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Capital Imports in Economic Development:
The Korean Case, 1962-85*

Chang Min Shinn**

The resut of the computation with the estimates of the equations of the model of the Korean economy reveals that the gain from the foreign capital inflow during the period, 1962-85, is about three times of the cost of it, in two different concepts of the foreign capital.

Based on the inverse relationship between the domestic saving and the foreign capital inflow, the gain can be computed as the sum of the direct and the indirect effect and the multiplier effect of more consumption due to the capital imports, whereas the depreciation of the imported capital and the interest payment add up to the total cost of it.

I. Introduction

The Korean economy carries a huge sum of international debt relative to her economy. The burden of $46.8 billion (as of 1985) has been one of the focal points of major controversies about the economy. This thesis intends to estimate the actual "balance sheet" of the gain from and the cost for the foreign capital inflow during the period from 1962 to 1985.

Experiencing the disastrous Korean War following the period of the colonial rule by Japan, the Korean society had gone through a great change almost in every aspect during the fifties, which laid the basis of the economic growth in the following years. At the beginning of the sixties, the newly established

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** Associate Professor of Economics, College of Business Administration, Chung-Ang University.

military government emphasized the urgent need of the economic growth.[1]

By that time, the size of the international capital inflow was very small as well as the volume of the international trade. On the other hand, the year of 1986 is the first year of producing a sizable positive balance in the current account of the international balance of payments in the recent history of the Korean economy. Therefore, this gives a kind of interesting period of estimating the resulting effect of the international capital borrowing on the Korean economy as a whole.

II. The Model

The survey of the literature about the international capital imports in developing countries shows various kinds of analyses in this field of study. We can find in it a general equilibrium analysis, comparative static analyses, dynamic analyses of optimization, models of risk factor and social disutility from the foreign capital inflow, the two gap models, models of the relationship between the domestic saving and the foreign capital inflow, and so forth. Among the different approaches in the aspect of capital imports in developing countries, the last one is taken to be the backbone of the model constructed here in this thesis, since it is the most feasible in its actual estimation and computation.

Discussing the inverse relationship between domestic saving and foreign capital, Bhagwati says the underlying rationale for this hypothesis is that, as an economy gets more foreign capital, it supplements its available resources, thus it is reasonable to assume that some part of the additional resources will be expended on increasing current, augmenting future, consumption. With current consumption rising at a given income level, current domestic saving would then fall.

Another reasoning may be as follows. Assuming the economy is in stable equilibrium in production and consumption, a capital inflow into the economy will bring a lowered rate of return, hence foreign capital may release some resources from domestic investment, making them available for current consumption, up to the

[1] See Kuznets.

point that the (lowered) marginal return on capital is equated to the (lowered) marginal utility of consumption, restoring equilibrium.

When domestic saving is regressed, on foreign capital and other variables, the coefficient may be positive or negative, if negative it may be less than or greater than -1. A positive coefficient means that the production pattern and consumption behavior are such that foreign capital inflow induces greater domestic saving. If the coefficient is less than -1, the host country will be better off without the foreign capital inflow.[2] Most of the results of major analyses summarized by Bhagwati and in others show coefficients between zero and -1 as shown in the Table 1. When a country has the coefficient closer to -1 in the Table, the foreign capital inflow is expected to increase more current consumption at the cost of the burden of the next generation of the country, whereas in the cases closer to zero, it allows more capacity in the production which enables economic growth.

The model constructed here encompasses largely the real sector of the economy.

It is assumed that the foreign capital inflow gives an effect on the domestic saving in the Korean economy during the period rather than the reverse holds. If the coefficient of our concern is indeed negative and less than one in its absolute value, it is equivalent to say that the amount of capital inflow is invested for production for output as originally intended, while the remaining is consumed outright. It is assumed that the ordering of preference by the people is lexicographic on the coordinate consisting of the future consumption and the present consumption. For present consumption gives a burden to the next generation, and it is not easy to have an exact estimation of the indifference curve between the two. And it is assumed that there exists no capital flight or it is negligible if any.

The foreign capital actually put into the production processes yields output by the amount of the marginal value product of capital. And it also enables more labor to be employed which gives the marginal value product of labor. To estimate the marginal value product of the factors of production, the Cobb-

[2] See Bhagwati.

Table 1

RESULTS OF MAJOR ANALYSES SHOWING THE RELATIONSHIP BETWEEN DOMESTIC SAVING AND CAPITAL INFLOWS

Author	Cross-Country (C) Time Series (T) Pooled (C, T)	Number of Observations	Form of Equation	Deflated Variables (D) Nominal Variables (N)	Effect of Foreign Inflows on Saving
Griffin and Enos	C	32	$\frac{S_d}{Y} \cdot 100 = a + b \frac{S_f}{Y} \cdot 100$	N	-0.73
	C	13		N	-0.82
Griffin	T	13	$\frac{S_d}{Y} \cdot 100 = a + b \frac{S_f}{Y} \cdot 100$	N	-0.84
Rahman	C	31	$\frac{S}{Y} = a + b \frac{F}{Y}$	D	-0.2473
Areskoug	T	(22 countries) = 13-14 observations per country	$I = aB + bY + cF$	D	-1.53 to +4.30
Weisskopf	C, T	(17 countries) 9-12 observations per country	$S = a + bY + c \frac{E}{Y} + dF$	D	-0.227
Chenery	T	(16 countries) 13-14 observations per country	$S = a + bY + c \frac{E}{Y} + dF$	D	+0.64 to -1.15
Chenery	C	90	$\frac{S}{Y} 100 = a + b \log Y + c(\log Y)^2 + dN + ct + fF$	D	-0.4894

Table 1 (continued)

Author	Cross-Country (C) Time Series (T) Pooled (C, T)	Number of Observations	Form of Equation	Deflated Variables (D) Nominal Variables (N)	Effect of Foreign Inflows on Saving
	C		$\frac{I_d}{Y}\ 100 = a + b\log Y + c(\log Y)^2$	D	-0.8892
Papanek	C	85	$S = a + bA + cI_p + dF_0 + dE_p + fE_0$	N	b c d -1.00 -0.65 -0.38
			$S = a + b\log\frac{Y}{N} + d\log N + eF + fE_P + gE_0$		-0.64
			$S = a + b\log\frac{Y}{N} + c\log N + dF$		-0.73
Clark	C,T	(33 countries)	$\frac{S}{Y}\ 100 = a + b\log\frac{Y}{N} - c\frac{F}{N}\ 100 + dP + eW + fD$	D	-0.58
Jhun	T	22	$\frac{S}{Y} = a + bF + ci + dE + eAid$	D	b e -0.149 -0.219
Shinn	T	17	$S_d = a + bY + cS_f$	D	-0.489

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List of Variables:

A = Net transfers received by government plus official long term borrowing
Aid = Foreign aid
B = Net government external borrowing
D = Dummy Variable: 0 pre-1955; 1 post-1955
Sources: Bhagwati, Jhun, Shinn.

E = Exports E_p Primary exports E_0 = Other exports
F = Net Foreign Capital inflows F_0 = Other capital inflows
I = Investment I_p = Private i = interest rate
N = Population size P = Decadal rate of population growth
S, S_d = Domestic saving S_f = Foreign saving Y = GNP
W = War damage expressed as multiple of 1938 NNP at factor cost

Douglas production function is assumed since other types of production functions, namely CES production function and the transcendental logarithmic production function, do not improve the goodness of fit substantially. To estimate the production function for each sector of the economy, the capital stock series are needed, which are not easy to be found.

Along the rate of depreciation of the capital imported, the capital gets small and continues to be put into the production processes until it vanishes. The increase in output due to the production processes mentioned above altogether can be said to be the result of the direct effect of the foreign capital inflow.

We can also find that there exists indirect multiplier effect which comes from the increment of the output due to the direct effect. The magnitude of the indirect effect depends largely on the marginal propensity to save given the production processes.

In addition to the direct effect and the indirect effect, we realize that the output of the economy increases as the consumption increases, which comes from the inverse relationship between the domestic saving and the foreign capital inflow. The increase in consumption initiates the multiplier processes.

The sum of the increment of the output due to the effects described above is to be compared with the sum of the international interest payments and the depreciation occurred during the period.

III. Estimation of the Model

A. Data

The data for the estimation of the equations of the model are in the form of 1980 constant billion won (unit of the Korean money) except the data for labor input. The capital series are constructed here based on the estimate of the capital for the year of 1968 conducted by Christensen and Cummings[3] and by the author[4] as shown in the Table 2. Since the complete data which

[3] See Christensen and Cummings.
[4] See Shinn.

Table 2

THE CAPITAL SERIES OF THE KOREAN ECONOMY

(in 1980 constant billion won)

Year	The Primary Sector	The Secondary Sector	The Tertiary Sector
1962	6,861.0	5,107.4	3,568.9
1963	6,965.9	5,347.0	4,235.5
1964	7,049.8	5,520.9	4,661.1
1965	7,131.1	5,716.9	5,086.6
1966	7,302.6	6,188.7	5,887.3
1967	7,439.4	6,621.8	6,943.3
1968	7,614.2	7,192.2	8,498.2
1969	7,823.7	7,912.5	10,947.2
1970	8,067.7	8,536.0	13,183.8
1971	8,347.5	9,243.8	15,718.5
1972	8,653.9	9,827.4	17,746.5
1973	9,026.5	10,750.7	20,241.1
1974	9,661.5	11,999.5	23,712.4
1975	10,162.7	13,241.5	27,525.6
1976	10,717.1	14,652.8	31,608.4
1977	11,391.1	16,197.5	36,888.2
1978	12,163.1	18,384.7	43,836.0
1979	12,962.1	20,963.3	52,370.7
1980	13,678.3	23,001.7	58,485.9
1981	14,379.3	25,009.1	64,890.4
1982	14,989.4	26,839.4	70,908.1
1983	15,777.9	28,777.9	78,465.1
1984	16,736.5	31,613.7	87,172.1

Source: Constructed here by the author based on the estimate of the capital for the year of 1968 shown in Chritensen and Cummings.

reveal the actual whole picture of the international debt of the Korean economy during the whole period are obtained from the Economic Planning Board of Korea and used for the estimation.

B. Estimate of the Equations

1. Domestic Saving and Foreign Capital Inflow

The estimation to find the relationship between the domestic

saving and the foreign capital inflow during the period was conducted in two different ways as follows.

a. The Case of the Long Term and the Short Term Capital Inflow

$$Sd = -1475.1 + 0.12152\ Y - 0.6833\ SLKF + 0.91543\ Sd\ (-1)$$
$$(-2.51) \quad (3.16) \quad (-1.89) \quad (10.61)$$

$$\bar{R}^2 = 98.3$$
$$d = 2.07$$

where Sd : domestic saving
Y : output
SLKF : short-term and long-term capital inflow
Sd (-1) : domestic saving one-year lagged
The values in parentheses : the Student t statistic
$\bar{R}^2$: R^2 adjusted for the degrees of freedom
d : the Durbin-Watson statistic

b. Total Capital Inflow Including International Inter-Bank Borrowing

In addition to the short and long-term capital inflow, the international inter-bank borrowing less the change in the foreign exchange holding is included to see the influence of the total borrowing from abroad.

$$Sd = -1621.6 + 0.13299\ Y - 0.7221\ SLKF + 0.1973\ IBF$$
$$(-2.66) \quad (3.44) \quad (-2.07) \quad (1.78)$$

$$+ 0.6539\ Sd\ (-1)$$
$$(3.99)$$

$$\bar{R}^2 = 98.5$$
$$d = 2.19$$

where IBF : international interbank borrowing

It is interesting to find the opposite sign between the variables SLKF and IBF. It can be interpreted as the physical capital and monetary capital play different role with respect to the product

market and the money market. At any rate, the decrease in the domestic saving due to the total capital inflow is less than that due to the short and long-term capital inflow alone.

In the following section IV, the comparison between the gain and the cost of the foreign capital is made in two different categories.

2. *The Production Function*

The estimates of the production functions in the form of the Cobb-Douglas production function are as follows for the primary, the secondary, and the tertiary sector.

In the secondary and the tertiary industrial sector, serial correlation was found to be substantial. To escape from this difficulty, assuming the first order serial correlation, and ARIMA method was employed to compute the production function in those sectors.

$$\ln Y^A = \underset{(-0.76)}{-2.509} \underset{(-3.01)}{-0.0835\ D} + \underset{(2.15)}{0.356}\ \ln L^A + \underset{(3.51)}{0.430}\ \ln K^A + \underset{(2.78)}{0.400}\ \ln Y^A(-1)$$

$$\bar{R}^2 = 92.4$$

$$d = 2.35$$

$$\ln Y^M = -54.184 + 0.73927\ \ln L^M + 0.91311\ \ln K^M$$

$$\bar{R}^2 = 99.4$$

$$\ln Y^S = 25.384 + 0.38852\ \ln L^S + 0.38689\ \ln K^S$$

$$\bar{R}^2 = 97.7$$

where Y^A, Y^M, Y^S : output of each industrial sector
L^A, L^M, L^S : labor of each industrial sector
K^A, K^M, K^S : capital of each industrial sector
superscripts *A*, *M*, *S*, stand for the primary industry, the secondary industry and the tertiary industry respectively.
D: dummy variable (1 = the year of poor crops; 0 = others)

In the secondary industrial sector an increasing returns to scale appears to be present while decreasing returns to be present in the primary and the tertiary industrial sector. This implies that the manufacturing industry has been playing the key role in the spectacular economic growth in Korea in the last two and a half decades.

3. The Rate of Depreciation

A linear regression is conducted to estimate the proportion of depreciation in the capital series.

$$\begin{aligned} DEP &= -45.8 + 0.040186\ K \\ &\quad (-0.47) \quad (27.04) \\ \bar{R}^2 &= 97.1 \\ d &= 1.12 \end{aligned}$$

Since the data for depreciation are not sufficient to fit heterogeneous capital stock in reality, several hypothetically higher depreciation rates were tried in the computation of the model with other perspectives in the following section.

IV. The "Balance Sheet" of the Foreign Capital Imports

The increase in output due to the foreign capital imports during the period is compared with the total cost of it. The increases in output comes from the direct effect of the production with more capital from abroad and with more labor employed with it. When the output increases, some of it is saved and reinvested for the next production processes successively. This is called an indirect effect of the foreign capital inflow in production. The capital-labor ratio is assumed to be the same in both cases of working with foreign capital and that with the domestic capital.

We also realize that there exists a multiplier effect due to the increase in consumption that arises from the negative effect of foreign capital inflow on the domestic saving. The amount from the negative effect can be considered as the net increase in the consumption. The magnitude of the multiplier is assumed to be

about 2 to have a conservative measure.[5]

On the other hand the Korean economy must pay for the foreign capital imports. The cost for it consists of the amount of the depreciation of the physical capital imported and the interest payments.

The 'balance sheet' of the gain and the cost resulting from the foreign capital inflow is shown in the Table 3. The data include the short-term capital as well as the long-term capital imports.

The straight line method is taken to compute the depreciation of the imported capital for simplicity.

The increment of output from the direct effect due to more capital imported is appeared to be 12,056 billion in 1980 won,

Table 3

CUMULATIVE GAIN AND COST OF LONG AND SHORT-TERM CAPITAL IMPORTS BETWEEN 1962-85

(in 1980 constant billion won)

Gain	Primary Industry	Secondary Industry	Tertiary Industry	Total
Direct Effect				
Capital	1,032.78	2,733.98	8,290.41	12,056.27
Labor	652.52	3,081.31	5,995.93	9,740.31
Indirect Effect				
Capital	81.35	252.07	693.41	1,026.83
Labor	52.19	284.23	501.50	837.92
Multiplier Effect of more Consumption				12,461.87
		Total Output Increment		36,123.20
Cost				
Depreciation		5,164.99		
Interest Payment		7,724.29		
			Total Cost	12,839.28

[5] See Crouch, 1972, pp. 353-360.

while that due to the more labor employed to work with the foreign capital is 9,740 billion won as a whole in the three industried sectors. The following indirect effect in the production shows that 1,027 billion won worth of more goods and services are produced through the successive reinvestment processes, while accompanying more employment yields 838 billion won. On the other hand, the multiplier effect from the increase in output and consumption due to the negative effect of the foreign capital inflow on the domestic saving gives 12,462 billion won as a whole. Therefore, the total output increment due to the long-term and the short-term capital imports during 1962-85 in the Korean economy amounts to 36,123 billion won in addition to the higher consumption.

On the other hand, when we look at the side of the cost, the depreciation of the capital during the period appears to be 5,165 billion won, while the interest payment has been 7,724 billion

Table 4

CUMULATIVE GAIN AND COST OF TOTAL CAPITAL IMPORTS BETWEEN 1962-85

(in 1980 constant billion won)

Gain	Primary Industry	Secondary Industry	Tertiary Industry	Total
Direct Effect				
Capital	2,113.93	5,582.35	17,113.80	21,810.0
Labor	1,451.39	7,331.55	12,231.15	21,134.0
Indirect Effect				
Capital	152.07	486.39	1,295.46	1,905.6
Labor	104.41	541.42	913.29	1,659.1
Multiplier Effect of more Consumption				11,913.8
		Total Output Increment		61,423.0
Cost				
Depreciation	6,210.83			
Interest Payment	16,557.09			
		Total Cost		22,767.9

won. Therefore, the total cost arising from the depreciation of the capital and the interest payment for the borrowed capital amounts to 12,839 billion won.

Consequently, the output increase due to the foreign capital inflow is about three times higher than the amount of the total cost for it during the period.

One may argue that the rate of depreciation computed here is too low. Unable to obtain more realistic rate of depreciation because of the lack of sufficient data, one way of escaping from this difficulty is artificially increasing the rate to find the change in the gain and the cost in the computation. By doing this, it is found that the net gain disappears when the rate goes higher than 15 percent per annum. This implies that however high the rate of capital depreciation might be in reality, it cannot reverse the result of the net gain from the foreign capital inflow from positive to negative.

To encompass the whole foreign capital inflow, physical or monetary, the variable of the international interbank borrowing is included. The computation based on this gives about the same pattern of the net gain. As the Table 4 reveals the total amount of output increase due to the effects explained above is about three times of the total cost due to depreciation and interest payments. And the breakeven point found with increasing depreciation rate is about 15 percent as in the case of excluding bank borrowing shown above.

V. Conclusion

It is concluded that the foreign capital imports during the period, 1962-85, have been beneficial to the Korean economy. The result of the computation with the estimates of the equations of the model reveals that the gain from the foreign capital inflow during the period is about three times of the cost for it in both cases of the concept of the foreign capital. As the rate of depreciation is increased artificially, the breakeven point of the gain and cost of the foreign capital imports during the period is reached at the rate of about 15 per cent per annum, assuming other estimates of the equations of the model are fairly good.

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