7) in terms of pr and

[7] There still remain some questions, such as, which variable is determined first. However, we do not discuss this type of questions further because it is not the point of this paper.

[8] Profitability of international loans is not simply an interest rate. We also need to think about cost, which includes every kinds of cost such as opportunity cost. Moreover, we need an overall profitability of international loans on several debtor countries.

Table 2: List of Variables

Category		Variables	Definition	Data Source
Dependent		$E[\Pi]$	Expectation of banks' total profit, which is calculated from profits before tax of commercial banks.	OECD
		pr	Profitability of international loans.	Estimated
		hc	Banks' home country's economy. Price indexes of a stock market in their home country.	Data Stream
		L	Banks' international loans. Cross-border international claims	BIS
Independent				
Creditor Conditions	X	hGdp	GDP of banks' home country.	IMF
	Z	hExc	Average exchange rate of banks' home country.	IMF
	W,Z	laRatio	Loans to assets ratio for banks.	BIS
	W	tCost	Total cost ratio of commercial banks, [total cost]=[interest cost]+[non-interest cost].	OECD
Debtor Conditions	X	fGdp	GDP of debtor countries.	IMF
	Z,W	fExc	Average exchange rate of debtor countries.	IMF
	Z	exDebt_gdp	Total external debt to GDP ratio.	World Bank
	Z	exDebt_exp	Total external debt to export of goods and services ratio.	World Bank
	Z,W	debtServRatio	Debt service ratio, which is total debt service to export of goods and services ratio.	World Bank
	X,Z	intServRatio	Interest service ratio, which is total interest payment to export of goods and services ratio.	World Bank
	Z	res_exDebt	International reserve to total external debt ratio.	World Bank
Bilateral Condition	X,Z	diffInt	Difference of interest rate between a banks' home country and a debtor country.	IMF

Note: X: variable that relate to return. W: variable that relate to cost.
Z : variable that relate to risk.
OECD: *Bank Profitability; financial statements of banks*
BIS: *BIS International Banking Statistics*
IMF: *International Financial Statistics yearbook*
World Bank: *Global Development Finance*
DateStream is a subsidiary of the Primark Corporation and provides a time series data retrieval service.

σ^2_{Pr}, respectively.

$$pr = \frac{E[\Pi] - hc * \beta}{L^*} \tag{16}$$

$$\sigma^2_{Pr} = \frac{Var[\Pi] - \sigma^2_{HC} * \beta^2 - 2 * L * \beta * Cov[Pr, HC]}{L^{*\ 2}} \tag{17}$$

To calculate the values of pr and σ^2_{Pr} from these equations, we need the value of coefficient β and Cov[Pr,HC]. We then estimate the value of β and Cov[Pr,HC] using Generalized Method of Moment (GMM). We follow the method developed by Hansen [4].

Substituting equations (16) and (17) into equation (11),

$$L^* = \left(\frac{E[\Pi] - hc * \beta}{R * (Var[\Pi] - \sigma^2_{HC} * \beta^2 - 2 * L * \beta * Cov[Pr, HC])} \right) * L^* \tag{18}$$

Rearranging this equation,

$$E[\Pi] - hc * \beta - Var[\Pi] * R - \sigma^2_{HC} * R * \beta^2 + 2 * L * \beta * R * Cov[Pr, HC] = 0$$

$$\Leftrightarrow \quad E[\Pi] - \beta * hc + \lambda * L - Const = 0 \tag{19}$$

$$\text{where} \qquad \lambda = 2 * \beta * R * Cov[Pr, HC] \tag{20}$$

$$Const = (Var[\Pi] + \sigma^2_{HC} * \beta^2) * R \tag{21}$$

Based on equation (19), we estimate the coefficients β, λ, and Const using GMM setup.

Let $\widehat{\beta}$, $\widehat{\lambda}$, and $\widehat{Const}$ be the estimators of β, λ, and Const, respectively. Then,

$$(19) \ \Leftrightarrow \quad E[\Pi] - \widehat{\beta} * hc + \widehat{\lambda} * L - \widehat{Const} = \epsilon \tag{22}$$

$$\Leftrightarrow \quad \boldsymbol{n}(E[\Pi], hc, L : \ \widehat{\beta}, \widehat{\lambda}, \widehat{Const}) = \epsilon \tag{23}$$

where ϵ is an error term.

Let $\boldsymbol{z}$ be an instrumental variable. Then,

$$E[\boldsymbol{n}(E[\Pi], hc, L: \ \widehat{\beta}, \widehat{\lambda}, \widehat{Const}) \otimes \boldsymbol{z}] = 0 \tag{24}$$

$$\Leftrightarrow \quad E[\boldsymbol{h}] = 0 \qquad \text{(Orthogonality Condition)} \tag{25}$$

$$\text{where} \quad \boldsymbol{h} = \boldsymbol{n}(E[\Pi], hc, L: \ \widehat{\beta}, \widehat{\lambda}, \widehat{Const}) \otimes \boldsymbol{z}$$

Using this orthogonality condition, this study estimates $\widehat{\beta}$, $\widehat{\lambda}$, and $\widehat{Const}$. Using $\widehat{\beta}$ and equation (16), we can calculate the value of pr. Moreover, the values of R, and Cov[Pr,HC] can be derived from equations (20) and (21).

4 EMPIRICAL RESULTS

Data

We examine the largest six bank groups: France, Germany, Japan, Netherlands, the UK, and the U.S. We use yearly data from 1989 to 1999 for each bank group. Because of the limitations of data availability, we pool the data of these six bank groups. Every variable is indexed based on 1995 values. We modify the variables for debtor countries by taking a weighted average over all debtor countries for each bank group. The weight for each bank group is a debtor country's share in the bank group's total international loans. This means that bank groups are affected differently by the changes in debtor countries because the bank groups distribute their international loans differently across LDCs. Because we focus on effects through international bank lending, it is reasonable to weight the changes in debtor countries by the percentage share of international loans to the debtor countries. Table 2 lists the definition and data sources of each variable.

GMM Estimation

We employ three different GMM estimation methods: two-step GMM, iterated GMM, and continuously-updated GMM (Hansen, Heaton, and Yaron [3]). These three methods have the same result asymptotically. Lagged values of hc are used as instrumental variables. The number of lagged values was chosen to be 1, 2, 3, and 4. Using the instrumental variables, this study employed four

Table 3: GMM Estimation Results

Method	Coefficients	estimates	s.e.
Two-step GMM	β	0.885	0.273
	λ	1.021	0.723
	Const	104.197	46.455
	J-test for overidentifying restrictions	1.660	
	p-value of the J-test	0.646	
Iterated GMM	β	0.644	0.222
	λ	0.424	0.538
	Const	73.226	34.928
	J-test for overidentifying restrictions	1.331	
	p-value of the J-test	0.722	
Continuously-Updated GMM	β	0.553	0.201
	λ	0.275	0.475
	Const	66.736	31.205
	J-test for overidentifying restrictions	1.079	
	p-value of the J-test	0.782	

orthogonality conditions to estimate β, λ, and Const in equation (19). Table 3 shows estimation results for each method.

We emphasize the results of Continuously-updated GMM because Two-step and Iterated GMM have poor finite properties compared to Continuously-updated GMM (Hansen, Heaton, and Yaron [3]). Moreover, the first order conditions are zero at the true values of the parameters in Continuously-updated GMM, but those are non-zero in Two-step and Iterated GMM, which can be a source of bias. Using the Continuously-updated GMM estimator, we derive the value of R and Cov[Pr,HC] from equations (20) and (21). The calculated values are $\beta = 0.5527$, R $= 3.5886 \times 10^{-3}$, and Cov[Pr,HC] = 69.4397.

β can be interpreted as an overall bank's beta, R is an overall coefficient of absolute risk aversion, and Cov[Pr,HC] is an overall covariance between Pr and HC for all six bank groups. All signs are reasonable. The values of β and Cov[Pr,HC] are reasonable, but that of R seems too small. However, considering that bank groups behaved differently and that R is an overall average of those groups, R can in fact be very small. We use the above result to calculate the value of pr.

Estimation of Simultaneous Equation System

We estimate the simultaneous equation system using 2SLS method. Table 4 shows the estimation results. We choose 2SLS method rather than 3SLS method to estimate the system because the 3SLS method estimates equations jointly and the results can be inconsistent if one of the equations is misspecified. On the other hand, 2SLS method estimates equations separately and thus the estimation of each equation is independent. We avoid the risk that a whole system is estimated inconsistently [9]. The values of pr are calculated using the GMM estimator ($\widehat{\beta}$) and equation (16). All variables in the system are logarithms. The definitions and data sources of other variables are in Table 2.

From the results in Table 4, we can observe interesting relationships among important determinants of international bank lending (Figure 3). The expectation of total profit ($E[\Pi]$) and the economic condition of banks' home country (hc), and the expectation of total profit ($E[\Pi]$) and the profitability of international loans (pr) positively affect each other. The profitability of international loans (pr) and the economic condition of banks' home country (hc) negatively affect each other. The profitability of international loans (pr) positively affects the level of international loans (L). The level of international loans (L) positively affects the economic condition of banks' home country (hc). Because we are interested in the interrelationship between the economic condition of banks' home country (hc) and the level of international loans (L), we analyze the results focusing on the effects on these two determinants.

The relationships show that there are four ways that the level of international loans (L) is affected by other determinants. First, the profitability of international loans (pr) has a direct positive effect on the level of international loans (L). Second, the expectation of total profit ($E[\Pi]$) has an indirect positive effect on the level of international loans (L) via the profitability of international loans (pr). Finally, the economic condition of banks' home country (hc) affects the level of international loans (L) in two ways. One way is that the economic condition of banks' home country (hc) has a direct negative effect on the profitability of international loans (pr) and then the changes in pr positively affect the level of international loans (L). Thus, in the end the economic condition of

[9] The result form 3SLS method was basically the same to that from 2SLS method; sign of coefficients, statistically significant coefficients, and relationships among variables. However, the statistical significance was lower in 3SLS than in 2SLS.

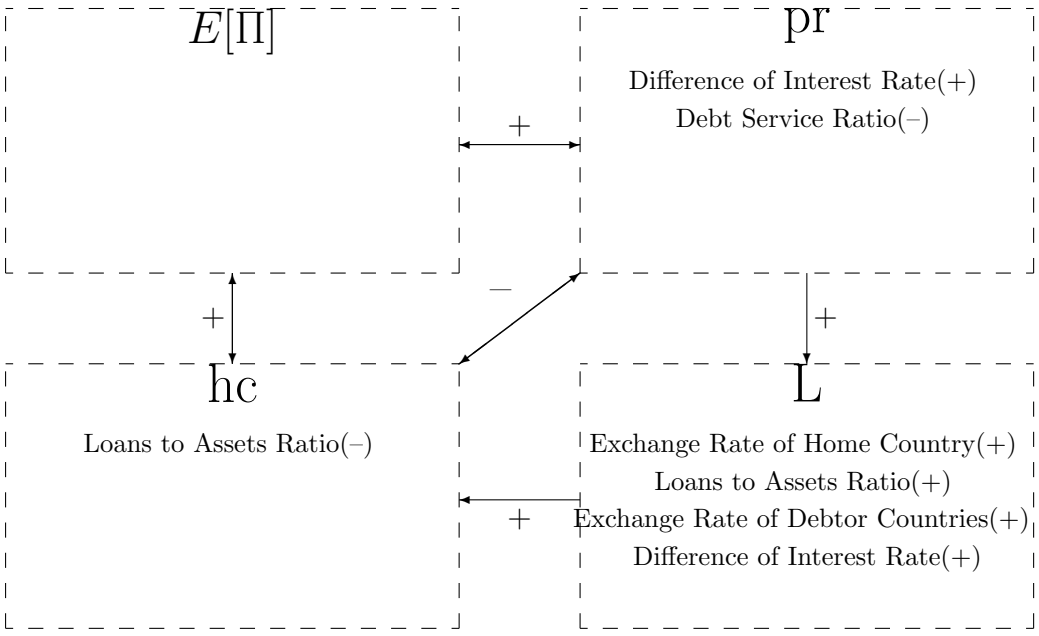
Table 4: Estimation of Simultaneous Equation System

Equation	Obs	Parms	RMSE	R-sq	F-Stat
$E[\Pi]$	66	3	0.067	0.843	54.005
pr	66	11	0.244	0.657	10.826
hc	66	7	0.064	0.883	70.189
L	66	10	0.162	0.293	6.941

	Coef.	Std.Err.	t	P> $\|t\|$	[95% Conf.	Interval]
$E[\Pi]$						
L	-0.026	0.101	-0.26	0.798	-0.225	0.173
pr	0.323**	0.033	9.62	0.000	0.257	0.389
hc	0.733**	0.097	7.57	0.000	0.542	0.924
Const	-0.140	0.180	-0.78	0.438	-0.495	0.215
pr						
$E[\Pi]$	3.600**	1.045	3.45	0.001	1.541	5.658
L	0.048	0.549	0.09	0.930	-1.034	1.131
hc	-2.887**	1.114	-2.59	0.010	-5.081	-0.692
fGdp	0.067	0.724	0.09	0.926	-1.360	1.494
fExc	0.403	0.404	1.00	0.320	-0.394	1.199
exDebt_exp	0.642	0.496	1.29	0.197	-0.335	1.619
exDebt_gnp	-0.175	0.730	-0.24	0.810	-1.614	1.263
debtServRatio	-2.521*	1.412	-1.79	0.076	-5.304	0.262
intServRatio	1.545	1.228	1.26	0.210	-0.875	3.965
res_exDebt	-0.488	0.795	-0.61	0.540	-2.054	1.078
diffInt	0.177*	0.102	1.73	0.085	-0.025	0.378
Const	1.477	2.702	0.55	0.585	-3.848	6.802
hc						
$E[\Pi]$	0.696**	0.168	4.14	0.000	0.365	1.026
L	0.498**	0.205	2.42	0.016	0.093	0.902
pr	-0.259**	0.081	-3.20	0.002	-0.419	0.100
hGdp	-0.267	0.284	-0.94	0.347	-0.826	0.292
hExc	-0.045	0.070	-0.64	0.525	-0.183	0.094
laRatio	-1.103**	0.380	-2.90	0.004	-1.853	-0.354
tCost	0.121	0.166	0.73	0.464	-0.205	0.448
Const	2.804	0.644	4.35	0.000	1.535	4.073
L						
pr	0.539**	0.272	1.98	0.049	0.003	1.076
hExc	0.607*	0.318	1.91	0.058	-0.020	1.234
laRatio	2.301**	0.830	2.77	0.006	0.666	3.936
fExc	0.779**	0.230	2.60	0.010	0.188	1.370
exDebt_exp	-0.075	0.227	-0.33	0.740	-0.523	0.372
exDebt_gnp	-0.530	0.380	-1.40	0.164	-1.279	0.218
debtServRatio	-0.503	0.732	-0.69	0.493	-1.946	0.920
intServRatio	1.304	0.827	1.58	0.116	-0.325	2.933
res_exDebt	-0.319	0.405	-0.79	0.432	-1.117	0.479
diffInt	0.100*	0.051	1.94	0.053	-0.001	0.201
Const	-6.554	3.612	-1.81	0.071	-13.670	0.562

Note: ** (*) indicates that the coefficients is statistically significant at 95% (90%)level

Figure 3: Relationships among Determinants for Bank's International Lending



banks' home country (hc) has a negative effect on the level of international loans (L). This shows a substitution effect between domestic and international assets. If the economy of banks' home country goes well, international loans will be relatively less profitable compared to domestic ones. Thus, the profitability of international loans for the banks decreases, which causes the decrease in their international loans. The second way is that the economic condition of banks' home country (hc) indirectly affects the profitability of international loans (pr) via the expectation of total profit ($E[\Pi]$). In this way, the economic condition of banks' home country (hc) has a positive effect on the level of international loans (L). This shows a wealth effect. When home country's economy is going well, banks will expect higher total profits and supply more international loans. Therefore, the final effect of the economic condition of banks' home country (hc) on the level of international loans (L) is the sum of a substitution and a wealth effect. Because these two effects have opposite signs, the sign of final effect of the economic condition of banks' home country (hc) on the level of international loans (L) is not obvious. For example, when the home country's economy is going

down, if the wealth effect dominates then banks will decrease their international loans. However, if the substitution effect dominates then banks will increase their international loans.

The relationships in Figure 3 also show that there are six ways that the economic condition of banks' home country (hc) is affected by other determinants. First, the level of international loans (L) has a direct positive effect on the economic condition of banks' home country (hc). When international loans are profitable, the increase in the loans will positively affect the economy of banks' home country through banks' profit. Second, the expectation of total profit ($E[\Pi]$) affects the economic condition of banks' home country (hc) in two ways. One way is a direct positive effect on the economic condition of banks' home country (hc). The second way is an indirect positive effect on the economic condition of banks' home country (hc) via the profitability of international loans (pr) and the level of international loans (L). In any ways, the expectation of total profit ($E[\Pi]$) positively affects the economic condition of banks' home country (hc). Finally, the profitability of international loans (pr) affects the economic condition of banks' home country (hc) in three ways. First, the profitability of international loans (pr) has a direct negative effect on the economic condition of banks' home country (hc). This is because the increase in the profitability of international loans (pr) raises international loans, which means money goes out from home country, negatively affecting the home country's economy. On the other hand, the profitability of international loans (pr) positively affects the economic condition of banks' home country (hc) in two ways via the expectation of total profit ($E[\Pi]$) and the level of international loans (L). If the profitability of international loans (pr) rises banks will expect higher total profits and this has a positive effect on the economy of their home country. The rise in the profitability of international loans (pr) also increases the level of bank's international loans. The increase in bank's international loans has a positive effect on their home country's economy. Because these three effects have different signs, the sign of the effect of the profitability of international loans (pr) on the economic condition of banks' home country (hc) is not obvious.

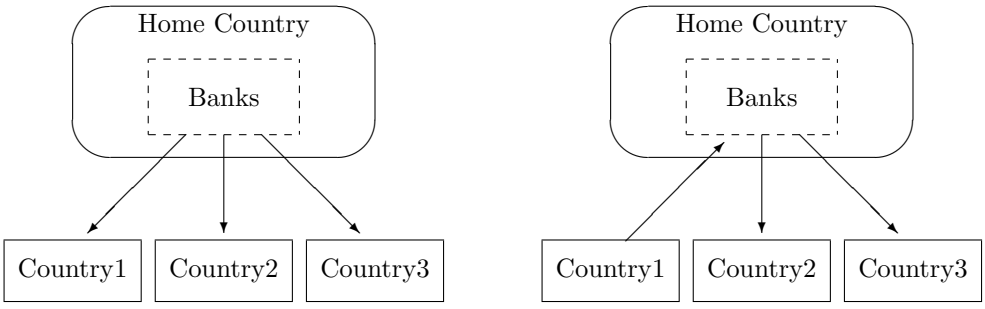
These findings give us a deeper understanding of the variation in bank's international lending by nationality. First, the difference in the economic condition of banks' home countries does not sufficiently explain the variation. Second, the source of the variation can be the difference in the degree of substitution and wealth effects of the economic condition of home country (hc) on the

level of international loans (L). Third, debtor and bilateral conditions can indirectly cause the variation through the effect on the profitability of international loans (pr) because the change in the profitability of international loans (pr) affects the economic condition of banks' home country (hc) differently depending on the degrees of the three distinct effects.

Interpretation in the Context of Transmission of Shocks

We can interpret our findings in the context of transmission of shocks. Our empirical results show that the economic condition of banks' home country affects the level of international loans in two ways and that both the profitability and the level of international loans affect the home country's economy. These indicate that banks change the level of their international loans because of a shock in their home country even when the debtor countries have no changes. Also, a shock in a debtor country affects the economy of banks' home country through their international loans. These findings suggest the possibility of two types of transmission of shocks through international bank lending: [i] transmission from a creditor country to debtor countries and [ii] transmission from a debtor country to other debtor countries via a creditor (banks).

Transmission of Shocks through International Bank Lending



[i] Transmission from a creditor country to debtor countries

[ii] Transmission from a debtor country to other debtor countries via a creditor (banks)

The effects of the economic condition of home country on international bank lending explain the transmission of shocks from a creditor country to debtor countries. For example, a negative shock in a bank's home country can decreases the international bank lending [10], and the decrease damages

[10] In this example, the wealth effect is assumed to be larger than the substitute effect.

the economy of debtor countries that borrow money from the bank [11].

The effects of international bank lending on the economy of their home country imply that a shock in a debtor country can be transmitted to other debtor countries via a creditor (banks). When there is a shock in a debtor country that decreases the profitability of international lending, the economy of the banks' home country is directly and indirectly affected through the international lending. If their home country's economy is worsened by the decrease [12], banks will decrease their total international lending. In turn, the decrease in total international loans can damage other debtor countries.

5 CONCLUSION

Using the portfolio selection model that explicitly includes the economic condition of banks' home country, we empirically show that there exist substitution and wealth effects of the economic condition of the home country on the international bank lending. Thus, the sign of the final effect of the economic condition of the home country on the international bank lending is not obvious. We also show that there are three distinct effects of the profitability of international loans on economic condition of banks' home country and these effects have different signs. Thus, the sign of the final effect of the profitability of international loans on economic condition of banks' home country is not obvious, either. From the results, we find that the difference in the condition of creditor countries may not be sufficient to explain the variation in the pattern of international bank lending by nationality. We then conjecture that the differences in the degree of the substitution and the wealth effects are important causes of the variation. In addition, we point out that detor and bilateral conditions can be a source of the variation through the effects on the profitability of international bank lending.

We also interpret the result in the context of transmission of shocks and demonstrate the possibility of two types of transmission of shocks through international bank lending:[i] transmission from a creditor country to debtor countries and [ii] transmission from a debtor country to other debtor

[11] We assume that the decrease in bank's international lending has a negative effect on the economy of a debtor country. Reisen and Soto [5] showed the importance of international bank lending on the income growth in 44 LDCs during 1987-97. The decrease in international lending also decreases credit availability in detor countries, which affects the level of output (Fackler and Rogers [2]). The decrease in available credit may be refilled by other creditors. However, it is costly to replace the banking system (Christopher [1]).

[12] The negative effect through the decrease in bank's international lending is assumed to be larger than the positive effect from the decrease in the profitability.

countries via a creditor (banks).

Our results support the idea of the common creditor (banks) effect in Kaminsky and Reinhart [6]. They suggested the possibility of the effect by analyzing economic characteristics of debtor countries. This study justifies the possibility by analyzing bank's international lending behavior. Our approach more fully clarifies how bank's international loans connect between a creditor country and debtor countries. As a result, we demonstrate two types of transmission of shocks out of the three that are presented in Kaminsky and Reinhart [7].

While this study gives deeper observation about the variation in international bank lending by nationality and explain the possibility of transmission of shocks through international bank lending well enough, there are several points which require further study. First, we could not explicitly show a difference among bank groups by nationality. If sufficient data are available, it will be worthwhile deriving the variation among bank groups explicitly by estimating β for each bank group or applying a panel data analysis. Moreover, this study examined only economic factors as the determinants of international bank lending. However, international bank lending is also strongly affected by legal and political factors. The effects of these factors on the international lending should be taken into consideration.

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