



Working Paper 02-01

# **Macroeconomic Effects of Capital Account Liberalization: The Case of Korea**

**Soyoung Kim · Sunghyun H. Kim · Yunjong Wang**

**KOREA INSTITUTE FOR  
INTERNATIONAL ECONOMIC POLICY**

# Macroeconomic Effects of Capital Account Liberalization: The Case of Korea<sup>+</sup>

Soyoung Kim<sup>\*</sup>

University of Illinois at Urbana-Champaign

Sunghyun H. Kim<sup>\*\*</sup>

Tufts University

Yunjong Wang<sup>\*\*\*</sup>

Korea Institute for International Economic Policy

Current Draft: February 2002

**Abstract:** The macroeconomic effects of capital account liberalization in Korea are examined. Simple data analysis suggests that capital account liberalization substantially changed the nature and composition of capital flows. Based on the VAR model, we find the following stylized facts: First, after capital market liberalization, capital flows become less driven by current account imbalances and therefore become more autonomous. Second, capital account liberalization significantly changes the effects of capital flows on macroeconomic variables. Third, capital account liberalization is highly related to consumption and investment booms, and subsequent appreciation of nominal and real exchange rates, which leads to the current account worsening. Finally, we find strong evidence of sterilized foreign exchange market intervention in response to capital inflows.

---

<sup>+</sup> This paper is based on our earlier study, *Capital Account Liberalization and Macroeconomic Performance: The Case of Korea*, published by Korea Institute for International Economic Policy.

<sup>\*</sup> Department of Economics, University of Illinois at Urbana-Champaign, DKH, 225b, 1407 W. Gregory Drive, Urbana, IL 61801. E-mail: kim11@uiuc.edu.

<sup>\*\*</sup> Department of Economics, Tufts University, Medford MA 02155. E-mail: Sunghyun.Kim@tufts.edu.

<sup>\*\*\*</sup> KIEP, 300-4 Yomgok-Dong, Socho-Gu, Seoul, Korea 137-747. E-mail: yjwang@kiep.go.kr.

## 1. Introduction

Many emerging market economies have relaxed and removed statutory restrictions on capital account transactions and liberalized domestic financial markets to capture the benefits of capital inflows. However, in a number of cases, capital account liberalization and ensuing capital surges seem to be associated with financial crises. We also observe that, following capital account liberalization, many countries experience so-called “boom-bust cycles.”<sup>1</sup> Then, does capital account liberalization necessarily lead to financial crises or boom-bust cycles? This question has significant policy implications for developing countries under the process of capital account liberalization. In order to answer this question, it is necessary to understand how capital account liberalization affects the dynamics of domestic macroeconomic variables. However, despite its importance, this issue has not been explored much in the literature, as authoritatively suggested by Eichengreen and Mussa (1998) surveying the related studies.<sup>2</sup>

This paper examines the effects of capital account liberalization on domestic macroeconomic variables, using the data of Korea. As an estimation method, we employ the VAR (vector auto-regression) method that allows us to derive detailed dynamic statistical evidence of the macroeconomic effects of capital account liberalization. The Korean economy provides a unique example because of the series of capital account liberalization policies undertaken throughout the 1990s and the experience of financial crisis in 1997. Even after the financial crisis, Korea continued to relax capital account restrictions as well as domestic financial market restrictions. These economic experiences of Korea supply a good data set to examine the effects of capital account liberalization on macroeconomic performance.

---

<sup>1</sup> Boom-bust cycles following capital inflows imply an initial surge in investment and asset bubbles, followed by capital outflows and recession.

<sup>2</sup> Eichengreen and Mussa (1998) note that there has been no systematic study that links capital account and financial market liberalization and macroeconomic performance. Most previous works have focused on different aspects of liberalization or were based on informal analysis. De Gregorio, et al. (2000) examined whether capital controls were successful by analyzing the nature of capital flows, without further addressing the general macroeconomic effects. Montiel (1996), Calvo, et al. (1996), and Antzoulatos (1996) used historical data analysis and informally examined the macroeconomic effects of capital inflows. Others such as Alesina, et al. (1994), Grilli and Milesi-Ferretti (1995), Eichengreen, et al. (1996), and Rodrick (1997) used cross-sectional regressions to analyze the effects of capital account liberalization on macroeconomic performance. Though cross-sectional studies may provide a long-run perspective on the issue, they provide limited insights on short-run and medium-run dynamic aspects for a specific country.

As a preliminary step, we review the history of Korea's capital account liberalization policies and examine the statistical properties of capital flows in the 1980s and 1990s using time-series data of balance of payments accounts. In particular, we investigate whether the nature and composition of capital flows changed after capital account liberalization.<sup>3</sup> We find that as the capital market liberalized during the 1990s, the capital account became less dependent on the current account and the autonomous part of the capital account movement increased. Moreover, the composition of capital flows significantly changed from the 1980s to the 1990s. These results suggest that Korea's capital account liberalization policy substantially influenced the nature and composition of capital flows.

Next, we formally examine the macroeconomic effects of capital account liberalization with a focus on the following aspects. First, are the macroeconomic effects of capital flows different before and after capital account liberalization? Second, what are the detailed effects of autonomous capital flow shocks on macroeconomic variables during the 1990s when the capital market was substantially liberalized? In particular, we examine whether the effects are consistent with so-called "boom-bust cycles." Third, did the government take policy actions to mitigate the effects of capital flows? For example, we investigate whether there were any foreign exchange market interventions, and if so, whether the intervention was sterilized.

We find that the effects of capital flows on the economy are significantly different before and after capital account liberalization. During the 1990s, capital account shocks are associated with more volatile movements in macroeconomic variables. During this period, Korea experienced consumption and investment booms, a real exchange rate appreciation, and current account deficits as a result of capital inflows, which is consistent with the main characteristic of the boom-bust cycles. We also find significant evidence of sterilization policy during the period of capital inflows.

The rest of the paper consists of the following sections. Section 2 summarizes the history and implications of Korea's capital account liberalization policies in the 1980s and 1990s. We also examine whether the capital account liberalization policy was

---

<sup>3</sup> We use the year 1990 to divide the period before and after capital account liberalization. Details for this classification are explained in Section 2.

successful, and if so, in what aspects. Section 3 analyzes the empirical issues using the VAR method. Section 4 concludes the paper and discusses the implications.

## **2. Capital Account Liberalization and Capital Flows in Korea**

### ***2.1 Liberalization in the 1980s***

Throughout the 1980s, the policy of the Korean government on capital flows was residual; developments in the current account balance dictated the government's interventions in the foreign exchange market and transactions related to capital account (Johnston et al., 1997; Park, 1995; Park and Song, 1998). Under the pegged exchange rate system, current account balances were determined autonomously. Then, policies on capital flows were used to accommodate the overall balance of payments. Therefore, the overall balance fluctuates around net zero balance and the current account and capital account move in opposite directions (see Figure 1).<sup>4</sup>

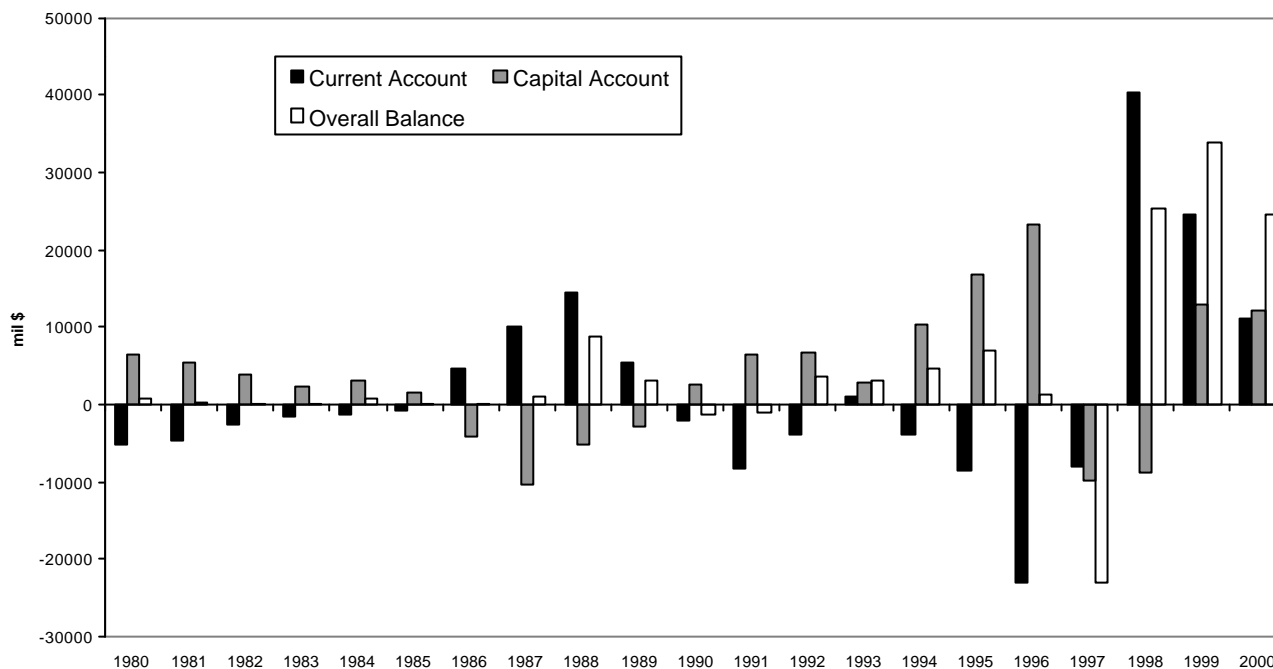
In the first half of the 1980s, the current account continued to record deficits, although the size of the deficit was steadily declining. For the purpose of financing the current account deficit, the Korean government undertook several measures to liberalize capital inflows, while tightening regulations on capital outflows, mainly by restricting residents' overseas investment. In particular, foreign investors were allowed to participate in the Korean stock market through investment trust funds set up exclusively for them.<sup>5</sup> In 1985, Korean firms were permitted to raise foreign capital by issuing overseas convertible bonds, bonds with subscription warrants, and depository receipts. As a result of liberalization measures on capital inflows, Korea saw significant net capital inflows (see Figure 1).

---

<sup>4</sup> The only exception was several quarters in 1988 in which the current account surplus was not fully compensated by capital account deficits.

<sup>5</sup> The Korea Fund, organized under the United States law and listed on the New York Stock Exchange, was launched in 1984. Other international trust funds followed, including the Korea Europe Fund (based in Guernsey and listed in London) in 1987 and the Korea Asia Fund (based in the Cayman Islands and listed in Hong Kong and London) in 1991.

Figure 1. Balance of Payments Accounts



Data Source: *IFS*, IMF.

In the second half of the 1980s, however, external balances started to change directions. The current account recorded a surplus, which continued to grow until 1989.<sup>6</sup> Foreign exchange reserves, only \$2.8 billion at the end of 1985, reached \$15 billion by the end of 1989. In order to reduce excessive foreign exchange holdings and maintain export competitiveness, the government dramatically changed its policy stance toward capital flows by re-imposing direct controls on capital inflows as well as easing restrictions on capital outflows. The government undertook various measures aimed at reducing capital inflows. Such measures include encouraging the early repayment of external borrowing, tightening the regulations on foreign commercial loans and foreign bank borrowing, and imposing restrictions on the volume of foreign exchange that could be brought in and sold to domestic banks (Johnston et al., 1997). On the other hand, all restrictions on residents' overseas direct investment below \$1 million were abolished in

<sup>6</sup> This surplus partially resulted from external factors, such as the recovery of the world economy and the rapid appreciation of the Japanese yen, which improved the competitiveness of Korean exports.

1987 and residents were permitted to purchase foreign real estate for bona fide business purposes in 1988.

## ***2.2 Liberalization in the 1990s Prior to the Crisis***

Several steps were taken to further liberalize capital flows. In 1988, the Korean government formally accepted the obligations of Article VIII, Section 2-4 of the IMF's Articles of Agreement and abolished its remaining restrictions on payments and transfers for current account transactions. In March 1990, the Korean government adopted a variant of a managed floating exchange rate regime, which allowed for a more market-based determination of the exchange rate.

The current account balance started to deteriorate again because of rising inflation, real appreciation of the Korean won, and recession of the world economy. The current account deficits reached \$8.7 billion in 1991. Facing difficulties in financing the mounting current account deficit, the government encouraged capital inflows by amending the Foreign Exchange Management Act (FEMA) in 1991 (Park, 1995). More importantly, effective from January 1992, nonresidents were allowed to directly purchase Korean stocks up to three percent of the outstanding shares of each company per individual, but no more than ten percent of a company in total.<sup>7</sup> Furthermore, the Korean government in June 1993 announced a blueprint for financial liberalization and opening of the financial sector, which aimed at substantial progress in the deregulation of domestic financial markets.<sup>8</sup>

The government also took several steps to liberalize capital outflows. Residents' overseas direct investment was significantly liberalized and domestic institutional investors were allowed to invest in foreign securities without any restrictions as of February 1994. The main liberalization policy was also unveiled in 1994 as the Korean government set up a new Foreign Exchange System Reform Plan (Park, 1995). The Plan attempted in three stages to completely liberalize current and capital account transactions

---

<sup>7</sup> Total ceiling was gradually raised up to 23 percent in May 1997 (completely lifted in May 1998).

<sup>8</sup> The plan envisaged further easing of requirements for foreign exchange transactions, widening the daily won-dollar trading margins, expanding limits on foreign investment in the stock market, and permitting long-term commercial loans.

with a few exceptions and to develop an efficient foreign exchange market over a five-year period.<sup>9</sup>

All these liberalization policies contributed to large inflows of foreign capital in the 1990s. Portions of the capital inflows were used to finance accumulated current account deficits. The current account temporarily improved in 1993 but started to show significant deficits from 1994 until the Asian crisis in 1997.<sup>10</sup> In the 1990s, specifically from the mid-1990s, the capital account started to reflect the autonomous movement of capital not used for financing the current account imbalances. As a consequence, the overall balance started to show a surplus (see Figure 1).

### ***2.3 IMF Program and Further Liberalization***

During the Asian crisis period, foreign capital moved out of Korea at a rapid pace (capital flight), and the capital account showed deficits of up to US\$8.3 billion in 1998. The overall balance also showed deficits. As a result of the crisis, the current account sharply improved and moved into the surplus zone. Surplus in the current account contributed to an accumulation of foreign reserves in 1998.

As regards capital account liberalization, the Korean government aimed for a far more extensive capital market opening than what had been agreed with the IMF. A variety of policies to induce foreign capital in an attempt to overcome the currency crisis were developed, and measures for capital account liberalization were undertaken.<sup>11</sup> To attract foreign direct investment, all institutional restraints on the takeovers and acquisitions of domestic firms by foreign investors, including hostile M&As, were completely abolished. Thirty additional industries, including insurance and leasing, were opened to foreigners in 1998.

---

<sup>9</sup> Despite a series of capital account liberalization measures, the Korean government maintained a gradual approach. For example, the opening of the domestic bond market was given special attention because interest rate differentials were still large.

<sup>10</sup> The amount of current account deficit reached beyond US\$23 billion in 1996. However, as a percentage of GDP, the amount of deficit was below five percent, which is similar to the amount of surplus in 1988.

<sup>11</sup> All regulations on foreign purchase of debt securities were eliminated in December 1997. Limits on the individual shareholdings of foreigners were lifted completely in May 1998. All the short-term money market instruments, such as commercial paper and trade bills, were also completely liberalized at the same time.



Moreover, the Korean government adopted a free-floating exchange rate regime.<sup>12</sup> Continued current account surplus and accumulation in foreign reserves enabled the central bank to relax most restrictions on foreign currency transactions. The new Foreign Exchange Transactions Law passed in April 1999 adopted a negative list system, which allows all capital account transactions except for those expressly forbidden by law. The new system also liberalized foreign exchange and capital account transactions by individuals in addition to further streamlining the remaining restrictions on foreign exchange transactions by corporations and financial institutions.

As Korea recovered from the crisis, the capital account started to show a surplus from the second half of 1998. It is important to note that after the crisis the financing role of the capital account for any current account imbalances has further decreased. That is, the capital account does not necessarily move in the opposite direction to the current account. In fact, both current and capital accounts exhibited surpluses in 1999 and 2000. The autonomous characteristics of the capital account resulting from capital flows in private and public sectors have become more conspicuous.

#### ***2.4. Components of Capital Account***

The components of the capital account have also changed over time.<sup>13</sup> Figure 2 shows the time-series graphs of balances (credit minus debit) of each component of the capital account. The most interesting feature is the movement of portfolio investment. During the 1980s, the portfolio investment constituted only a small part of the capital account. However, during the 1990s, portfolio investment surged and became the most important component in the capital account. Other investment occupied substantial parts of the capital account both in the 1980s and 1990s, though its relative importance became significantly smaller in the 1990s. Foreign direct investment was not volatile for the whole period compared to the other two components of the capital account. Overall,

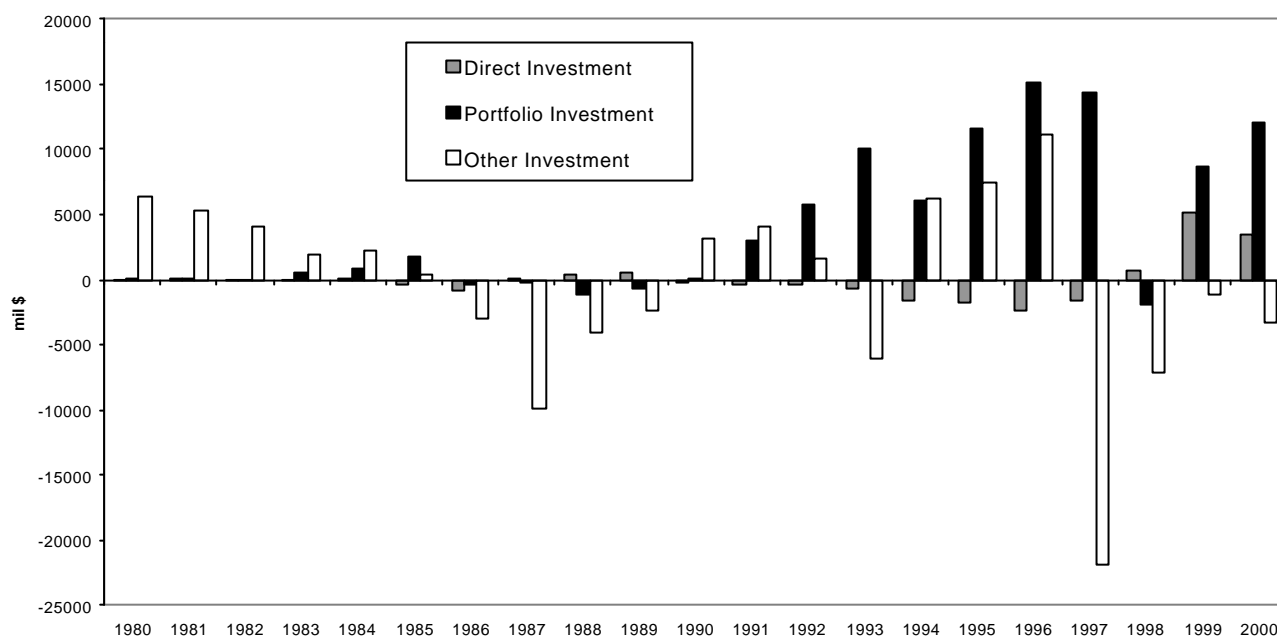
---

<sup>12</sup> Korea widened its won trading band from 2.25 percent to 10 percent on November 19, 1997, and finally abolished its band and allowed the won to float on December 16, 1997.

<sup>13</sup> The capital account consists of direct investment, portfolio investment, financial derivatives and other investment. Direct investment includes cross-border transactions of equity capital, reinvestment earnings and other capital apart from exceptional financing such as debt-for-equity swaps. Portfolio investment mainly includes equity and debt transactions. Other investment covers transactions in currency, loans and trade credits.

capital account liberalization substantially changed the composition of the capital account by increasing the portion of portfolio investment.

<Figure 2> Components of Capital Account



Data Source: *IFS*, IMF.

### 3. Empirical Analysis

In this section, we use the VAR analysis and perform formal empirical analysis on several observations on capital account liberalization as discussed in the previous section. As a preliminary step, we examine the basic properties of capital flows before and after capital account liberalization and test whether capital account liberalization was effective in changing the nature of capital flows. In particular, we test whether the capital account (or capital flows) becomes less dependent on current account movement and more autonomous during the 1990s when the capital market becomes more liberalized.

Next, we address the interrelation between capital flows and macroeconomic variables. In particular, based on the empirical evidence of the 1990s, we examine whether macroeconomic variables respond to autonomous capital flow shocks created by capital account liberalization and if so, how.<sup>14</sup> We also investigate whether the macroeconomic data follows the boom-bust cycle pattern after capital account liberalization. Empirical evidence on foreign exchange intervention and sterilization policy in reaction to capital inflows is presented toward the end of the section.

Based on the history of capital account liberalization summarized in Section 2, the whole sample period (1980-1999) is divided into two sub-periods: the 1980s in which severe capital account restrictions were imposed and the 1990s in which capital account liberalization gradually got under way. By comparing the empirical results of the 1980s with those of the 1990s, we infer how capital account liberalization affects the nature of capital flows and the relationship between capital flows and macroeconomic performance.<sup>15</sup>

The econometric framework that we employ requires some degree of economic stability during the sample period. However, during the Asian crisis period in the late 1990s, the economy behaves substantially differently from the non-crisis period. Therefore, we omit the crisis period (from the third quarter of 1997 to the first quarter of 1998) from our sample period. Therefore, the three sub-sample periods that we use are:

- (a) 1980-1989,
- (b) 1990-1999 (without the crisis period), and
- (c) 1990-1997 (2<sup>nd</sup> quarter).

We use quarterly data for the estimation due to the non-availability of some data in monthly frequency.<sup>16</sup>

---

<sup>14</sup> Autonomous capital flow shocks are defined as the autonomous component of the capital account that is not related to current account imbalances.

<sup>15</sup> As discussed in Section 2, the exchange rate regime changes in 1990. Therefore, some differences in empirical results between pre- and post-liberalization periods may reflect the differences in the exchange rate regime, in addition to the differences in the degree of capital account liberalization.

<sup>16</sup> Results based on monthly data (available upon request) show that most results based on quarterly data are robust.

### 3.1. Vector Auto-Regression Model

The economy is described by a structural form equation

$$(1) \quad G(L)y_t = e_t$$

where  $G(L)$  is a matrix polynomial in the lag operator  $L$  (the diagonal elements of  $G(0)$ , contemporaneous structural parameter matrix, are 1's),  $y_t$  is an  $n \times 1$  data vector, and  $e_t$  is an  $n \times 1$  structural disturbance vector.  $e_t$  is assumed to be serially uncorrelated with  $\text{var}(e_t) = \mathbf{L}$ .  $\mathbf{L}$  is a diagonal matrix where diagonal elements are the variances of structural disturbances, which means that structural disturbances are assumed to be mutually uncorrelated.

We can estimate a reduced form equation

$$(2) \quad y_t = B(L)y_t + u_t$$

where  $B(L)$  is a matrix polynomial (without a constant term) in the lag operator  $L$  and  $\text{var}(u_t) = \mathbf{S}$ . Note that  $\mathbf{S}$  may not be a diagonal matrix and the reduced form residuals may be correlated with each other. For simplicity, we ignore a constant term and seasonal dummies both in the reduced form and the structural form equations.

There are several ways of recovering the mutually uncorrelated structural shocks  $e_t$  and structural parameters  $G(L)$  from the estimated reduced form parameters  $B(L)$  and the reduced form residuals  $u_t$ . In this paper, we use a popular method suggested by Sims (1980), orthogonalizing reduced form residuals by Cholesky decomposition. This method assumes that contemporaneous structural parameters have recursive structures. That is,  $G(0)$  is assumed to be a lower triangular matrix. Further, the structural shocks are assumed to be recursive, shown as

$$(3) \quad e_t = G(0)u_t$$

Since  $G(0)$  is a lower triangular matrix, a recursive structure exists between structural shocks and reduced form residuals.

From equation (3), we can obtain another representation that shows how structural shocks are constructed from the reduced form residuals.

$$(4) \quad u_t = (I - G(0))u_t + e_t$$

Since  $I - G(0)$  is a lower triangular matrix without diagonal elements, the first element of the structural shock is equal to the first element of the reduced form residuals. The second element of the structural shock is constructed as part of the second element of the reduced form residuals that is orthogonal to the first element of the reduced form residuals (or the structural shocks), and so on.<sup>17</sup>

### 3.2 *The Nature of Capital Flows*

Using the VAR model, we first examine how capital account liberalization affects the nature of international capital flows. In particular, we expect that capital account movements are governed by current account imbalances in the 1980s, while in the 1990s, they are more likely to be autonomous. We construct a two-variable VAR model that includes the current account and the capital account. We assume that the current account is contemporaneously exogenous to the capital account and obtain the following interpretation of the structural shocks.<sup>18</sup> In this model, the relationship between the reduced form residuals and structural shocks based on equations (3) and (4) is<sup>19</sup>

$$(5) \quad \begin{bmatrix} e_{CA} \\ e_{KA} \end{bmatrix} = \begin{bmatrix} g_{11} & 0 \\ g_{21} & g_{22} \end{bmatrix} \begin{bmatrix} u_{CA} \\ u_{KA} \end{bmatrix} \quad (e_t = G(0) u_t)$$

---

<sup>17</sup> Refer to Chapter 11 of Hamilton (1994) and Sims (1980) for the details of the methodology.

<sup>18</sup> It is not easy to justify the identifying assumption using economic structure, because capital account movements may also affect the current account within one period through some macro-variables such as exchange rate. Therefore, it is better to interpret the identifying assumption as definitional. That is, the identifying assumption itself defines the nature of the shock.

<sup>19</sup> Note that  $e$ 's are mutually uncorrelated structural shocks and  $u$ 's are reduced form residuals that can be interpreted as unexpected movements given history.

$$(6) \quad \begin{aligned} u_{CA} &= e_{CA} & (u_t = (I-G(0))u_t + e_t) \\ u_{KA} &= -g_{21}u_{CA} + e_{KA} \end{aligned}$$

where both CA (current account) and KA (capital account) are included as the ratio to the trend GDP.<sup>20</sup> A constant term and complete seasonal dummies are included, with four lags assumed.<sup>21</sup>

The structural shocks to the current account are constructed as its own residuals or unexpected movements of the current account, while the structural shocks to the capital account are constructed as the unexpected movements of the capital account that are orthogonal to the unexpected movements of the current account. Therefore, the current account shocks in this system represent all of the unexpected current account movements, while the capital account shocks represent the autonomous shocks to the capital account, in the sense that they are not related to unexpected current account movements.

Table 1 reports the forecast error variance decomposition of the capital account. In the 1980s, 40-45 percent of capital account movements are explained by current account shocks. However, the role of current account shocks decreased sharply in the 1990s (20-28 percent). By the same token, capital account movements are explained more by their own shocks (or autonomous capital account shocks) in the 1990s (71-79 percent) than in the 1980s (54-59 percent). These results support the claim that the autonomous parts of capital account movements that are not related to financing current account imbalances increased from the 1980s to the 1990s with capital account liberalization.<sup>22</sup>

---

<sup>20</sup> We use an exponential trend on the GDP level (or a linear trend on the log level of GDP). Both variables are denominated in U.S. dollars.

<sup>21</sup> We adopt the Bayesian inference, which is not subject to conventional criticism in the presence of unit root and cointegration. Refer to Sims (1988) and Sims and Uhlig (1991). We also experimented with log level of the variables but results were qualitatively unchanged.

<sup>22</sup> As mentioned in footnote 18, we should be cautious in interpreting the results considering the potential contemporaneous effects of capital account on current account movements. A more precise statement for the results in table 1 can be that the autonomous parts of (unexpected) capital account movements that are not “correlated with” (unexpected) current account movements increased from the 1980s to the 1990s.

*Table 1. Forecast Error Variance Decomposition of Capital Account (Quarterly Data)*

	Horizon\ period	1980s	1990s, w/o Crisis	1990-97:2
Current Account Shocks	2 quarters	40.3 (12.2)	20.8 (11.4)	20.7 (12.2)
	4 quarters	43.8 (12.3)	24.2 (12.1)	20.6 (12.3)
	8 quarters	45.6 (13.9)	28.2 (12.9)	25.4 (13.1)
Capital Account Shocks	2 quarters	59.7 (12.2)	79.2 (11.4)	79.3 (12.2)
	4 quarters	56.2 (12.2)	75.8 (12.1)	79.4 (12.3)
	8 quarters	54.4 (13.9)	71.8 (12.9)	74.6 (13.1)

*Note: Numbers in the table represent the degree to which current account or capital account shocks explain movements of capital account in percentage terms. Numbers in the parentheses are standard errors.*

### **3.3 Effect on Macroeconomic Variables**

We use the expanded VAR model to analyze how autonomous capital flow shocks affect macroeconomic variables. We first compare the results from the 1980s data with those from the 1990s and then infer the effects of capital account liberalization and the resulting capital flow shocks on the macroeconomic variables using the results from the 1990s when the capital account was liberalized. Considering the low degree of freedom due to the small sample size, only three variables are included in each model. In each model, the data vector is {CA, KA, X} in which contemporaneously exogenous variables are ordered first and X is a macroeconomic variable of interests including output, price, exchange rate, interest rate, and money.

The ordering of the variables implies the following relationship between reduced form residuals and structural shocks.

$$(7) \quad \begin{bmatrix} e_{CA} \\ e_{KA} \\ e_X \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ g_{21} & 1 & 0 \\ g_{31} & g_{32} & 1 \end{bmatrix} \begin{bmatrix} u_{CA} \\ u_{KA} \\ u_X \end{bmatrix} \quad (e_t = G(0) u_t)$$

$$(8) \quad \begin{aligned} u_{CA} &= e_{CA} \\ u_{KA} &= -g_{21}u_{CA} + e_{KA} \\ u_X &= -g_{31}u_{CA} - g_{32}u_{KA} + e_X \end{aligned} \quad (u_t = (I-G(0))u_t + e_t)$$

We order the contemporaneously exogenous variable (CA) first. As in the two-variable VAR model, structural shocks to the capital account are constructed by their own residuals that are orthogonal to current account shocks.<sup>23</sup> Each variable is used in the logarithm form, except for the interest rates that are used in the level forms and the current and the capital accounts that are used as the ratio to the trend GDP.

Figure 3 reports the impulse responses and 95 percent probability bands of National Income Accounting components to capital account shocks, including capital account, current account, real GDP, consumption, and investment over three years in each sub-period. The scale represents percentage changes. Interestingly, the response of real GDP is substantially different in the 1980s and 1990s. Positive capital account shocks (capital inflows) substantially increase output in the 1990s but not in the 1980s. In the 1980s, output tends to decrease slightly for the first year after capital inflow shocks, which seems to be due to a current account deficit. In the 1990s, consumption and investment booms contribute to the substantial output increase.

---

<sup>23</sup> When constructing capital account shocks, we do not condition on unexpected changes in macroeconomic variables in order to construct consistent data for capital account shocks. If we construct capital account shocks as orthogonal to unexpected changes in macro-variable X, then the nature of capital account shocks may differ substantially across models with different macroeconomic variables. It can be controversial to interpret the empirical results in terms of a causality relationship due to the difficulty in justifying the ordering of the variables from the economic structure per se. Therefore, it is safe to state that the empirical results in this paper represent the general relationship between capital flows and macroeconomic variables, or simultaneous and mutual changes in the two variables, rather than the causal relationship from capital flows to macroeconomic variables. For example, if investment increases in response to capital account shocks, we may interpret that investment demand induces capital flows or investment and capital flows are positively related rather than that capital inflows cause investment increases.



Figure 3. Impulse Responses of NIA Components

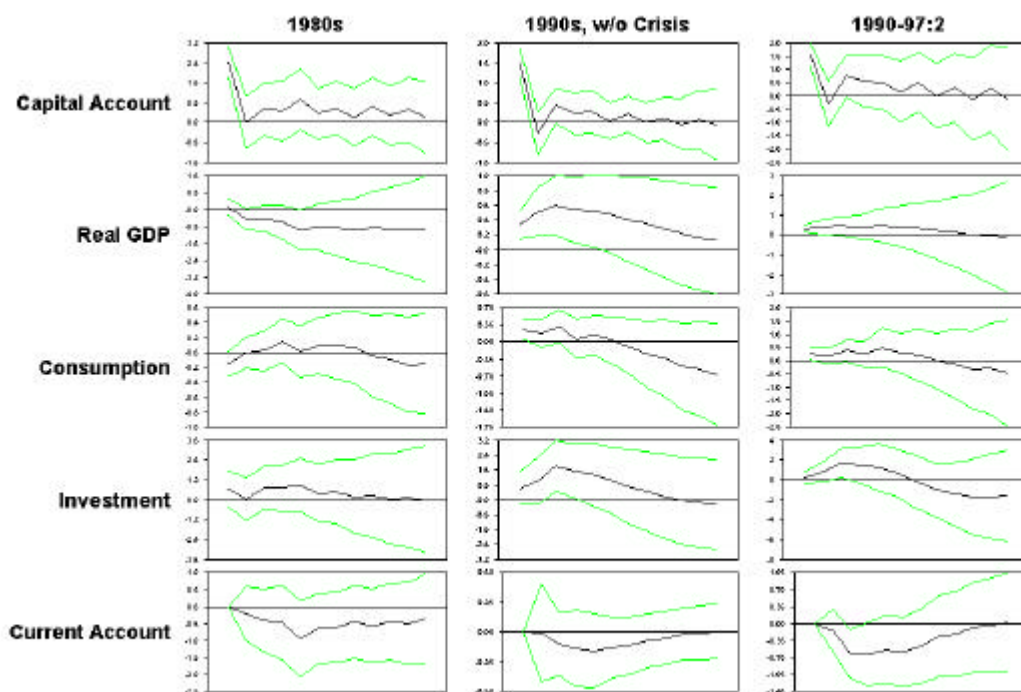


Figure 4 reports the responses of price variables including nominal and real exchange rates, consumer price index, and GDP deflator. In the 1980s, the price levels and the exchange rates do not change much following capital account shocks. In the 1990s, however, the exchange rates tend to appreciate, especially the real exchange rate.

Table 2 reports the variance decomposition of macroeconomic variables following capital account shocks. The results roughly show the relative importance of capital account shocks in explaining the movements of each macroeconomic variable. The contribution of capital account shocks to fluctuations in real GDP, consumption, investment, and nominal and real exchange rates tends to increase from the 1980s to the 1990s. The contribution to the price level fluctuations does not differ much in the two periods.

Figure 4. Impulse Responses of Price Variables

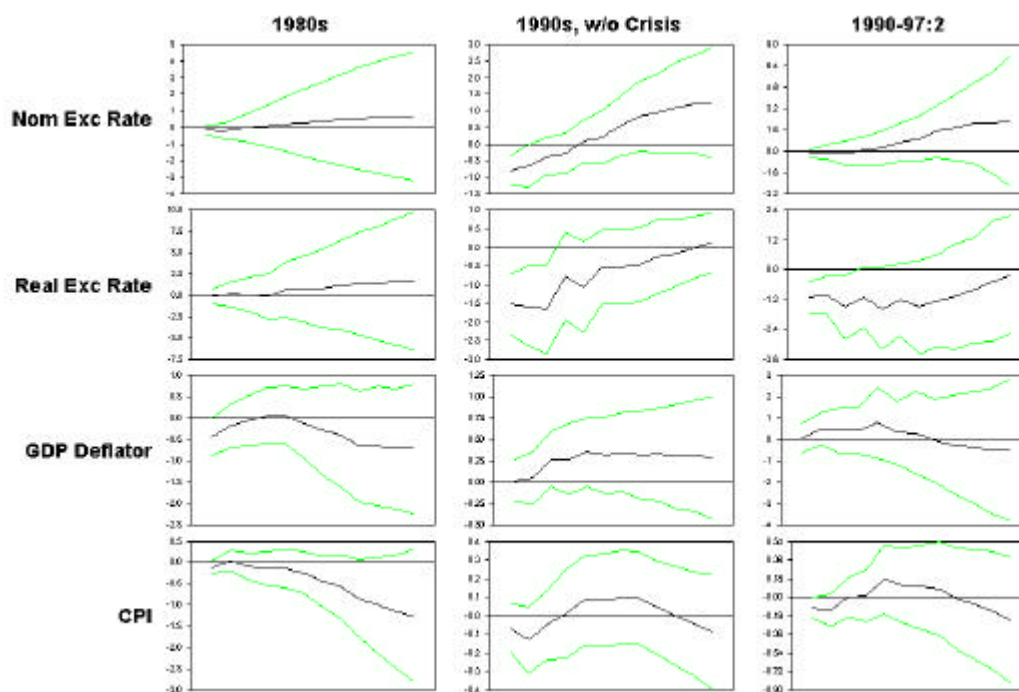


Table 2. Forecast Error Variance Decomposition of Macroeconomic Variables

		(Quarterly Data)		
	Horizon\ period	1980s	1990s, w/o Crisis	1990-97:2
Real GDP	2 quarters	13.7 (8.6)	36.7 (14.0)	30.3 (14.7)
	4 quarters	19.4 (12.7)	34.1 (15.5)	31.9 (17.4)
	8 quarters	31.9 (18.3)	24.1 (14.4)	28.0 (18.2)
Consumption	2 quarters	10.3 (7.6)	17.7 (11.6)	26.3 (14.7)
	4 quarters	12.5 (7.7)	17.0 (11.6)	29.4 (17.3)
	8 quarters	11.4 (9.1)	9.3 (6.9)	19.7 (14.7)
Investment	2 quarters	7.3 (6.3)	12.4 (9.6)	12.9 (10.8)
	4 quarters	12.5 (9.1)	23.9 (13.5)	33.6 (18.3)
	8 quarters	14.2 (10.8)	14.3 (10.1)	28.1 (16.1)
Nominal Exchange Rate	2 quarters	4.6 (5.2)	36.1 (14.1)	7.0 (6.9)
	4 quarters	5.0 (5.6)	28.5 (13.8)	7.2 (7.4)
	8 quarters	9.5 (11.3)	20.0 (9.4)	21.6 (15.0)
Real Exchange Rate	2 quarters	3.7 (4.4)	45.7 (14.3)	53.5 (13.3)
	4 quarters	6.1 (6.7)	43.2 (16.5)	46.7 (16.1)
	8 quarters	11.3 (12.4)	32.9 (15.7)	37.3 (17.3)
GDP Deflator	2 quarters	12.6 (9.2)	4.3 (4.9)	12.8 (10.0)
	4 quarters	12.0 (8.2)	9.4 (7.6)	16.2 (12.0)
	8 quarters	9.1 (7.8)	14.3 (9.9)	18.4 (13.8)
CPI	2 quarters	6.0 (4.5)	10.4 (8.9)	22.5 (14.0)

4 quarters	9.9 (8.4)	8.1 (6.9)	16.2 (10.4)
8 quarters	19.1 (14.4)	9.9 (7.0)	21.0 (14.4)

*Note: Numbers in the table represent the degree to which the capital account shocks explain the movements of each macroeconomic variable in percentage terms. Numbers in the parentheses are standard errors.*

Two factors can explain the differences in the effects of capital flows on macroeconomic variables between the 1980s and the 1990s: first, the exchange rate regime and second, the degree of capital account liberalization or capital controls. In the 1980s, the government maintained controls over most capital flows other than those necessary to finance the current account imbalances, as discussed in Section 2. In addition, the exchange rate was kept pegged to major currencies. In this regime, capital flow shocks (identified in our empirical model) are more likely to represent erratic movements of capital flows in financing the current account imbalances. In other words, capital flow shocks can be considered as residual parts in matching current account imbalances. Such capital account shocks are likely to have relatively minor effects on the economy as in our results, especially given that the exchange rate is tightly controlled, which is also reflected in the impulse responses of the exchange rate. However, in the 1990s, the capital account was gradually liberalized and the exchange rate regime changed towards floating, as discussed in Section 2. In this regime, capital flow shocks are more likely to represent truly autonomous capital movements as a result of the gradual policies for capital account liberalization, rather than erratic movements in financing current account imbalances or in pegging exchange rates. Therefore, macroeconomic variables tend to respond more to capital flows, as we observed in the impulse responses.

Finally, the results for the two sub-samples in the 1990s are in general similar. One interesting difference is the response of the nominal exchange rate. In the sample including only the pre-crisis period (1990-97:2), the nominal exchange rate does not respond much, while in the sample including the post-crisis period (the 1990s without the crisis period) the nominal exchange rate responds notably to capital account shocks. These results are consistent with the fact that the foreign exchange market was significantly liberalized in the post-crisis period.

These findings that the macroeconomic effects of capital flow shocks are quite different before and after capital market liberalization suggests a possible explanation for the puzzling findings in past studies. Montiel (1996) and Calvo et al. (1993, 1996) report that consumption booms and real exchange rate appreciation are found following capital inflows in most Latin American countries while such effects are not found in most Asian countries such as Korea, Malaysia, and Thailand. The main reason for this difference is that these Asian countries were examined during the period before serious capital account liberalization. As shown in our results, the effects of capital account shocks are substantially different before and after capital account liberalization; and during the 1990s when Korea liberalized its capital account, we find evidence of consumption boom and real exchange rate appreciation.

### ***3.4 Boom-bust Cycles***

Boom-bust cycles related to capital account liberalization work as follows.<sup>24</sup> Capital account liberalization leads to an initial period of capital surges, real exchange rate appreciation, domestic credit expansion, consumption and investment boom and asset price bubbles. This is especially likely to occur if, prior to the resumption of capital inflows, consumption lending and investment lending were tightly rationed. Over time, however, the process tends to reverse itself: real exchange rate appreciation worsens the international competitiveness of firms and generates a current account deficit, which influences foreign investors to negatively view the domestic market and withdraw capital investment. Therefore, net capital inflows decline and eventually net capital outflows start, which reverses the "boom" phase and starts the "bust" phase.

We investigate whether the Korean economy experiences such boom-bust cycles following capital account liberalization, based on the effects of autonomous capital account shocks in the 1990s. As shown in Figures 3 and 4, capital inflows appreciate the nominal and real exchange rates. Consumption and investment increase (due to expanded credit availability), which in turn raises the real GDP. The increase in income and the

---

<sup>24</sup> See Obstfeld (1986), Engel and Kletzer (1989), Edwards (1989), Allen and Stein (1990), Bacchetta (1992), Bacchetta and van Wincoop (1998), and, Agenor and Hoffmaister (1999).

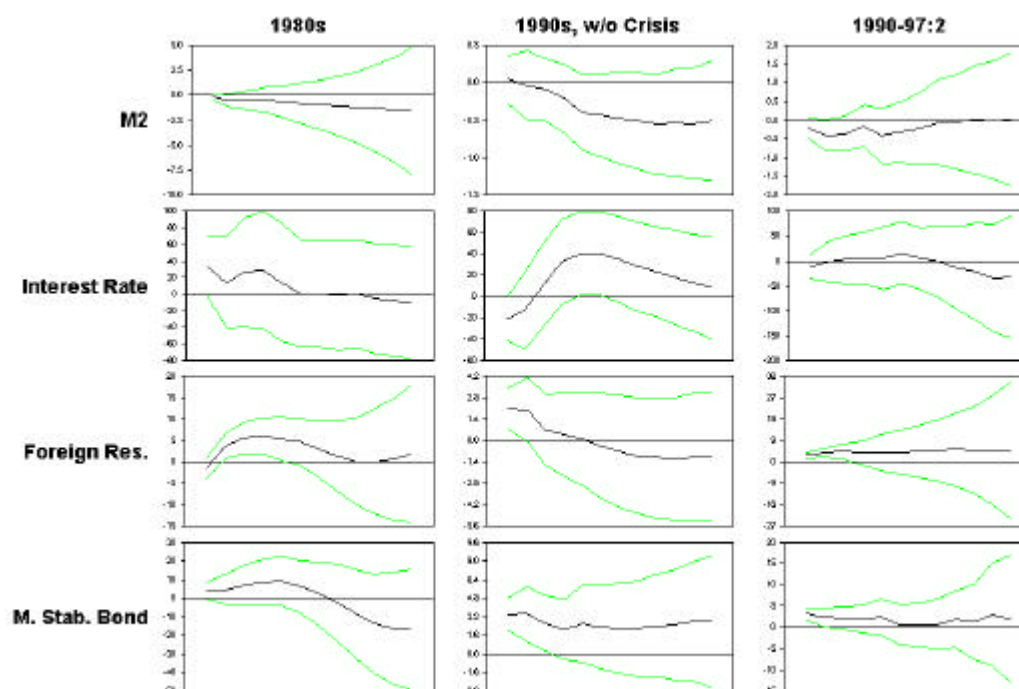
exchange rate appreciation lead to the deterioration of the current account. These results are in line with typical boom-bust cycles.

Without including the crisis period, however, it is hard to discuss whether there were “bust” phases in Korea. Still, considering simple observations of huge capital outflows and recession during the crisis period, the low-frequency behavior of the Korean economy during the whole 1990s is perfectly consistent with boom-bust cycles. However, we cannot argue that capital flows alone brought such dramatic self-generated bust cycles to Korea because factors other than capital account liberalization may have contributed to the crisis.

### ***3.5 Foreign Exchange Market Intervention and Sterilization Policy***

Foreign exchange and monetary policy reactions to capital inflows are shown in Figure 5. The figure displays impulse responses of M2, nominal interest rate, foreign exchange reserves, and monetary stabilization bonds. In all sub-samples, foreign reserves increase sharply following capital inflows, which suggests significant foreign exchange market intervention. That is, to prevent exchange rate appreciations due to capital inflows, the government intervened in the foreign exchange market and accumulated foreign reserves. In the 1980s, the foreign exchange intervention seemed to be almost complete so that the exchange rate did not change much (see Figure 4), which is consistent with the fixed exchange rate regime adopted during that period. However, in the 1990s, the exchange rate continuously appreciated, implying that the foreign exchange intervention was not complete or partially sterilized.

Figure 5. *Impulse Responses of Monetary Variables*



The way to distinguish sterilized and unsterilized intervention is to investigate the movement of domestic credit and money supply. Unsterilized capital inflows would increase money supply, while sterilization would increase domestic credit but effect little change in the money supply. The figure shows that in all sub-samples, M2 did not increase significantly but monetary stabilization bond issues significantly increased following capital inflows, which implies that there were substantial sterilization activities.

Overall, the empirical evidence suggests that there was substantial foreign exchange intervention and sterilization in response to capital inflows. Although it is difficult to quantify the exact role of these policies, we may conclude that these policies mitigated the economic impact of capital inflows. If the government had not intervened in the foreign exchange market following capital inflows, the exchange rate would have appreciated further and the current account might have deteriorated even more. If the central bank had not sterilized, the money supply and aggregate demand would have increased further.

Table 3 reports the forecast error variance decomposition for the monetary variables. We find that the role of capital account shocks in explaining the changes in foreign reserves and monetary stabilization bonds is substantial, but the role in explaining M2 and interest rate is rather limited. These results are consistent with the evidence of substantial sterilized intervention.

*Table 3. Forecast Error Variance Decomposition of Monetary Variables  
(Quarterly Data)*

	Horizon\ period	1980s	1990s, w/o Crisis	1990-97:2
M2	2 quarters	4.9 (5.8)	5.7 (6.2)	8.0 (8.5)
	4 quarters	5.7 (6.4)	5.9 (5.2)	14.7 (10.1)
	8 quarters	8.6 (9.6)	8.4 (7.1)	20.2 (13.7)
Interest Rate	2 quarters	8.3 (7.1)	8.8 (7.7)	7.2 (7.2)
	4 quarters	14.6 (10.9)	11.3 (6.3)	8.7 (8.4)
	8 quarters	16.8 (11.5)	18.3 (10.2)	14.6 (11.0)
Foreign Reserves	2 quarters	21.6 (9.7)	19.9 (11.4)	54.6 (14.0)
	4 quarters	45.6 (14.2)	9.9 (7.1)	42.1 (17.9)
	8 quarters	44.9 (15.5)	7.4 (5.8)	38.0 (22.0)
Monetary Stabilizing Bonds	2 quarters	9.3 (8.3)	41.4 (13.0)	42.6 (14.0)
	4 quarters	17.7 (13.7)	25.2 (11.4)	25.2 (13.2)
	8 quarters	12.8 (10.0)	21.4 (11.7)	25.4 (13.8)

*Note: Numbers in the table represent the degree to which the capital account shocks explain the movements of each monetary variable in percentage terms. Numbers in the parentheses are standard errors.*

#### **4. Conclusion**

We examined the macroeconomic effects of capital account liberalization in Korea using the VAR model, comparing the results for the 1980s when substantial capital account restrictions were imposed and the 1990s when the capital account was gradually and substantially liberalized. Our main findings are as follows.

First, capital account liberalization substantially changes the nature and composition of capital flows. Capital flows become more autonomous in the sense that they are not related to current account imbalances. The portion of portfolio investment in the capital account significantly increases and influences the overall capital account movement.

Second, the effects of autonomous capital flow shocks on macroeconomic variables are considerably different before and after capital account liberalization. The results show that during the 1980s, capital flow shocks were mainly residual parts that matched the current account imbalances and therefore did not seriously affect macroeconomic performance. However, during the 1990s, capital flow shocks were more likely to represent autonomous capital flows and have more substantial effects on the economy.

Third, the autonomous capital flow shocks that resulted from gradual capital account liberalization in the 1990s are related to consumption and investment booms, leading to an increase in output. In addition, capital inflows appreciated the nominal and real exchange rates and worsened the current account. These effects are consistent with the predictions of boom-bust cycle models.

Finally, we find strong evidence of sterilized foreign exchange market intervention. Following capital inflows, aggregate money supply did not change much, while foreign exchange reserves and monetary stabilization bonds significantly increased. The Korean government tried to mitigate the influence of capital inflows on exchange rate appreciation and macroeconomic variables by using sterilized intervention.

## References

- Agenor, P. and A. Hoffmaister. 1998. "Capital Inflows and the Real Exchange Rate: Analytical Framework and Econometric Evidence." In R. Glick ed. *Managing Capital Flows and Exchange Rates*. Cambridge University Press.
- Alesina, A., V. Grilli, and G.M. Milesi-Ferretti. 1994. "The Political Economy of Capital Controls." In L. Leiderman and A. Razin eds. *Capital Mobility: The Impact on Consumption, Investment, and Growth*. Cambridge: Cambridge University Press.
- Allen, P.R, and J.L. Stein. 1990. "Capital Market Integration." *Journal of Banking and Finance* 14 (5), pp. 909-928.
- Antzoulatos, A.A. 1996. "Capital Flows and Current Account Deficits in the 1990s: Why Did Latin American and East Asian Countries Respond Differently?" Research Paper No. 9610. Federal Reserve Bank of New York.



- Bacchetta, P. 1992. "Liberalization of Capital Movements and of the Domestic Financial System." *Economica* 59, pp. 465-474.
- Bacchetta, P. and E. van Wincoop. 1998. "Capital Flows to Emerging Markets: Liberalization, Overshooting, and Volatility." NBER Working Paper No. 6530.
- Calvo, G.A., L. Leiderman, and C. Reinhart. 1993. "Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors." IMF Staff Papers 40, pp. 108-151.
- Calvo, G.A., L. Leiderman, and C. Reinhart. 1996. "Inflows of Capital to Developing Countries in the 1990s." *Journal of Economic Perspectives* 10 (2), pp. 123-39.
- De Gregorio, J., S. Edwards, and R. Valdes. "Controls on Capital Flows: Do They Work?" *Journal of Development Economics* 63 (1), pp.59-83.
- Edwards, S. 1989. "The Liberalization of the Current Capital Accounts and the Real Exchange Rate." *Canadian Journal of Economics* 22, pp. 79-92.
- Eichengreen, B., A. K. Rose and C. Wyplosz. 1996. "Contagious Currency Crisis." *Scandinavian Economic Review* 98 (4), pp. 463-484.
- Eichengreen, B. and M. Mussa, 1998. "Capital Account Liberalization: Theoretical and Practical Aspects." IMF Occasional Paper No. 172.
- Engle, C. and K. Kletzer. 1989. "Saving and Investment in an Open Economy with Non-traded Goods." *International Economic Review* 30 (4), pp. 735-52.
- Grilli, V. and G. Milesi-Ferretti. 1995. "Economic Effects and Structural Determinants of Capital Controls." IMF Staff Papers 42 (3).
- Hamilton, James D. 1994. *Time Series Analysis*. New Jersey: Princeton University Press.
- Johnston, R.B., S.M. Darbar, and C. Echeverria. 1997. "Sequencing Capital Account Liberalization: Lessons from the Experiences in Chile, Indonesia, Korea, and Thailand." IMF Working Paper 97/157.
- Montiel, P.J. 1996. "Policy Responses to Surges in Capital Flows: Issues and Lessons." In G.A. Calvo, M. Goldstein, and E. Hochreiter eds. *Private Capital Flows to Emerging Markets After the Mexican Crisis*. Washington, D.C.: Institute for International Economics.
- Obstfeld, M. 1986. "Capital Flows, the Current Account, and the Real Exchange Rate: Consequences of Liberalization and Stabilization." In S. Edwards and L. Ahamed eds. *Economic Adjustment and Exchange Rate in Developing Countries*.

Park, Y.C. 1995. "Korea's Experience with Managing Foreign Capital Flows." Paper presented at the UNDP Meeting on Proposals for an International Currency Transaction Levy, New York. (October 10)

Park, Y.C., and C. Song. 1998. "Managing Foreign Capital Flows: The Experiences of the Republic of Korea, Thailand, Malaysia and Indonesia." In G.K. Helleiner ed. *Capital Account Regimes and the Developing Countries*. UNCTAD, Macmillan Press.

Rodrik, D. 1998. "Who Needs Capital Account Convertibility?" In P. Kenen ed. *Should the IMF Pursue Capital Account Convertibility?* Essays in International Finance, No. 207. Princeton University.

Sims, Christopher A. 1980. "Macroeconomics and Reality." *Econometrica* 48, pp. 1-48.

Sims, Christopher A. 1988. "Bayesian Skepticism on Unit Root Econometrics." *Journal of Economic Dynamics and Control* 12, pp. 463-474.

Sims, Christopher A. and Harold Uhlig. 1991. "Understanding Unit Rooters: A Helicopter Tour." *Econometrica* 59, pp. 1591-1599.