Re-examination of the Theoretical Model for Global-Flow-of-Funds Analysis*

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Abstract

This paper corrects the model of the global-flow-of-funds which was built in 2005. Also, it presents a more specific idea of the global-flow-of-funds, and explains the outlines of theoretical analysis from three different viewpoints, the balance of savings-investment, current balance flows, and international capital flow. Then this paper considers the issues that arise in interpreting and estimating multiple-equation models. Special characteristics of model of global-flow-of-funds are also examined.

Key Words: Balance of Savings-Investment, Current Account Flows, International Capital Flow, Simultaneous-Equations Model, Two-Stage Least Squares, Three-Stage Least Squares

1. Introduction

The concept of the global-flow-of-funds, the framework of analysis, and theoretical model for the global-flow-of-funds were brought up in 2005.[1)] After that, we have made some important advice about the model of the global-flow-of-funds from international society and research seminar during these years. In this paper, we will clarify the concept of the global-flow-of-funds and build the framework of analysis for the global-flow-of-funds analysis. And we want to solve the mathematical structure of a simultaneous equations system in the analytic theoretic model. Also, according to the economic theory, we will examine the economic meaning of endogenous variables and exogenous variables in the model.

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1) Nan Zhang, 2005, *The Global Flow of Funds Analysis in Theory and Application,* Mineruvula-shobo.

The global-flow-of-funds are flow of funds that relates to domestic flows and international capital flows. The analysis of global flows of fund is an analysis which shows the characteristics and the structure in the flows of fund, includes the flows of all domestic funds with investment-savings, links current balance, and connects international capital flows.

The financial markets indicate the debts and credits of funds as a whole plus the total process of financial liquidity. Investigated more carefully, items of financial markets include inflows of domestic funds, overseas funds by domestic savings and credit loans of banks on the side of fund-sources (funds inflow). On the other hand, funds split into supply of funds to the domestic economy and funds outflow overseas in fund uses (funds outflow). When the flow of funds in financial markets is tied up with the international balance of payments, the overseas sector will become fund outflow excess (net capital outflows) if the current account is in surplus. Conversely, the domestic sector will become fund inflow excess. Therefore, when the real economy side of the domestic economy and overseas is analyzed under an open economic system, the balance of savings-investment of the domestic economy corresponds to the current account balance. According to the dynamic process of external flow of funds and the definitional equation of a System of National Account, from the accounting identity as follows,

$$Y = C + I + G + EX - IM$$

We can get the equilibrium condition below with through arranging the above formula.

$$S - I = EM - IM$$

The right side of equilibrium condition shows Current Account, and the left side of equilibrium condition shows the balance of savings-investment, or it is also called by Net Financial Investment. So we can get the relationship of equilibrium condition equations as follows.

$$S - I = EX - IM = NFI$$

However, domestic net funds outflow correspond with the capital account balance, when the relationship between domestic and overseas on the financial side is examined. Therefore, relations between the domestic savings-investment balance, the financial surplus or deficit, the current account, and the overseas net fund outflow will be expressed in the following structural formulae.

Savings-Investment and Current Account Balance

$$S - I = \Delta FA - \Delta FL = EX - IM \tag{1}$$

The Overseas Income and Expenditures Balance

$$EX - IM = (FO - FI) + \Delta FER \tag{2}$$

The Financial-Markets Balance

$$FO_d + FO_o + \Delta FER = FI_d + FI_o \tag{3}$$

The upper formula is transformed as follows:

$$FO_o - FI_o + \Delta FER = FI_d - FO_d \tag{4}$$

Net fund supply to overseas balance

$$NFO_o + \Delta FER = NFI_d \tag{5}$$

The constitution of the net overseas fund flows

$$(FO_o - FI_o) = DI + PI + OI + CaA \tag{6}$$

Notes: ΔFA : financial assets increase, ΔFL : financial liabilities increase,
EX: exports, IM: imports, FO: fund outflow, FI: funds inflow,
ΔFER : Foreign exchanges reserves, FO_d : domestic funds outflow,
FO_o : overseas funds outflow, FI_d : domestic funds inflow,
FI_o : oversea funds inflow, $NFO_o = FO_o - FI_o$ (net outflow of overseas funds),
$NFI_d = FI_d - FO_d$ (net inflow of domestic funds), CaA: Capital account,
DI: Direct investment, PI: Portfolio investment, OI: Other investment

It is apparent that the net overseas flow of funds $(FO_o - FI_o)$ corresponds with the Capital & Financial Account in Balance of Payment by (4) and Capital & Financial Account is constituted of Financial Account and Capital Account, the net overseas flow of funds as (6). All the items on the right of formula made into net value, and indicate course, composition, and scale the global flow of fund. From (1) to (6) we build the framework of global flows of funds. And through the (6), we know that the changes of the global flows of funds are determined by foreign direct investment, portfolio investment, and other investment. This is how we obtain the analysis framework of the global flow of funds from the above structural formula.

2. Mathematical Principle of the Motel for Global-Flow-of-Funds

Three techniques are generally used for joint estimation of the entire system of equations: Three-Stage Least Squares (3SLS), Generalized Method of Moments (GMM), and Maximum Likelihood. The model of Global-Flow-of-Funds was built by 3SLS method. When Two-Stage Least Squares (2SLS) was used for joint estimation of the entire system of equation, 2SLS assumed no correlation between error terms ε_1 and ε_2 in simultaneous equations. On

the other hand, 3SLS is presuming that exist correlation between error terms ε_1 and ε_2 of simultaneous equations.

As the presumed method, 2SLS is how to solve the equation of each of structural equations separately. But compared with this method, 3SLS is the methods for presuming simultaneous equations that take into consideration all directions of a simultaneous-equations system using the variance-covariance matrix of the error term between equations. Intuition would surely suggest that systems method, 3SLS is to be preferred to single-equation methods 2SLS. The estimator of presumption that was by 3SLS is a consistent estimator, and when the disturbance terms of each structural equation have correlation, it becomes the estimator of effective presumption more asymptotically than 2SLS

We begin with a slightly abstract linear model

$$Y_t = \alpha + X_t\beta + \varepsilon_t \tag{7}$$

Where Y is an observable $n \times 1$ random vector, X is an observable $n \times p$ random matrix, and β is an unobservable $p \times 1$ parameter vector. The α_i are IID with mean 0 and finite variance σ^2; ε is random errors. This is the standard regression model, except that X is endogenous, i.e., X and α are dependent. Conditional on X, the OLS estimates are biased by $(X'X)^{-1}X'E(\alpha \mid X)$. This is simultaneity bias.

The structural form of the model is

$$\begin{aligned}
&\gamma_{11}y_{t1} + \gamma_{21}y_{t2} + \cdots + \gamma_{m1}y_{tm} + \beta_{11}x_{t1} + \cdots + \beta_{k1}x_{tk} = \varepsilon_{t1} \\
&\gamma_{12}y_{t1} + \gamma_{22}y_{t2} + \cdots + \gamma_{m2}y_{tm} + \beta_{12}x_{t1} + \cdots + \beta_{k2}x_{tk} = \varepsilon_{t2} \\
&\qquad\qquad\qquad\qquad \vdots \\
&\gamma_{1m}y_{t1} + \gamma_{2m}y_{t2} + \cdots + \gamma_{mm}y_{tm} + \beta_{1m}x_{t1} + \cdots + \beta_{km}x_{tk} = \varepsilon_{tm}
\end{aligned} \tag{8}$$

There are M equations and M endogenous variable, denoted $y_1, \cdots, y_m$. And there are K exogenous variable, $x_1, \cdots, x_k$, that may include predetermined values of $y_1, \cdots, y_m$ as well. The first element of x_t will usually be the constant 1. Finally, $\varepsilon_{t1}, \cdots, \varepsilon_{tm}$ are the structural disturbances.

In matrix terms, the system may be written

$$\begin{bmatrix} y_1 & y_2 & \cdots & y_m \end{bmatrix}_t \begin{bmatrix} \gamma_{11} & \gamma_{12} & \cdots & \gamma_{1m} \\ \gamma_{21} & \gamma_{22} & \cdots & \gamma_{2m} \\ & & \cdot & \\ & & \cdot & \\ \gamma_{m1} & \gamma_{m2} & \cdots & \gamma_{mm} \end{bmatrix}$$

$$+\begin{bmatrix} x_1 & x_2 & \cdots & x_k \end{bmatrix}_t \begin{bmatrix} \beta_{11} & \beta_{12} & \cdots & \beta_{1m} \\ \beta_{21} & \beta_{22} & \cdots & \beta_{2m} \\ & & \cdot & \\ & & \cdot & \\ \beta_{k1} & \beta_{k2} & \cdots & \beta_{km} \end{bmatrix} = \begin{bmatrix} \varepsilon_1 & \varepsilon_2 & \cdots & \varepsilon_m \end{bmatrix}_t$$

or

$$y_t'\Gamma + x_t'\mathrm{B} = \varepsilon_t' \tag{9}$$

Each column of the parameter matrices is the vector of coefficients in a particular equation, whereas each row applies to a specific variable. The economic theory will imply a number of restrictions on Γ and B. one of the variables in each equation is labeled the dependent variable so that its coefficient in the model will be 1. Economic theory may also impose other types of restriction on the parameter matrices.

To handle simultaneity bias, economists would estimate (9) using instrumental-variables regression, also called Two-Stage Least Squares (2SLS). The method requires an $n \times q$ matrix of instrumental or exogenous variables, with $n > q \geq p$. The matrix will be denoted Z. The $Z'X$ and $Z'Z$ need to be of full rank, q and p respectively. If $q > p$, the system is over-identified. If $q = p$, the system is just-identified. If $q < p$, the case which is excluded by assuming $q \geq p$, the system is under-identified. Parameters will not be identifiable.

For the exactly identified equation, Indirect Least Squares (ILS) provides a consistent estimator. In the usual case, the equation to be estimated will be over-identified, so $X'Z_j$ will have more rows than columns and cannot be inverted. The method of 2SLS is the usual alternative. The 2SLS method consists of using as the instruments for Y_j the predicted values in a regression of Y_j on all the $x's$:

$$\hat{Y}_j = X\left[(X'X)^{-1}X'Y_j\right] = XP_j$$

The 2SLS estimator is, thus,

$$\hat{\delta}_{j,2SLS} = \begin{bmatrix} \hat{Y}_j'Y_j & \hat{Y}_j'X_j \\ X_j'Y_j & X_j'X_j \end{bmatrix}^{-1} \begin{bmatrix} \hat{Y}_j'y_j \\ \hat{X}_j'y_j \end{bmatrix} \tag{10}$$

In the matrix $[\hat{Y}_j, X_j]$, which has $M_j + K_j$ columns, all columns are linear functions of the K columns of X. there exist, at most, K linearly independent combinations of the columns of X. If the equation is not identified, then $M_j + K_j$ is greater than K, and $[\hat{Y}_j, X_j]$, will not have full column rank. In this case, the 2SLS estimator cannot be computed.

When using 2SLS, it is assumed that there is no correlation between the structural distur-

bances ε_1 and ε_2 in two simultaneous equations. On the other hand, Three-Stage Least Squares (3SLS) is the method that explicitly consider the correlation between the structural disturbances ε_1 and ε_2 in equation-by-equation. For estimation of the entire system of equations, we can use 3SLS. The formula of 3SLS is as follows.

$$\hat{\delta}_{3SLS} = \left[\hat{Z}'(\Sigma^{-1} \otimes \mathrm{I})Z\right]^{-1} \hat{Z}'(\Sigma^{-1} \otimes \mathrm{I})y \text{ 2)} \tag{11}$$

For this estimator to be a valid instrumental variable (IV) estimator, Zellner and Theil (1962) have ever suggested[3] that using the disturbances which were computed by 2SLS estimator to estimate σ_{ij}. That is, compute 2SLS estimators δ_i in each equation from (11), and calculate vector $\varepsilon_i (i = 1, \cdots m)$ after substitute it for (9) formulas, then, calculate the estimators s_{ij} of σ_{ij}. Therefore, the $\hat{\delta}_{3SLS}$ estimator is thus given as follows.

A. Estimate Π[4] by OLS and compute $\hat{Y}_j$ for each equation.

B. Compute $\hat{\delta}_{j,2SLS}$ for each equation; then

$$\hat{\sigma}_{ij} = \frac{(y_i - Z_i\hat{\delta}_i)'(y_j - Z_j\hat{\delta}_j)}{T} \text{ 5)} \tag{12}$$

C. Compute the *GLS* estimator according to (11) and an estimate of the asymptotic covariance matrix according to (12) using $\hat{Z}$ and $\hat{\Sigma}$.

By showing that it the 3SLS estimator satisfies the requirements for an IV estimator, we have established its consistency, and will use the 3SLS to estimate the motel of global-flow-of-funds in the next section.

3. Building the Model of Global-Flow-of-Funds

The motel of global of flow of funds is based on **IS-LM** theory and general equilibrium theory, refers to the view of **Mundell-Fleming** model, and is created by the form of a simultaneous equation. Creation of this model has two purposes. One of the purposes is related to the immanent factors of many economic variables. It estimates the quantity relation between change of the savings and investment, export and import, external flow of funds and economic growth in certain country, and there are in reflecting the structural changes of the flow of funds

2) $\otimes$ is Kronecker product.

3) A. Zellner and H.Theil, 1962, "Therr-stage, Least-squares: Simultaneous Estimation of Simultaneous Equations," Econometrica, vol. 30, pp. 54–78.

4) Π is reduced-form coefficient matrix.

5) T is observations.

in a medium-to-long period of time.

Another purpose is to analyze the influencing mechanism of an economic policy and policy coordination in a certain international area. The change of international trade and financial transaction is reflected in global-flow-of-funds. In this way, it is necessary to investigate the influences of the fiscal and monetary policies on global-flow-of-funds. In this part, we attempt to create the theoretical model of global-flow-of-funds based on the analysis framework of global-flow-of-funds.

3.1 *Description of the model by Economics*

When we will explore the structural change of the global-flow-of-funds, it not only need to consider the factor which real economy, such as savings and investment, but also need to observe the factor of the financial market, that involving the interest rates, the change of share price, and the foreign exchange rate, etc. In the globalization of world trade, we also need to consider the relations of interdependence of the international trade and the financial transaction from the view of the global-flow-of-funds.

According to the analysis framework which showed the formula from (1) to (6) in this paper, we designed a flowchart of the motel as figure 1. Figure 1 showed the mechanism of the global-flow-of-funds. The ellipse in the figure 1 show the endogenous variables and the rectangle in the figure 1 show exogenous variables in the motel, and the arrow show the relationship between the endogenous variables and exogenous variables. According to the framework of analysis of Section 1, we try to look into at the global-flow-of-funds from three different viewpoints, that is, the balance of savings-investment, current balance flows, and international capital flow.

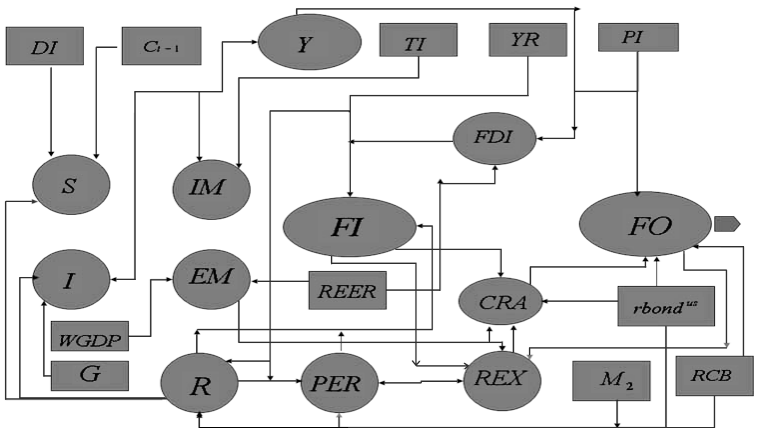

Figure 1: The flowchart for the motel of global flow of funds

In the first viewpoint, we designed the equation of Savings-Investment. The change of Disposable Income (*DI*) can influence the savings (*S*), the more *DI* is high, and the more savings will increase. We also wanted to use final consumption expenditure in the previous period (C_{t-1}) to observe the influence on savings. According to the theory of consumption, the savings in this period will reduce if consumption expenditure in the previous period increased. We also can know that one more important factor which interest rates (*R*) work upon on the change of savings, and if the interest rate increases, that means the monetary tightening, so the amount of consumption will reduce.

The factors which affected investment (*I*) were set up as economic growth (*Y*), government expenditure (*G*), and interest rate (*R*). We use the ΔY_{t-1} as the exogenous variables of economic growth, that is the difference of GDP in the previous period ($Y_{t-1} - Y_{t-2}$). According to the principles of acceleration of investment, change of the quantity of production or final demand will make an acceleration in the change of investment growth, so we can consider the plus relationship between *I* and ΔY_{t-1}. J. M. Keynes studied control of investment and classified the case which control of investment is possible, and the case of being impossible, by controlling an interest rate. If in the case which can't control investment by interest, it needs government to increase government expenditure to push investment. So in order to explain change of investment, government expenditure (*G*) is made into an explaining variable, and it is the plus relation between *I* and *G*. Also we can know that *I* has a negative relation with the interest (*R*).

In the second viewpoint, we need to connect with *S* equation and *I* equation from the viewpoint of the current balance flows, and derive the Import (*IM*) equation and the Export (*EX*) equation from the systems of the global-flow-of-funds. When we will analyze the change of the import and export in the global-flow-of-funds, we divided into the demand factor (*GDP*), the price factor (Import Price Index, *IPI*), the factor of the world economy factor (the world economy other than country which becomes candidate for analysis, the *WGDP* can stand for that), and Real Effective Exchange Rate (*REER*) as the exogenous variables. And we used these exogenous variables and presumed the each elasticity regarding the *IM* and *EX*. In the *IM* equation, we can know that the *IPI* has a negative relation with the *IM*, and the *Y* (=GDP) has plus relation between *Y* and *IM*.

There is the phenomenon in which both of external assets and foreign liabilities have been growing large in the global flow of funds since 2000s. By looking from the third viewpoint, in order to observe the continuous adjustment process to the balance from the imbalance of an

international capital flows, it is necessary to build a model not only on a net base, but also on a gross basis, we have formed the equations of the international capital inflow and domestic capital outflow on the gross base.

From the third viewpoint, we examine the causal relationship of the international capital flow. As explanatory variables of the international capital inflow equations (*FI*), we used *GDP* growth rate in the previous period (YR_{t-1}), price earnings ratio (*PER*), foreign direct investment (*FDI*), the difference of the interest rate which own country and a foreign country (*DR*), and dummy variable (*D*). According to the theory of financial investment, the international capital whether flow into a country are mainly decided by two factors, that is, the risk and return of financial investment. We can know *FI* has plus relation with YR_{t-1}, *PER*, and *FDI*. Also we consider a positive relation between *DR* and *FI*, because an interest rate gap with a foreign country will arise if the interest rate of own country falls, the capital flows will flow out from the own country to a foreign country. In other hand, if the interest rate of own country rise and it is higher than a foreign country, the international capital flows will flow in into this country.

According to formula (6) of Section 1, since the capital inflow mainly consisted of *FDI*, International-Portfolio-Investment (*IPI*), and external debt (*ED*), we set up the *FDI* function, the *IPI* function, the *ED* function, etc. from the dynamic process of the global-flow-of-funds.

In order to observe the ripple effect between international market and the fiscal and monetary policy of each country, we added the *PER* function, the interest rate function (*R*), and exchange rate (*EXR*) in this model that based on the mechanism of profitability and risk regarding to the international capital movement. We used *R*, YR_{t-1}, *EXR*, and the ratio of foreign liabilities(*risk*) as the explanatory variables of the *PER* function. The *R*, *EXR* and *risk* have a negative relation with *PER*, and the plus relation between YR_{t-1} and *PER*.

We use real money supply (*RM*), external net financing (*NFI*), benchmark interest rates of central bank (*RCB*) and YR_{t-1} as the explanatory variables to explain the change of *R*. According to the theory of Mundell-Fleming, we can consider *RM* and *NFI* have a negative relation with *R*, and *BCB* and YR_{t-1} have a plus relation with *R*. Because the cost of a financial transaction will decrease if an amount of money supplied increases, an interest rate will be going down. Also an interest rate will fall, since domestic supplies of funds will increase if oversea capital inflows were raised.

Exchange rate (*EXR*) is a very important factor in the global-flow-of-funds, and we set *DR*, *PER*, *FI* and *EX* as explanatory variables in the *EXR* functions. Since increase in value of an

exchange rate differs from the increase concept of other economic variables, first we need to clarify the concept of revaluation of an exchange rate.[6] As the (a) of Figure 2 shows, the exchange rate is to be revalued, since the inflow of foreign capital will increase if the interest rate of its own country is higher than other foreign country. So we can know the plus relation between the *DR* and *EXR*. And as a change of stock market always shows, since a stock price index moves in the direction always contrary to an exchange rate, so we can consider *PER* has a negative relation with *EXR*. By observing the (b) of Figure 2, we can know *EXR* has a plus relation between *FI* and *EX*. If the *IS* curve will be going down, the export slump, the capital inflows will also reduce as a payment which exported the goods and services. Then, the exchange rate will devalue.

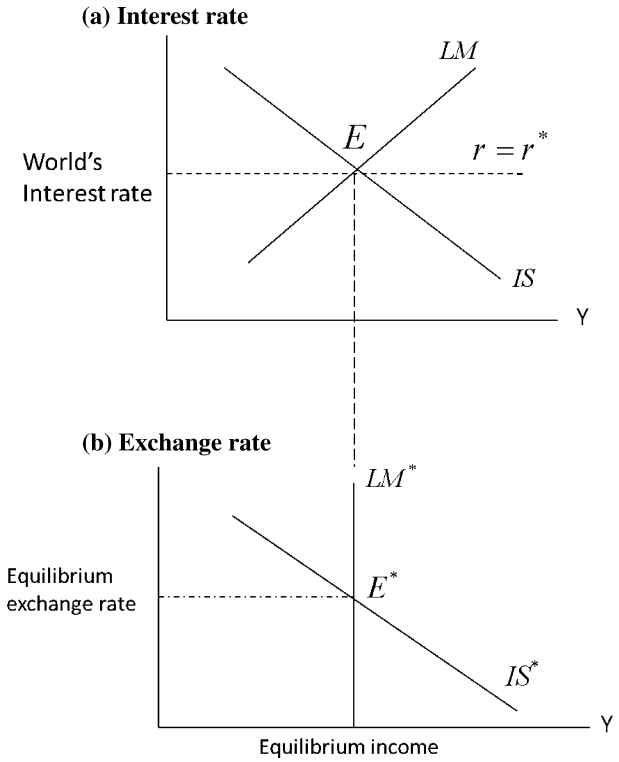

Figure 2: Determination of an exchange rate in the global flow of funds[7]

6) For example, it was 1 dollar = 97 yen on yesterday, but if it become 1 dollar = 95 yen today, it will be called the revaluation of the yen, and if it is 1 dollar = 99 yen today, it will be called depreciation in yen.

7) This graph refers to Mundell-Fleming model and created it (Robert A. Mundell, 1968, International Economics).

In the function of changes in the foreign-reserves assets (*CRA*), we set current account (*CA*), *NFI*, interest rate of central bank (*RCB*) and the U.S. federal fund interest rate (*FFR*) as explanatory variables to explain the change of *CRA*. *CA* has a plus relation with *CRA*, because current balance surplus makes *CRA* increase, and current balance deficit decreases *CRA*. According to formula (2) in the Section 1 of this paper, we know that *CA* and *NFI* are like two sides of the same coin for the change of *CRA*. If $CA < 0$, and $NFI = 0$, *CRA* will decrease. But if $NFI > 0$ (net inflow of funds), and it can cover current balance deficit, the quantity of *CRA* will be kept. Also, if $NFI > 0$, but it can't cover current balance deficit, *CRA* will be subtracted. So we can know the relationship between *CRA* and *NFI* will depend on the change of *CA*. We want to use interest rate of central bank (*RCB*) as police factor to explain the change of *CRA* If the *RCB* go up, it means execution of restrictive monetary policy, and money market rates will be raised. An exchange rate is revalued by this. And *CRA* will decrease, since export will decrease if an exchange rate revalued. So we can know *RCB* has a negative relation with *CRA*.

We also use the U.S. federal fund interest rate (*FFR*) as an international factor to explain the change of *CRA*, because FFR is a very important factor in the global-flow-of-funds. The U.S. is a key currency nation, especially, in China or Japan, more than half of foreign reserves are in the U.S. dollar-treasury bond. According to the market mechanism, if *FFR* goes up, *CRA* of the country containing the U.S. Treasury bond will increase, so the relation of plus exists between *FFR* and *CRA*.

In order to observe the domestic outflow of funds (*FO)*, we use *CRA*, Profit from Investment (*PI*), *RCB*, *FFR*, and dummy variable (*D*) as explanatory variables to explain the change of *FO*. *CRA* are the debts of foreign country in regard to own country, and it can become a part of *FO*, so *CRA* has a plus relation with *FO*. PI means invest that included foreign direct investment in foreign countries and it is gained profit by investment, so we can know the plus relation between *PI* and *FO*. Then, we put *FFR* as an international factor to explain the change of *FO*. *FFR* has a plus relation with *FO*, because if *FFR* go up, the *FO* will increase.

3.2 *Basic structure of the model*

There are 16 endogenous variables and 21 exogenous variables in the model of the global-flow-of-funds. This model referred to the principle of Applied General Equilibrium model. This model takes the change in the formation of expectation and risk, it with a lag structure or immanent relevant factors of many economic variables, and explains the state of the funds flow

in the continuous adjustment process to the balance from imbalance, and in a medium-to-long period of time. It also belongs to a kind of dynamic model. A system of simultaneous equations is a model of financial market equilibrium, consisting of the follows.

Through those simultaneous-equations models, we want to observe systematically the structural factor and cyclic factor in flow-of-funds; how the profit factor and the risk factor affect international capital flows, and how the change of the pattern of funds flow affect domestic economy growth. In order to perform prediction of a future flow-of-funds trend, and the simulation of the policy effect at the end of the model, three definitional equations called Net Flow of Funds, Current Account Balance, National Income identical equation are formed.

Structural Equations

(1) Savings $S_t = b_{11} + b_{12}DI_t + b_{13}C_{t-1} + b_{14}R_t + \varepsilon_{t1}$

(2) Investment $I_t = b_{21} + b_{22}\Delta Y_{t-1} + b_{23}G_t + b_{24}R_t + \varepsilon_{t2}$

(3) Import $IM_t = b_{31} + b_{32}IPI_t + b_{33}Y_t + \varepsilon_{t3}$

(4) Export $EX_t = b_{41} + b_{42}REER_t + b_{43}WGDP_t + \varepsilon_{t4}$

(5) Capital inflow $FI_t = b_{51} + b_{52}YR_{t-1} + b_{53}PER_t + b_{54}FDI_t + b_{55}DR_t + b_{56}D_t + \varepsilon_{t5}$

(6) Foreign direct investment $FDI_t = b_{61} + b_{62}Y_{t-1} + b_{63}PI_t + b_{64}REER_t + \varepsilon_{t6}$

(7) International-portfolio-investment $OPI_t = b_{71} + b_{72}rbond_t^{US} + b_{73}risk_t + b_{74}R_t + \varepsilon_{t7}$

(8) External debt $ED_t = b_{81} + b_{82}RFL_{t-1} + b_{83}CA_t + b_{84}R_t + \varepsilon_{t8}$

(9) Expected stock profit $PER_t = b_{91} + b_{92}R_t + b_{93}YR_{t-1} + b_{94}REX_t + b_{95}risk + \varepsilon_{t9}$

(10) Market interest rate $R_t = b_{101} + b_{102}RM + b_{103}NFI_t + b_{104}RCB_t + b_{105}YR_{t-1} + \varepsilon_{t10}$

(11) Exchange rate $REX_t = b_{111} + b_{112}DR + b_{113}PER_t + b_{114}FI_t + b_{115}EX_t + \varepsilon_{t11}$

(12) Reserve asset $CRA_t = b_{121} + b_{122}CA_t + b_{123}NFI_t + b_{124}RCB_t + b_{125}FFR_t + \varepsilon_{t12}$

(13) Capital outflow $FO_t = b_{131} + b_{132}CRA_t + b_{133}PI_t + b_{134}RCB_t + b_{135}FFR_t + b_{136}D_t + \varepsilon_{t13}$

Identities Equation

(14) Net Fund flow definition $NFI_t = FO_t - FI_t$

(15) Current balance definition $CA_t = NFI_t + CRA_t$

(16) GDP identical equation $Y_t = NFI_t + C_t + I_t + G_t$

The model of the global-flows-of-funds is created from three viewpoints, that is, investments-savings balance, current balance flow, and international capital flow. First, savings-investment equation is formed from the side of domestic savings-investment balance. Moreover, we built Import and Export equation that connected with savings-investment equa-

tion from the side of trade flow. And we are trying to show the feature of the global-flow-of-funds in an international area, when assembling a structural equation. In order to follow the continuous adjustment process of the global-flow-of-funds the international side, we built the international capital inflow equation and domestic capital outflow equation of the gross base which are from simultaneous-equations (5) to (13). Then, we built identities equation which from (14) to (16) for performing the simulation of a policy. Each variable name and classification in the model is shown in the Table 1.

Table 1 The list of Variables and Definition

Variable	Variable name	Classification
Y	Chinese GDP	Endogenous
Y2	Dif2 of lag of GDP	Exogenous
S	Gross Savings	Endogenous
DI	Disposable Income	Exogenous
I	Gross Investment	Endogenous
C	Final Consumption	Exogenous
K(–1)	lag of the capital stock	Exogenous
EX	Export	Endogenous
IM	Import	Endogenous
CA	Current account	Endogenous
REER	Real Effective Exchange Rate	Exogenous
REX	Exchange rates	Endogenous
R	One-year loans interest	Endogenous
CPI	Consumer Price Index	Exogenous
PER	Shenzhen B share	Exogenous
CRA	Changes in Reserve Assets	Exogenous
CF	Errors & omissions	Exogenous
FO	Fund outflows	Endogenous
FI	Fund inflows	Endogenous
NFI	Net financial investment	Endogenous
YR	Economic growth rate	Exogenous
FDI	Foreign direct investment	Endogenous
OPI	Portfolio investment	Endogenous
OIO	Other investment (liabilities)	Endogenous
RFL	Interest payment	Exogenous
Risk	Liability ratio	Exogenous
RCB	Interest rates of central bank	Exogenous
MR	Real money supply	Exogenous
G	Government expenditure	Exogenous
PI	Profit from Investment	Exogenous
FFR	Federal Funds Rate	Exogenous
WGDP	Total of Japan, U S and Euro	Exogenous

4. Conclusions

This paper considered the estimation method of the simultaneous equation. This paper discussed the estimation method of the model which are 2SLS and 3SLS, and concluded that method of 3SLS is superior than method of 2SLS.

We explained the mechanism of the motel of global-flow-of-funds using the flowchart. And the causal relationship of each endogenous variable and exogenous variables in the model of global-flow-of-funds was examined from three different viewpoints. In the end, the model was built by simultaneous equation. In order to create this model, it required huge statistical data. This model will be more realistic by uniting descriptive analysis and inferential analysis, and better result can be expected when change of the global-flow-of-funds is seen in dynamic state.

If the time series of the statistical data that was used in the model are very long, we need to examine whether there is problem of spurious regression in the time series. We will study how to take in the time-series-analysis technique to simultaneous-equation model as the next research project.

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