The Optimal Current Account in the Presence of Capital Control and Excessiveness of Capital Inflows

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This paper investigates whether the current account and capital flows are excessive or not, prior to the financial crisis in East Asian five countries, using the intertemporal model. The optimal current account series are calculated on the basis of intertemporal approach both under perfect capital mobility and under capital controls, against which actual current account and capital flows are compared and judged. The empirical results show that actual current accounts move closely in line with the optimal current account under perfect capital mobility in Korea, Malaysia, the Philippines and Thailand. In the case of Indonesia, actual current accounts are similar to the restricted optimal current accounts in the presence of capital controls. The analytical results show that capital inflows in Malaysia, Thailand and Indonesia seem to be too much in the sense that they are much larger than optimal level of capital flows prior to financial crisis. But actual capital flows move in the same way both in level and in direction as the optimal capital flows in Korea.

Keywords: Intertemporal approach to current account, Restricted optimal current account, Excessive capital flows, Financial crisis

JEL Classification: F3, F4

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I. Introduction

The surge in international capital flows has been remarkable in 1990s, in particular into a group of developing countries. For example, net capital inflows into developing countries have increased from US$ 88.8 billion in 1991 to US$ 175.8 billion in 1996.[1]

International capital movement is known to have important beneficial effects on economies. First of all, it makes resource allocation more efficient, as the capital moves to the country with a higher risk adjusted rate of return. Also by borrowing or lending across countries, it enables agents in the economy to smooth consumption in response to unexpected shocks, thus improving national welfare. In addition, the capital movement across countries can enhance the scope for risk diversification. From a different perspective, international capital movement may lead to problems. For example, it sometimes leads to excessive capital inflows, causing economic bubbles, overheating or a subsequent disruptive reversal of capital flows. International capital movement increases the economy's vulnerability to external shocks because the capitals may move rapidly in a disruptive manner. International capital movement sometimes counteracts intended government economic policies. In short, there are both bright sides and dark sides for the international capital movement.

It is interesting to note that many countries have large capital inflows prior to financial crises. For example, the massive capital inflows in Mexico reached up to 9% of GDP before the 1994 exchange rate crisis. Also, in Thailand, Indonesia and Malaysia the massive capital inflows took place before the eruption of the financial crisis of 1997. So policy makers and economist alike are often concerned about the excessive capital inflows in developing countries. Some economists cast doubt about the sustainability of

[1]There are many reasons for the enormous capital inflows into some developing countries. International foreign investors believed that emerging economies had changed fundamentally and had a prospect for high expected rates of return. Some developing countries opened their capital accounts and pursued active capital inflow incentive policy measures. Also moral hazard and herding effects of the international commercial bank and domestic banks contributed to the large capital flows into several developing countries. See Lopez-Mezia (1999) for more details.

capital inflow. The frequent currency crisis experiences may be interpreted to further support the argument that excessive capital inflow caused the financial crisis.

Once capital inflows (which correspond to current account deficits) prove to be unsustainable, creditors or investors rush to withdraw their loans or their money from the country, which possibly precipitates a currency crisis. On the other hand, if the current account deficits are sustainable, then even countries with large capital inflows may continue to borrow from international financial markets in order to finance their current account deficits. Therefore the concept of excessive international capital movement is closely connected with excessive current account deficits.

Here the question is raised as to which amount of capital inflow is optimal or excessive. To the best of my knowledge, there is no formal definition regarding excessiveness of international capital flows. For example, Lopez-Mejia (1999) do a comprehensive survey on the large capital flows, and compared the ratio of cumulative capital flows to GDP across countries in the chosen period of significant capital inflows for selected countries. By descriptive comparisons, he judges how large the capital inflows are. Conventional wisdom is that the current account deficit and corresponding capital inflow above 5% of GDP are reasons for concern, particularly if the deficit is financed with short term debt.[2] However such a magnitude is based on rule of thumb and experiences in several countries rather than on optimization principles or economic reasoning.

The intertemporal model of the current account is useful for deriving the concept of the excessiveness of current account deficits and capital flows. International capital flows and current account deficits are two sides of the same phenomenon. Usually the current account deficit (surplus) requires capital to move in (out) on net. Obstfeld and Rogoff (1996) provide a review of models of the current account that are based on intertemporal optimization on the part of consumers and firms. The consumption-smoothing approach to the determination of the current account implies that current account imbalance and the accompanied international capital flows act as a buffer to smooth aggregate consumption in the face of temporary shocks to a economy. Such shocks alter the

[2]Refer to Milesi-Ferreti and Razin (1996).

intertemporal pattern of consumption, which generates current account imbalances and changes the demand for international capital flow. The optimal current account and optimal capital flow derived by the intertemporal approach could be used as a benchmark against which the current accounts and the capital inflows are compared to evaluate the excessiveness.

The standard intertemporal approach assumes complete capital mobility. But actually emerging market economies often have more or less capital controls, which impact economic situations such as the current account position. For example, Korea experienced chronic current account deficits prior to the mid 1980s. During the period of current account deficits, the Korean government pursued policy measures that were designed to attract foreign capital in order to finance the current account deficit, and at the same time restricted capital outflow. By contrast, during the period of current account surplus, active capital outflow policies are pursued while at the same time preventing capital inflows. The Korean government encouraged the capital outflow when the economy enjoyed large current account surpluses during the second half of the 1980s. These different policy reactions to the current account position are not unusual in developing countries. These facts suggest that the assumption of capital mobility needs to be revised in the intertemporal approach.

The aim of this paper is to investigate how the optimal current account can be measured and how excessiveness of capital flows is checked, under the framework of the intertemporal approach. The model will be set up both under perfect capital mobility and in the presence of capital controls. The optimal current account and international capital flow series are taken as a benchmark against which actual current account and actual capital flow can be compared and its excessiveness can be judged. This paper also examines whether capital inflows were excessive prior to the financial crisis in the East Asian countries in 1997.

Specifically, this paper uses the standard intertemporal model of current account model which has been popular, following works by Sheffrin and Woo (1990), Otto (1992), Agenor, Bismut, and Cashin (1999) and the revised intertemporal model with capital control as developed in Callen and Cashin (1999) and Adeledeji (2001). But this paper is different from previous research in several respects. First, I focus on the optimal level of capital flow as well as the

optimal current account, whereas the previous researches have dealt with the current account behavior and sustainability in an intertemporal perspective. Second I derive the optimal capital account series and compare with the actual capital flow to evaluate the excessiveness of capital flows. Previous researches examine whether capital mobility is excessive or not by comparing the actual current account with optimal current account, or by comparing the variance of current account. But such methods are indirect and have some problems. The actual capital movement is not exactly the same as the negative value of the current account imbalance. Therefore the actual capital account is a more appropriate measure of capital flows across the border. Finally this paper investigates the excessiveness of the current accounts and capital flows in the economies that experienced serious financial crisis in 1997. This is important in the sense that such analysis can contribute to our understanding of the reasons for financial crisis.

The paper is organized as follows. In section II, a brief survey of previous research is presented. In section III the basic model for the intertemporal approach to current account determination and international capital flows will be presented and the revised model with capital controls will be set up. In section IV, the empirical results will be presented. In section V, a summary and a conclusion are provided.

II. The Literature Survey

It is generally recognized that international capital flows have increased since the abolition of fixed exchange rate systems and adoption of capital account liberalization measures. Much research has been conducted for the purposes of measuring the degree of international capital mobility. The quantitative analysis of capital mobility was initiated by Feldstein and Horioka (1980). They measure international capital mobility by regressing the country's investment rate on the savings rate. They suppose that the coefficient on the savings rate ranges from 0 (under perfect capital mobility) to 1 (under no international capital mobility). Their empirical results show that the null hypothesis of no capital mobility cannot be rejected. Subsequent research show similar

results supporting imperfect capital mobility, though the coefficients in many cases are smaller than those of earlier studies. In contrast to Feldstein and Horioka's arguments, many studies show that perfect capital mobility does not imply a zero correlation between savings and investment.[3] To this day, Feldstein and Horioka's methodology remains controversial as a measure of the degree of international capital mobility.

Talyor (2002) examines the degree of international capital flow by checking the convergence speed of current account imbalances. Lower (higher) speeds of adjustment of the current account imply that capital has high (low) mobility. He shows that the convergence speed is very low at 0.31 (meaning a half life of 1.5 years) during the pre-1914 era, and that it subsequently rises to 0.74 under Bretton-Woods system and decreases again to 0.32 during the recent floating exchange rate period.

Ghosh (1995) proposes the variance of the current account as a means for measuring international capital mobility. His idea is that a low variance, relative to the benchmark value, could be interpreted as indicating low capital mobility. He constructs the optimal current account series and compares this with the actual current account series on the basis of the consumption smoothing model. His idea is that if international capital mobility is perfect, then the two series would be identical. The larger (smaller) variance of the actual current account than that of the optimal current account implies excessive (less) capital mobility. His empirical results show that capital flows in several industrial countries have been excessive in the sense that they are driven by speculative forces rather than by economic fundamentals.

The Intertemporal approach becomes standard in research on the

[3]Obstfeld (1986) shows that a positive domestic productivity shock will increase both investments and savings even though capital is perfectly mobile. The nontraded goods and immobile factors cause a positive relationship between savings and investment. Tesar (1991) shows that both demand shocks and supply shocks in nontradable goods leads to comovements of investment and saving under the assumption of nontraded goods. Thus the high correlation of saving and investment does not provide evidence of low capital mobility. Summers (1988) and Bayoumi (1990) show that current account policy targets provide the rationale for a positive correlation between savings and investment. Therefore a positive correlation between savings and investment does not, in itself, provide evidence against capital mobility.

determination of the current account and international capital flows. The intertemporal approach puts focus on the optimal saving decision of a representative household as it smoothes consumption. For example, a country experiencing a temporary fall in output would smooth consumption by borrowing in world capital markets, thereby running a current account deficit. In contrast, a country experiencing a temporary increase in output would save some of a increase in order to smooth consumption and lend in world capital markets, thereby running a current account surplus. There are many empirical research studies on the intertemporal model of the current account. Sheffrin and Woo (1990), Otto (1992), Agenor *et al.* (1999) are typical examples. They adopt present value tests in line with the methodology developed by Campbell and Shiller (1987). Sheffrin and Woo show that the intertemporal approach to the current account does a satisfactory job for Belgium and the United Kingdom, but fails in Canada and Denmark. Agenor *et al.* (1999) examine whether the intertemporal model could explain the actual current account and predict correctly the sharp turnaround in the current account for France. They also show that the variance of the actual current account is higher than that of the optimal current account, which implies excess volatility of capital flows.

Bergin and Sheriff (2000) take a look at the fact that the simple intertemporal current account model has often been found to work fairly well for large countries, while it tends to fail for many small countries. This is surprising, keeping in mind that the assumptions in the simple intertemporal approach are more appropriate for small countries. Small economies can borrow from the world capital market without changing global market interest rates. They propose that the reason why the simple model does not hold in small open economies might be due to the failure of the model to incorporate external shocks, which are common in small open economies. They incorporate external shocks such as the interest rate or real exchange rate in the model. They show that the country adjusts the current account in response to movements of the real interest rate in world markets. Their empirical work indicates that the extended model, which included the interest rate and the exchange rates, improves the fit of the current account relative to the simple model.

Callen and Cashin (1999) and Adeledeji (2001) examine the

intertemporal model in the presence of capital controls, and focus on the fact that many developing countries have capital inflow or outflow controls. Their idea is that in the case of capital controls, consumption smoothing is limited or asymmetric in response to temporary shocks to national cash flow. For example, when capital inflow control exists, the economy cannot access world capital market to smooth consumption in response to a temporary reduction in national cash flow, but it is able to respond to a temporary increase in national cash flow. In the presence of capital outflow controls, the economy takes a limited response to a temporary increase in national cash flow, but is able to smooth the consumption response to a decrease in national cash flow. Callen and Cashin (1999) take into account this asymmetric behavior to incorporate capital controls in the model. Capital movement is sometimes limited by international capital markets as well as by the government. Considering the fact that international capital markets are not willing to lend money to private agents in economies with serious macroeconomic or political instabilities, Adeledeji interprets capital inflow restriction as a constraint imposed by world capital markets rather than by governments. They find that the adjusted intertemporal model explains the actual current account movement fairly well in India and Nigeria.

In the next section, I set up the standard and revised intertemporal model of the current account and international capital flows which are adopted from Callen and Cashin (1999) and Adeledeji (2001) for the purposes of my empirical analysis.

III. The Models for the Optimal Current Accounts and Capital Flows

A. The Basic Model

The question as to whether current account imbalances and amount of capital inflows are at an optimal level can be answered within the context of intertemporal model. The intertemporal model of the determination of the current account or international capital flows focuses on the optimal saving decision of a representative household in the process of consumption smoothing in the face of shocks to the economy. The current account imbalance occurs as a means toward obtaining higher welfare through consumption

smoothing. Capital moves across countries in order to finance the current account imbalance.

The basic intertemporal model to the current account has been developed and applied in many areas since the early of 1990s.[4] The basic model for the intertemporal approach to the current account will be explained shortly. Consider a small open economy represented by a single infinitely lived agent. The small economy can borrow and lend freely in the international capital market at the world interest rate r. The net foreign asset (liability) accumulation, which is the current account, is equal to the saving investment balance of the economy. The representative consumer maximizes the expected lifetime utility subject to an intertemporal budget constraint.

$$U=\sum_{s=t}^{\infty}\beta^{s-t}E[U(C_s)] \tag{1}$$

E is the expectation operator and β is the subjective discount factor. The world interest rate is given by r. $U(\ )$ represents the time separable temporal utility function, which is subject to the condition that $u'>0$ and $u''<0$. The representative budget constraint is provided in (2).

$$b_{t+1}-b_t=rb_t+y_t-c_t-i_t-g_t \tag{2}$$

where b_t denotes the economy's stock of net external assets at the beginning of period t, and y_t, c_t, i_t and g_t stand for real GDP, real consumption, real investment, and real government consumption respectively. The representative consumer maximizes equation (1) subject to (2) and a transversality condition. When the utility function has quadratic form, then the optimal level of consumption c* is given by equation (3).[5]

$$\text{Letting} \quad \Theta\equiv\frac{\beta(1+r)r}{\beta(1+\beta)^2-1}$$

[4]Obstfeld and Rogoff (1996) is a good reference source for these.

[5]More details are available in previous research such as Ghosh (1995), Callen and Cashin (1999) and Adeldeji (2001). Strictly speaking, a small number should be added to the right hand term in order for equation (3) to hold.

$$c_t^* = \frac{r}{\Theta}\{b_t + (1+r)^{-1}E_t[\sum_{t=0}^{\infty}(1+r)^{-i}(y_{t+1} - i_{t+1} - g_{t+1})] \quad (3)$$

where Θ is a constant of proportionality reflecting the consumption tilting dynamics of consumption. If $\Theta = 1$, there is no consumption tilting effect. The deviation of Θ from 1 corresponds to consumption tilting toward the future ($\Theta > 1$) or the present ($\Theta < 1$). The current account movements associated with the consumption-tilting motive are not included in this context. Here the current account level associated only with consumption smoothing motive is defined as the optimal current account. The optimal current account path is expressed as follows;

$$CA_t^* = y_t + rb_t - i_t - g_t - \Theta c_t^* \quad (4)$$

Substituting the optimal consumption in (4) and using national cash flow ($z = y - i - g$), the optimal consumption path is derived as follows:

$$CA_t^* = -E_t \sum_{t=1}^{\infty}(1+r)^{-i}\Delta Z_{t+1} \quad (5)$$

The above optimal current account path shows that temporary shocks to national cash flow lead to a change in the current account. A country will run a current account surplus if its net output is expected to be falling temporarily in the future. In contrast, temporary positive shocks to national cash flow lead to a current account deficits. However, permanent shocks to national cash flow do not change the current account position, because such shocks have no effects on expected change in national cash flow.

Equation (5) implies that the current account imbalance plays a role as a buffer for consumption smoothing. Current account imbalance enables the future (present) output to be transferred to the present (future) consumption in response to shocks to national cash flow. During these adjustments, capital moves across countries.

How to test for the validity of the intertemporal approach to the current account will be examined next. To check if the intertemporal approach is valid, actual current account must be compared with the derived optimal current account. Here it must

be pointed out that actual current account includes both the consumption smoothing and the consumption-tilting motive. Here, for the purposes of comparison, only the consumption-smoothing component must be dealt with as mentioned above. The first step is to remove the time tilting component from the actual current account. The actual current account with the consumption-tilting motive excluded can be given by:

$$CA_t = y_t + rb_t - i_t - g_t - \Theta c_t \tag{6}$$

Θ is the cointegtating vector between national cash flow plus interest income on the outstanding external assets and national consumption. In order to compare this actual current account with the optimal current account, the optimal current account must be measured.

The estimation of the optimal current account is worth explaining. A direct test of equation (5) requires estimating the expected change in national cash flow. Campbell and Shiller (1987) show that the current account must incorporate all the information available to consumers regarding expected changes to output, investment and government spending (that is net cash flow). In another words, the consumption smoothing component of current account should be the best forecast of the present discounted value of the future changes in national cash flow. The current changes in net cash flow reflect the current and previous accounts. Therefore the expected changes in net cash flow can be got by estimating a bivariate autoregressive model of the current account balance and a change in national cash flow. The VAR model can be set up as equation (7) in the form of $W_t = AW_{t-1} + \varepsilon_t$, where $W_t = (\Delta Z_t, CA_t)'$, $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$ in the case of a first order VAR.[6]

$$\begin{bmatrix} \Delta Z_t \\ CA_t \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \Delta Z_{t-1} \\ CA_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \tag{7}$$

After iterating forward and taking expectation and using the fact that $E_t(W_{t+j}) = A^j W_t$, the consumption smoothing optimal current account is provided as follows:

[6]The p-order VAR form can be expressed in a similar way.

$$CA_t^* = -[1 \quad 0][A/(1+r)][I-A/(1+r)]^{-1}\begin{bmatrix} \Delta Z_t \\ CA_t \end{bmatrix} = BW_t \tag{8}$$

where $B = -[1\ 0]A/(1+r)[I-A/(1+r)]^{-1}$ and I is identity matrix. This expression holds as long as the variables in the VAR are stationary. B might be interpreted as the factor which transforms the future expected net cash flow and current account into the present values.

The capital flow is required to finance the current account imbalance resulting from the consumption smoothing behavior. Therefore the optimal capital flow position can be defined as the sum of opposite sign of actual current account position and the consumption tilting component of the current account $(1-\Theta)$. The optimal capital account (KA^*) can be expressed in (9)

$$KA_t^* = -CA_t^* + (1-\Theta)C_t \tag{9}$$

There are several methods to test for the intertemporal model of the current account. One is to check if the consumption-smoothing component of the actual current account is stationary. As equation (5) shows, if ΔZ_t is stationary as assumed, then the optimal current account is also stationary since it is a linear combination of stationary variables. Therefore the actual current account must be stationary in order for the actual current account to be equal to optimal current account. The second is to check if the current account Granger causes subsequent movement in national cash flow. Equation (5) implies that the current account Granger causes a change in future's national cash flow. The third method is to check the correlation of the actual current account and the optimal current account. The last formal way to test the intertemporal approach is to compare the actual current account with the optimal current account. This test can be done by the Wald test with the following restriction.

$$B = -[1\ 0][A/(1+r)][I-A/(1+r)]^{-1} = [0\ 1] \tag{10}$$

If the above restriction is consistent with the data, the optimal current account is equal to actual current account. Let $\widetilde{B}$ be the difference between the actual B and the hypothesized value (0,1).

Then $\widetilde{B}((\partial B/\partial A)V(\partial B/\partial A)')^{-1}\widetilde{B}'$ will be distributed chi-squared with the number of restriction (2), where V is the variance-covariance matrix of the underlying parameters in the VAR and $\partial B/\partial A$ is the matrix of derivatives of the B vector with respect to the underlying parameters in the VAR.

Cambell (1987) also shows that the restrictions implied by equation (10) can be formally tested by running a linear regression of the following form:

$$CA_t - \Delta Z_t - (1+r^*)CA_{t-1} = \alpha W_{t-1} + \xi_t \tag{11}$$

If the data are to be consistent with the restriction (10), the left hand side should be orthogonal to lagged values of *CA* and a change in *z*. This orthogonality means that the coefficients of the lagged current account should be insignificant.

B. The Revised Model with Capital Controls

The previous basic model assumes that capital moves freely across countries. But many developing countries have barriers to international capital flows. Therefore if the basic model does not explain the current account position, then capital controls can be considered. Callen and Cashin (1999) and Adedeji (2001) allowed for asymmetric behaviors on the part of economic agent in responding the temporary shocks to net cash flow. When international capital flow is imperfect, then there are some limitations to consumption smoothing behavior. For example, when negative shocks to current national cash flow take place, the future output must be converted into present consumption, causing capital inflow. But capital may not flow in because of the capital inflow control. A temporary positive shock to current national cash flow leads to a current account surplus, which requires capital to flow out. But the capital may not move out because of the existence of capital outflow controls. Therefore the consumption smoothing process may be limited because of capital controls.

This paper takes into account capital controls, following the way in which Callen and Cashin (1999) did. The smoothed consumption current account is divided into two parts, that is, positive and negative smoothed consumption current account because it has different reactions owing to capital controls. Specifically, capital

control can be incorporated in the following separated consumption smoothing current account expression.[7]

$$CA_t^p = D_t^p CA_t \quad \text{where } D_t^p = 1 \text{ (if } CA_t > 0) \; D_t^p = 0 \text{ (if } CA_t < (=) 0)$$
$$CA_t^N = D_t^N CA_t \quad \text{where } D_t^N = 1 \text{ (if } CA_t < 0) \; D_t^p = 0 \text{ (if } CA_t > (=) 0) \tag{12}$$

The variables ΔZ_t^p and ΔZ_t^N, are defined in a same way.[8] It is expected that the capital inflows control will limit the ability of agents to smooth consumption in response to temporary adverse shocks to national cash flow, so that no Granger causality will be present from CA_t^N to ΔZ_t^p, whereas CA_t^p will Granger cause future changes in national cash flow (ΔZ_t^N). In contrast to capital inflows control, capital outflow controls will limit the ability to smooth the consumption in response to a temporary positive shock to national cash flow.[9] So CA_t^p will not Granger cause future changes in national cash flow (ΔZ_t^N), whereas CA_t^N will Granger cause future changes in national cash flow (ΔZ_t^p).[10]

To derive the optimal current account series in the presence of capital controls, a four variable VAR of current and lagged changes in national cash flow and current and lagged values of the actual current account should be set up in a same way as in the basic model, except the fact $W = (Z_t^p, Z_t^n, CA_t^p, CA_t^N)'$.

Using the fact that $E_t(W_{t+j}) = A^j W_t$ (A is a 4×4 matrix of coefficient), an estimate of the optimal current account (denoted by CA^{**}: restricted optimal current account) in the presence of capital controls can be expressed as a nonlinear function of the VAR parameters:

$$CA^{**} = -[1 \;\; 1 \;\; 0 \;\; 0][\Psi/(1+r)][I - A/(1+r)]^{-1} = BW_t = [B_1 \;\; B_2 \;\; B_3 \;\; B_4]W_t \tag{13}$$

[7] More details are available in Callen and Cashin (1999) and Adeldeji (2001).

[8] $\Delta Z_t^p = D_t^p \Delta Z_t$ where $D_t^p = 1$ (if $\Delta Z_t > 0$) $D_t^p = 0$ (if $\Delta Z_t < (=) 0$)
$\Delta Z_t^N = D_t^N \Delta Z_t$ where $D_t^N = 1$ (if $\Delta Z_t < 0$) $D_t^p = 0$ (if $\Delta Z_t > (=) 0$)

[9] The extent of the limitation on transfers of consumption from the present to the future may be less serious than that from the future to the present because the resource can be stored.

[10] It should be pointed that current output can be converted into future consumption by storing even without lending to foreign countries. But this causes an inefficient resource allocation. So the positive current account position might not Granger cause the negative national cash flow.

where $B=-[1\ \ 1\ \ 0\ \ 0][\Psi/(1+r)][I-A/(1+r)]^{-1}$. If the actual current account moves in line with the optimal current account with the presence of capital outflow (inflow) controls, then $B_4=1$ ($B_3=1$).

The optimal capital flow (restricted optimal capital flows) can be calculated by using the restricted optimal current account and the consumption-tilting component of the current account in the same way as was done for the simple model as in equation (9). The other tests are done in same ways that are explained in the basic model.

IV. Empirical Results

The data are adapted from the World Bank development indicator CD-Rom and International Financial Statistic CD-Rom. All data are converted into real per capita terms by dividing nominal variables by GDP deflator and population. The actual current account is achieved by subtracting private consumption, government expenditure and investment from GNP. The annual data are limited to the period from 1960 to 1996. The real world interest rate is assumed to be 4% as in other research.[11] The empirical analysis is limited to the five Asian countries (Indonesia, Korea, Malaysia, the Philippines and Thailand), which experienced financial crisis in 1997.

In the first place, I will discuss the empirical results of the basic model. After that, the empirical works of the revised model will be investigated. Here the centerpiece of this empirical analysis is to set up the VAR with two variables such as the actual consumption smoothing current account and changes in national cash flow.[12] Since the variables entering the VAR must be stationary time series, the actual consumption smoothing current account and change in national cash flow must be stationary. The actual consumption smoothing current account is calculated by removing the consumption-tilting component from the actual current account. Stationarity of the actual current account requires cointegration between national cash flows and private consumption.

First, unit root tests for national cash flow and private consumption are done.[13] All the level variables are nonstationary

[11]Sheffrin and Woo (1990) and Agenor *et al.* (1999).

[12]The lag length of the VAR system is determined by the Akaike information or Schwarz criterion. In this manner, the lag number is chosen to be 2 for Korea and 1 in other countries.

TABLE 1

THE CONSUMPTION TILTING PARAMETER

Country	θ	Standard error
Korea	1.00	0.024
Indonesia	0.91	0.025
Malaysia	0.93	0.022
Philippines	0.96	0.007
Thailand	0.96	0.034

TABLE 2

GRANGER CAUSALITY TEST

Country	From current account to a change in national cash flow	From a change in national cash flow to current account
Indonesia	3.25 (0.05)	0.28 (0.75)
Korea	3.02 (0.06)	0.03 (0.96)
Malaysia	2.66 (0.08)	0.69 (0.50)
Philippines	5.81 (0.01)	0.86 (0.43)
Thailand	3.65 (0.03)	2.12 (0.13)

Note: ( ) denotes p-value.

and the first differenced variables are stationary. Since level variables are found to be nonstationary, the actual consumption smoothing current account can be constructed by examining the cointegration relationship between national cash flow and private consumption. Cointegration between two variables is a necessary and sufficient condition for the international budget constraint.[14] Since the two variables are cointegrated, the cointegration regression is estimated by the fully modified OLS (FM OLS). The estimated coefficient of the FM OLS regression is required to remove the consumption tilting parts from the actual consumption.[15]

The estimates of the consumption-tilting coefficient are shown in Table 1. Korea does not have a consumption tilting effect, because the null of unity for the coefficient cannot be rejected at a

[13]The unit root rest is available upon request.

[14]Taylor (2002) shows that stationarity of the current account is a necessary and sufficient condition for the intertemporal budget constraint.

[15]Agenor *et al.* (1999) is recommended for more details.

TABLE 3

THE CORRELATION BETWEEN ACTUAL CURRENT ACCOUNT AND OPTIMAL CURRENT ACCOUNT

Country	Correlation	Country	Correlation
Korea	0.980	Philippines	0.995
Indonesia	0.778	Thailand	0.996
Malaysia	0.996		

reasonable significance level. But countries other than Korea consumed more than the national cash flow, which is reflected in an estimated coefficient less than one.

First, empirical results for the basic model with perfect capital mobility will be examined. The results of the Granger Causality test are shown in Table 2. The current account Granger causes a change in national cash flow by the 10% significance level, whereas a change in national cash flow does not Granger cause the current account.

Next the optimal current account series (relative to per capital GDP) are calculated by equation (8). The optimal current accounts are shown in Figure 1. A casual glance reveals that actual current accounts are more volatile than the optimal current accounts in Malaysia and Indonesia. The current account position in Indonesia is worth explaining. In Indonesia, the consumption smoothing current account had been in surplus for a long time. The large consumption tilting effects are reflected in the lower estimated coefficient.

Next the correlation between the actual current account and optimal current account will be examined. The correlation is shown in Table 3. The correlation coefficient is very high in Korea, Malaysia, Philippines and Thailand. The correlation in Indonesia is 0.778, which is relatively low.

The formal test for the equality of the optimal current account to actual current account will be examined. This is checked by two methods as explained in the previous section. One is the Wald test and the other is the test for orthogonality between the regression variable and the regressors. The results of the Wald test are reported in Table 4. The null hypothesis is that actual current account series is equal to the optimal current account series. The

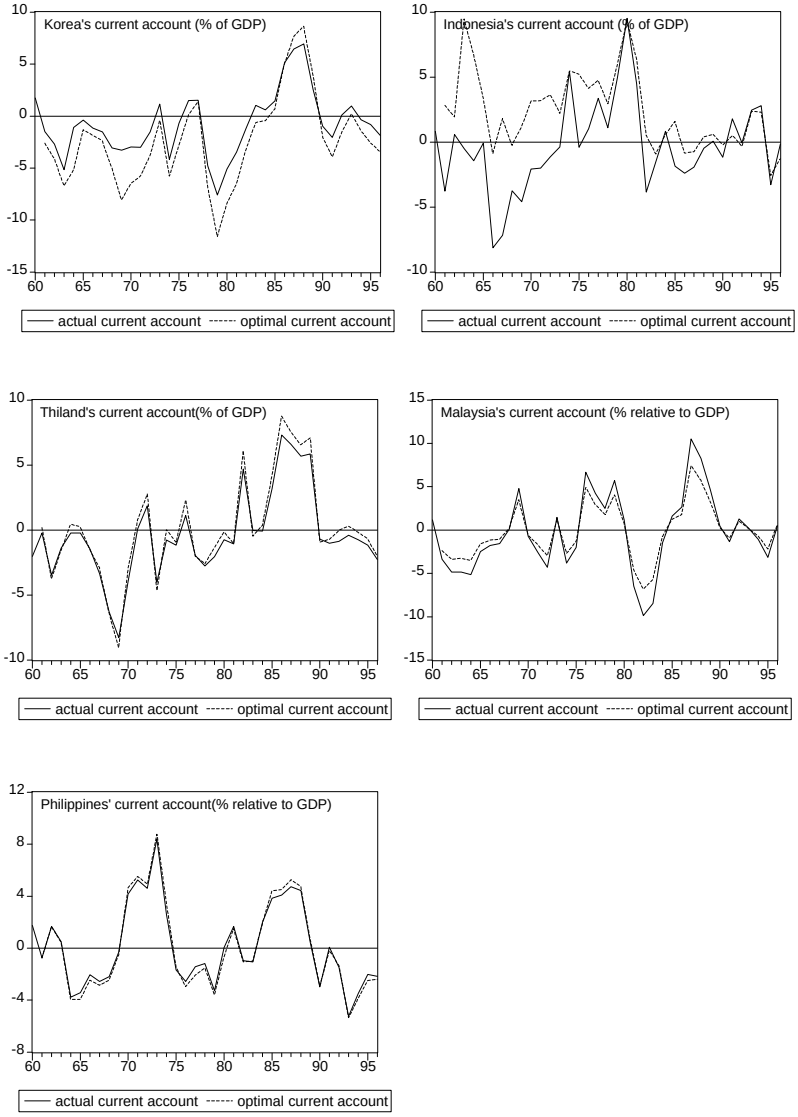

FIGURE 1

THE ACTUAL CURRENT ACCOUNT AND OPTIMAL CURRENT ACCOUNT WITH PERFECT CAPITAL MOBILITY

TABLE 4

WALD TEST IN THE CASE OF NO CAPITAL CONTROL

Country	$\chi^2(2)$	p-value
Indonesia	13.26	0.00
Korea	3.445	0.18
Malaysia	0.67	0.71
Philippines	0.43	0.82
Thailand	0.25	0.87

TABLE 5

THE REGRESSION RESULTS OF EQUATION (10)

	Korea	Indonesia	Malaysia	Philippines	Thailand
CA_{t-1}	-0.31	-0.93***	-0.17	-0.29*	0.069
	(-1.47)	(-3.94)	(-0.94)	(-1.84)	(0.21)
ΔZ_{t-1}	-0.01	-0.24	-0.07	0.06	0.10
	(-0.03)	(-0.87)	(-0.60)	(0.42)	(0.25)

Notes: 1) The dependent variable is $CA_t - \Delta Z_t - (1+r)CA_{t-1}$.
2) The number of ( ) denotes the t-value.
3) ***(*) denotes the 1% (10%) significance.

table shows that the null cannot be rejected in the four countries except in Indonesia. In Indonesia the null of hypothesis can be rejected significantly.

The results of orthogonality test by using regression equation in (10) are reported in Table 5. The regressors are the lagged variables of the current account and the change in national cash flow. The results of the regression are provided in Table 5. It is shown that the coefficient of the lagged current account is significant at the 1 % significance level for Indonesia. The significance of the lagged actual current account is consistent with the results of the Wald test in Indonesia. The coefficients on lagged variables in other countries are not significant, even though the coefficient on the lagged current account is significant at the 10% significance level. These results are compatible with the Wald test results. The formal test shows that the simple intertemporal model explains the actual current account fairly well in four countries, but not in Indonesia. Therefore the optimal current account series can be used as a benchmark against which the actual capital flow is evaluated in the four countries.

TABLE 6

GRANGER CAUSALITY TEST UNDER CAPITAL CONTROL IN INDONESIA

Direction	From negative current account to a positive change in national cash flow	From positive current account to a negative change in national cash flow
χ^2	9.17 (0.00)	0.65 (0.52)

Note: ( ) denotes *p*-value

TABLE 7

WALD TEST IN THE CASE OF CAPITAL OUTFLOW CONTROL

Country	χ^2	*p*-value
Indonesia	1.52	0.217

These empirical results indicate that the current account imbalance is not excessive in four countries (Korea, Malaysia, the Philippines and Thailand), in the sense that the actual current account series move closely with the optimal current account level.

The above results suggest that Indonesia had capital controls. Therefore the tests of the intertemporal current account model with capital controls will be examined for Indonesia, as explained in section III. First of all, Granger causality test will be examined (as shown in Table 6). The Granger causality tests show that the current account surplus does not Granger cause a negative change in national cash flow, while the current account deficits Granger cause a positive change in national cash flow These results imply that the there are some barriers to capital outflow in Indonesia whereas there are no barriers to capital inflows. So the restricted optimal current accounts in the presence of capital controls are calculated by equation (13). Those are plotted in Figure 2.

Table 7 shows the results of the Wald test with capital controls in Indonesia. The null hypothesis for the Wald test is that the actual current account is equal to the restricted optimal current account under the assumption of capital controls. The null cannot be rejected, which means that the actual current account moves in line with the restricted optimal current account subject to the capital control.

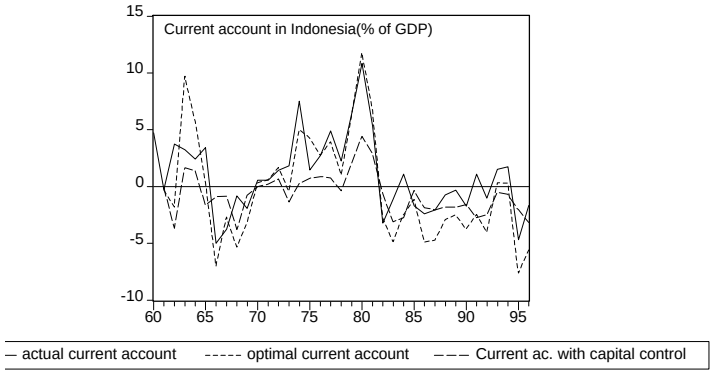

FIGURE 2
THE CURRENT ACCOUNT AND OPTIMAL CURRENT ACCOUNT SERIES WITH CAPITAL CONTROL IN INDONESIA

These empirical results show that the revised intertemporal model with capital control is valid in Indonesia. Figure 2 confirms that the actual current accounts move more closely with the restricted optimal current accounts than the optimal current account without capital control in Indonesia.

Now we will examine if the capital flows are excessive or not. The above results indicate that the optimal current accounts with no capital can be calculated as a benchmark in four countries (Korea, Malaysia, Thailand and the Philippines), whereas the restricted optimal current accounts are used in Indonesia. Then the actual capital flows will be evaluated against the optimal capital flows. It should be pointed out that the capital flows required to finance the consumption tilting effects are adjusted in checking whether the capital flows are excessive or not. Here the optimal capital inflows are defined as the capital flows that are required to finance the optimal current account imbalance.[16] The capital flows associated with the consumption tilting parts are excluded in actual capital

[16]This definition of optimal capital flow is very limited because capital flows also have other objectives such as risk diversification and pursuit of higher rates of return, rather than just financing the current account imbalance. However, taking into account that for the most part capital flows are related to the current account imbalance for developing countries, optimal capital flow is defined as in this context.

TABLE 8

THE COMPARISON OF ACTUAL CAPITAL FLOW AND OPTIMAL CAPITAL FLOW

Country	Correlation	Variance Ratio (actual and optimal capital flows)	Test for Mean Equality*
Malaysia	0.73	2.67	2.36 (0.02)
Philippines	0.60	1.27	1.78 (0.09)
Korea	0.87	1.67	1.09 (0.27)
Thailand	0.49	1.07	5.83 (0.00)
Indonesia	0.56	1.09	2.16 (0.04)

Notes: 1) * *t*-value for the mean equality.
2) The number of ( ) denotes the *p*-value.

flows, which will be compared with the optimal capital flows. Here all capital flows are expressed in terms of GNP for convenience of comparison. It is noted that the optimal capital flows in Indonesia are calculated under the assumption of capital controls. A rough look at Figure 3 shows that the actual capital flows in Thailand and Malaysia might be much larger than the optimal capital flow. But the actual capital flows in Korea seem to move closely in line with optimal capital flows. Here it is worthwhile to notice that the actual capital flows were larger than the optimal levels prior to the financial crisis.

Table 8 shows the analytical results of comparing actual capital flows with the optimal capital flow. First, the actual capital flow is highly correlated with the optimal capital flow in Korea with a correlation of 0.89 whereas the correlations in Thailand, Indonesia and Philippines are relatively low at under 0.60. The correlations appear compatible with the figure. The variance ratio of actual capital flows to optimal capital flows in Malaysia is much higher than that in any other country. This means that capital flows are so volatile in Malaysia.

Next we will examine the mean test for actual capital flows and optimal capital flows. Figure 3 indicates that actual capital flows are higher than optimal capital flows in most of countries. The null of equal means cannot be rejected in Korea. But the null of equal means can be rejected significantly in Malaysia, Thailand and Indonesia. It looks marginal in the Philippines. The null of equal means has a *p*-value of 9%. It is noted that the correlation coefficients is 0.60, which is lower than that in Malaysia.

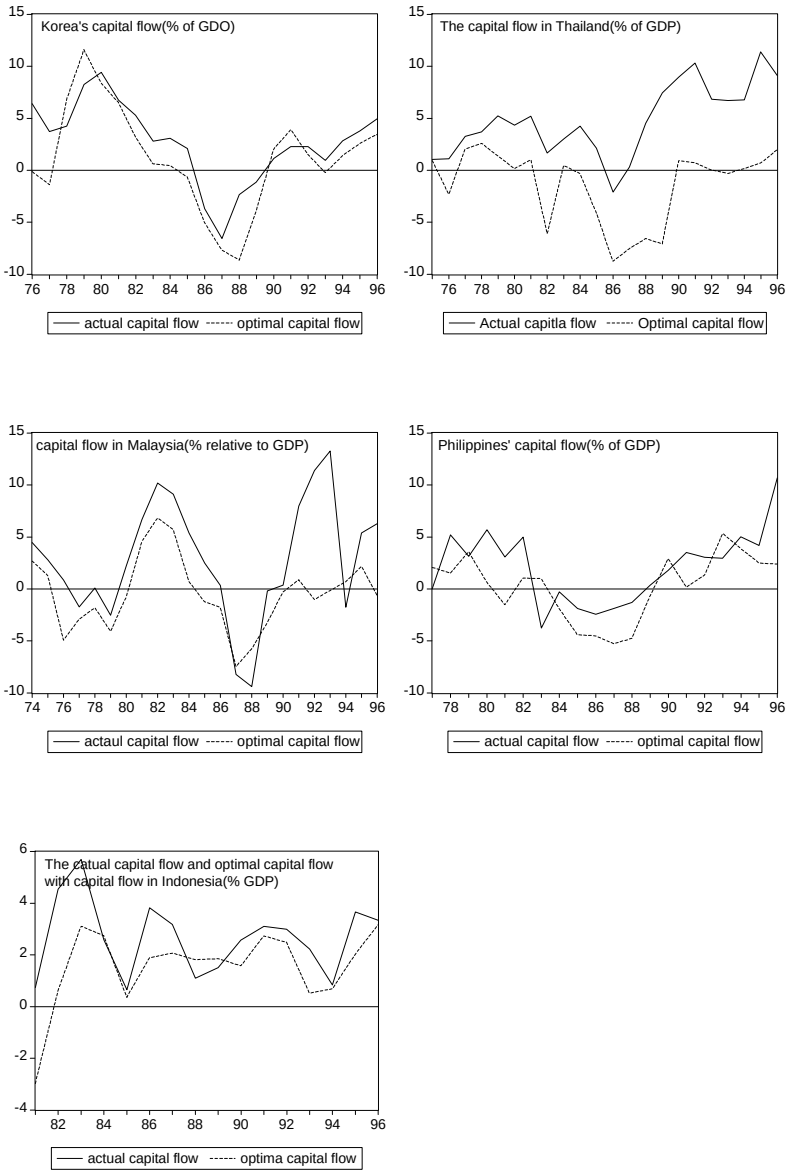

FIGURE 3

THE ACTUAL CAPITAL FLOW AND OPTIMAL CAPITAL FLOW

The above results enable us to conclude that Korea's capital inflows were not excessive prior to financial crisis. But excessive capital flow took place in Malaysia, Thailand and Indonesia. We can cautiously argue that capital inflows were excessive in the case of the Philippines.

These conclusions seem to be compatible with suggestions of several other researches even though the analyses are descriptive and informal. Lopez-Mejia (1999) suggests that the capital inflows into Malaysia, Thailand were too much, in the sense that the ratio of cumulative capital inflows to GDP came close to 50% prior to the financial crisis. Ito (1999) also argues that current account deficits and capital inflows were large in Malaysia, Thailand and Indonesia, whereas not too much in Korea. He suggests that Korea experienced the currency crisis by the contagion effect from the outside, unlike the other four countries. In addition, Radelet and Sachs (1998) also implies that the capital inflows in Thailand and Malaysia were too large to have beneficial effects on the economy by putting emphasis on the facts that those countries had more than 10% of GDP capital inflow prior to the financial crisis.

V. Conclusion

There are many research studies on the causes of financial crisis in East Asian countries in 1997. Many economists argue that the current account deficits and the accompanying international capital inflows were excessive prior to the financial crisis, which caused over-investment and inefficient use of resources. This paper examined the optimality of the current account and capital flows from the perspective of the intertemporal model both under perfect capital mobility and capital controls. I also checked if capital controls were present by examining the asymmetry of the response of the current account to a change in national cash flow. The optimal capital flows were derived from the optimal current account as a benchmark, against which the actual capital flows were compared to evaluate the excessiveness of capital flows.

The empirical results show that the current account imbalances in four countries (Korea, Malaysia, Indonesia and the Philippines) are not excessive in the sense that the actual current account moves closely with the optimal current account under the

intertemporal model with perfect capital mobility. The empirical works show that capital controls were present in Indonesia. The actual current accounts move in a similar way with the restricted optimal current accounts in Indonesia.

The empirical analyses show that the capital inflows into Korea were not too large in the sense that actual capital flows moved in the same manner as the optimal capital flows. However the capital inflows into Malaysia, Thailand and Indonesia seem to be too large in the sense that correlations between actual capital flow and optimal capital flows are low and the former are much larger than the latter in mean. In the case of the Philippines, it can be cautiously argued that capital inflows were excessive. It can be said that the excessive capital flows into Malaysia, Thailand and Indonesia might be related to the currency crisis in 1997. It is interesting to note that the actual capital inflow is much larger than the optimal level for some time just prior to the financial crisis in all countries, and in particular in Malaysia, Thailand and the Philippines.

I will finish this paper by remarks on the limitations and problems of this study. The most important problem is that definition of optimal capital flows is limited. The capitals move across countries not only in order to finance the current account imbalances, but also in pursuit of autonomous objectives, like risk diversification or higher rates of return. The intertemporal model that is used in this paper, does not account for such types of capital flows. Therefore the definition of optimal capital flows is required to be more refined. Next, our model does not incorporate external shocks such as interest rate or real exchange rate shocks. I will leave these problems and limitations to future research.

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