

Exchange Rate Flexibility and Economic Recovery of Korea: To what extent did the depreciation of the Korean won affect the earnings of the Korean Manufacturing Firms?

Abstract

This paper investigates how much the depreciation of the Korean won vis-a-vis the US dollar following the outbreak of the currency crisis in 1997 affected the earnings of Korean companies and thus helped the rapid recovery of the Korean economy. In fact, a depreciation of the Korean won by 47% during the year 1998 is estimated to have increased the operating profits of the whole Korean manufacturing industry by about 31 trillion Korean won. Given that the operating profit of the whole manufacturing industry was only 25 trillion Korean won in 1998, this implies that the recovery to profitability after the crisis was due entirely to the depreciation of Korean won. Also it shows that broken down by type of manufacturing industry, electronics, textile and automobiles sectors were the most important beneficiaries of the depreciation of the Korean won.

Moon, Woosik (GSIS, Seoul National University) Email: mwoosik@snu.ac.kr

Lee, Jong Kun (Bank of Korea) Email: jkleee@bok.or.kr

1. Introduction

Exchange rate rigidity is now widely accepted as one of the main causes of the Asian and Korean currency crisis. Indeed, there are many studies arguing that the fixed peg to the US dollar was one aspect of policy mismanagement that triggered the crisis in Korea and other Asian countries. (McKinnon (1998) and Moon (2000))

As a consequence, the Korean government was forced to give up the fixed exchange rate system, letting the exchange rate depreciate sharply. This was certain to lead to the rapid recovery of the Korean economy inflicted by the crisis, thus helping Korean companies to regain their profits. The role of exchange rates as a macro-economic adjustment tool was not, however, given sufficient recognition, with most studies dealing with the recovery from the currency crisis, focusing on the effect of macro-economic and corporate reforms in the Korean economy.

This paper focuses on the microeconomic impact of the exchange rate fluctuations on the earnings of different manufacturing sectors. Particularly, this paper tries to investigate to what extent the depreciation of the Korean won after the currency crisis affected the earnings of Korean manufacturing firms, thereby helping the Korean economy to recover from the fallouts of the crisis. In general, exchange rate fluctuations have influenced the earnings of Korean companies substantially. The most typical example can be found during the aftermath of the 1997 currency crisis when the sharp depreciation of the Korean won vis-à-vis the US dollar contributed to the rapid recovery of the corporate earnings.

Despite its importance, however, there are only a few studies investigating the effect of the exchange rate fluctuation on the earnings of Korean firms. (Shin(1999), Suh(1999), Lee(2002)). First of all, Suh (1999) analyzes the impact of exchange rate fluctuations on the earnings of the manufacturing industry in general but fails to examine its sectoral impact. Lee(2002) examines the sectoral impact of exchange rate fluctuations on the corporate earnings for 350 companies and estimates that a 10% depreciation of the Korean won brings about a reduction of about 8.5 trillion Korean won to their corporate earnings. However, Lee's estimation is insufficient and limited in that he does not consider the effects of the exchange rate fluctuations on the pass-through to the export and import prices and the demand elasticities of exports and imports.

On the contrary, there are quite numerous studies concerning the pass-through of the exchange rate, which could be extended into studies analyzing the effect on corporate

earnings. (For instance, Kang and Oh (2001) and Choi (2000)). However, the extension of these studies necessitates the procurement of the data at the company or industry level about overseas sales and inputs, which has limited the studies on the effect of the exchange rate fluctuations on corporate earnings.

This paper finds that a depreciation of Korean won by 47% during the year 1998 contributed to increasing the operating profits of the whole manufacturing industry by about 31 trillion Korean won. Given that the operating profit for the whole manufacturing industry was only 25 trillion Korean won in 1998, it implies that the recovery of profitability after the crisis was due entirely to the depreciation of the Korean won. It also shows that, when broken down by type of manufacturing industry, electronics, textile and automobiles sectors were the most important beneficiaries of the depreciation of the Korean won.

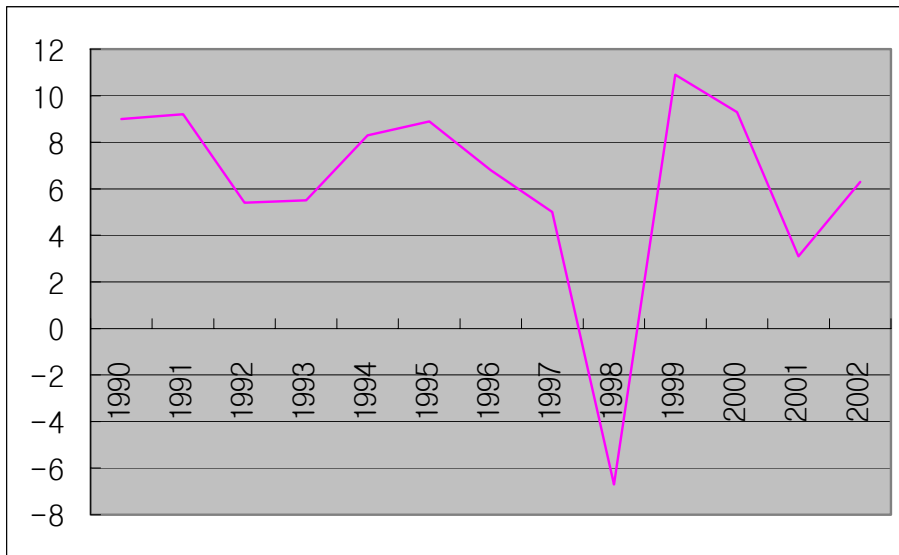
The organization of this paper is as follows. In Section II, macroeconomic situations in Korea are briefly examined. In particular, interest, wage rate and exchange rate movement are examined. In Section III, the method to calculate the effect of exchange rate changes on the earnings of Korean firms is presented. In Section IV, on the basis of the method developed in Section III, the effect of a depreciation of the Korean won on the profitability of Korean firms for the whole manufacturing sector and for the individual manufacturing sectors is calculated. Section V provides a conclusion.

II. The Role of Exchange Rate in the Macro-economic Adjustment and Recovery

A brief examination of the macroeconomic conditions before and after the currency crisis in Korea will help understand the role of the exchange rate fluctuations on the recovery process.

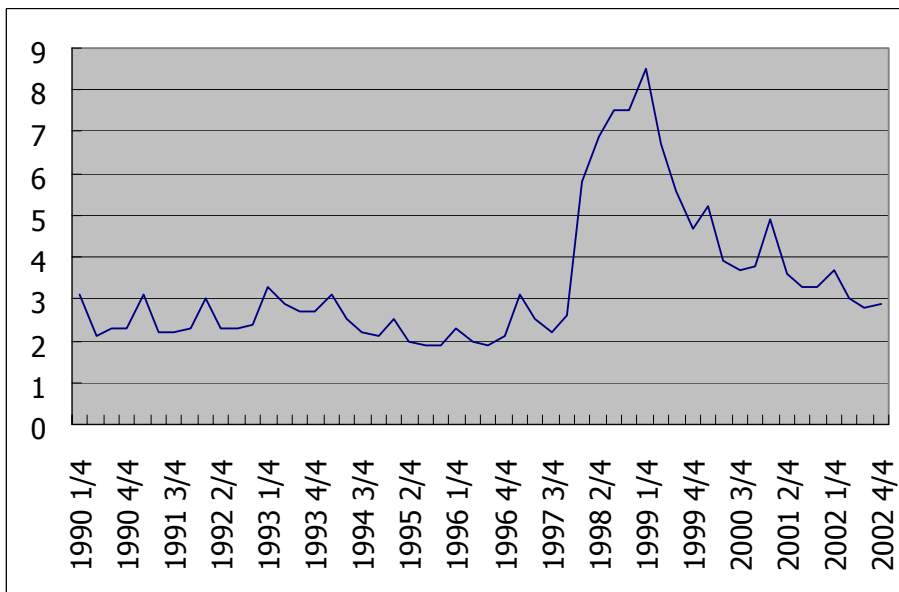
Until the outbreak of the currency crisis, Korea had continued to record high growth rates. Real GDP grew more than 6% throughout the early to middle 1990s but this came to a sudden halt with the growth rate shrinking to less than -6% in 1998. The unemployment rate increased sharply from a low 2% during the middle of the 1990s to 8% in the first quarter of 1999 (See Figure 1 and Figure 2).

Figure 1 Trend of growth rate (constant GDP, %)



Source: Bank of Korea

Figure 2 Trend of unemployment (%)



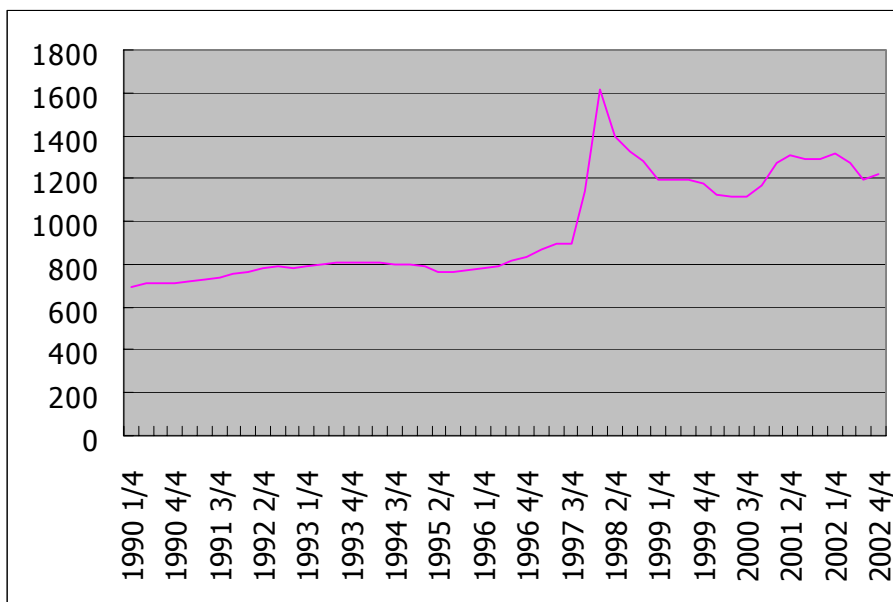
Source: Office of Statistics

However, a rapid recovery soon began, with the growth rate regaining its pre-crisis level.

In 1999 and 2000, for instance, the real GDP growth rate reached 10.9% and 9.3% respectively. Also, the unemployment rate fell to 6.3% in 1999 and 4.1% in 2000. The recovery was apparent, even though many economic problems still remained. How was this rapid recovery possible? Many people, both inside and outside the country, point to the role of the economic reforms and public support introduced by the then Korean government. Some rightly mention the increase in exports, made possible due to the sharp depreciation of the Korean won vis-à-vis the US dollar. However, the general emphasis, whether intended or not, seems in most cases to focus on the contribution of economic reforms, not the impact of the exchange rate depreciation. The role of the exchange rate fluctuation in the recovery of the Korean economy is either partially recognized or insufficiently analyzed.

Figure 3, Figure 4 and Figure 5 show respectively the movement of the three most important macroeconomic variables, the exchange rate, the wage level and the interest rate before and after the currency crisis.

Figure 3 Trend of the exchange rate of the Korean won vis-à-vis the US dollar



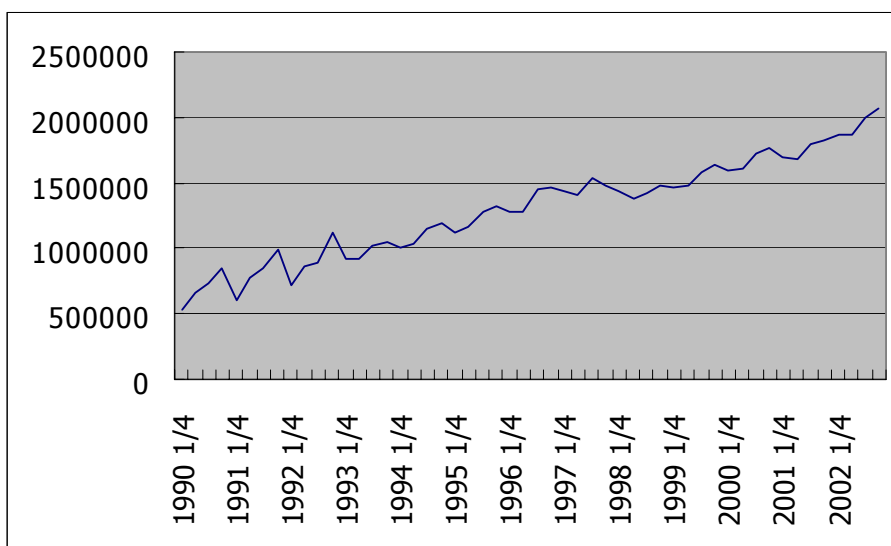
Source: Office of Statistics

Figure 3 shows the trend of the exchange rate of the Korean won vis-à-vis the US dollar. Until the outbreak of the currency crisis, Korea's exchange rate system was a tightly managed float with the won/dollar exchange rate moving in the range between 700 and 800 won. The exchange rate of the Korean won was especially stable during

the period 1996, one year before the crisis. During the crisis, however, it incurred a massive depreciation reaching 47.7%, the annual average won/dollar rate jumping to 1404 won in 1998 from 949 won in 1997. Since then, it declined slightly, appreciating by 15.5% in 1999 and 5% in 2000. The exchange rate of the Korean won was back on the rise in 2001, reaching 1251 won per dollar. In a nutshell, the exchange rate has widely fluctuated after the crisis. This implies that the Korean economy is more likely to be affected by exchange rate fluctuations now than ever.

Looking at wage levels, we notice there was no notable reduction in the monthly remuneration even during the crisis period (Figure 4). The wage level continued to climb, despite a very temporary stabilization in 1998. The saving of labor costs was achieved through large scale lay-offs of redundant labors during 1998.

Figure 4 Trend of monthly wages

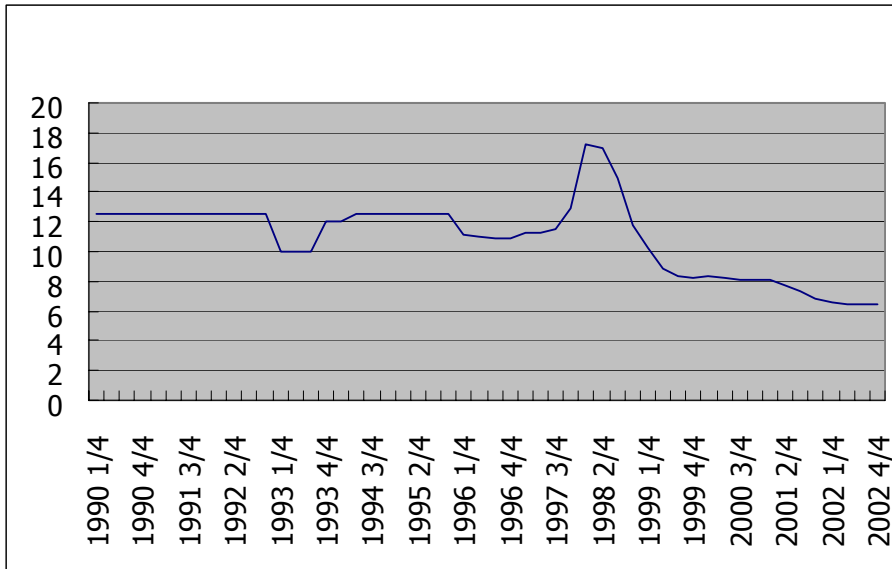


Source: Office of Statistics

Finally, Figure 5 shows the interest rate (loan rate) movements. The interest rate was rather up momentarily during the currency crisis, eclipsing the performance of the manufacturing sector. In fact, the loan rate, which remained at around 11% in 1996, rose to 18% in the middle of 1998. This high loan rate aggravated the crisis at least at the company and sectoral levels. It started to decline but only after the first quarter of 1999 did it reach its pre-crisis level. Since then, the loan rate has remained at 8% as companies started to reduce their investment massively and accumulate their cash flows. Indeed, as many Korean firms were reducing the excessive gearing ratios that they had

had in the past, relying less and less on bank borrowings, the loan rate began to decline.

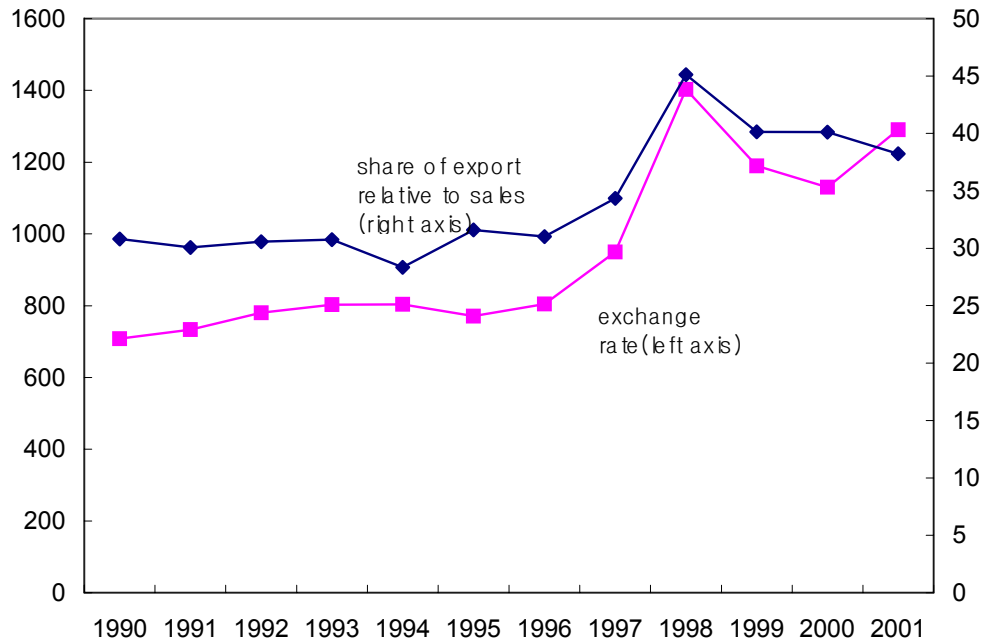
Figure 5 Trend of interest rate (loan rate) (%)



Source: Bank of Korea

Given the fact that wage and interest rates have throughout the periods been stable or have slightly risen, the comparison of these three figures suggests that Korea's macroeconomic recovery is more likely due to exchange rate adjustment, which has ended up raising the price competitiveness of the Korean export industry. Indeed, Figure 6 shows the relationship between the won-dollar exchange rate and the export share of manufacturing industries in Korea. It shows that especially in 1998, the share of overseas sales (export) to total sales in the manufacturing sector abruptly peaked due to the large-scale devaluation of the Korean won vis-à-vis the US dollar and has since tended to decline together with the slight appreciation of the Korean won.

<Figure 6> The Korean won/US dollar exchange rate and the share of export sales relative to total sales in the manufacturing industries



Source: Financial Statement Analysis, Bank of Korea

So far we have examined the behavior of the principal macro-economic variables. We will now investigate to what extent the depreciation of the Korean won vis-à-vis the US dollar affected the earnings of Korean companies by industry

III. Estimation Method and Data

1. Basic Model

The fluctuation of exchange rates affects corporate earnings through its effect on export revenues and on import costs. When examining the effect of a change in the value of the Korean won on the revenue of the Korean exporters, there are two possible channels. A drop in the exchange rate of the Korean won vis-à-vis the US dollar, for example, is translated into a proportionate increase in won denominated revenues of Korean exporters. In fact, they decide how much to lower the dollar denominated prices

seen by their foreign consumers, taking into account how much foreign consumers will adjust their demand for Korean goods responding to the change in the dollar denominated prices. Thus, the positive effect of a depreciation of the Korean won on export revenue depends on the price adjustment effect (associated with the pass-through of Korean won denominated prices to dollar denominated sales prices), on the one hand, and the quantity adjustment effect (associated with the price elasticity of foreign demand), on the other hand.

Also, fluctuations of the won/dollar exchange rate affects the input costs of Korean exporters through its effect on the price of imported goods. When the Korean won depreciates, for example, the Korean won denominated prices of imports such as oil and other intermediate commodities, which are typically contracted in US dollar terms, increase input costs. The rise in these input costs thus offsets the positive effect of a decrease in the value of Korean won on the earnings of Korean exporters.

We can express the effect of a change in the value of the Korean won on the corporate earnings mathematically. Let's denote the operating profit of a firm by Π . Then

$$\begin{aligned} \Pi &= \text{total sales value} - \text{input costs} \\ &= (\text{domestic sales} + \text{overseas sales}) - (\text{intermediate inputs} + \text{labor costs and other expenses}) \\ &= (\text{domestic sales} + \text{overseas sales}) + (\text{domestic intermediate inputs} + \text{foreign intermediate inputs} + \text{labor costs and other expenses}) \\ &= (\text{overseas sales} - \text{overseas intermediate inputs}) + (\text{domestic sales} + \text{domestic intermediate inputs} + \text{labor costs and other expenses}) \end{aligned}$$

We can assume that except for overseas sales and overseas intermediate inputs, all other items are fixed in value with respect to a change in the exchange rate of the Korean won. We define foreign earnings as the difference between overseas sales (i.e., exports) and overseas intermediate inputs (i.e., imports) and denote it by Π_f . If we denote the overseas sales of an export firm by eP_xQ_x and the overseas intermediate inputs by eP_mQ_m , then

$$\Pi_f = eP_xQ_x - eP_mQ_m,$$

where Q_x : overseas sales (export) in volume,

Qm: overseas input (import) in volume
Px: dollar denominated overseas sale (export) price
Pm: dollar denominated overseas input (import) price.

We assume that all Korean exports and imports are invoiced in the US dollar. Given that more than 80% of Korean exports and imports are currently invoiced in the US dollar, this assumption is not unrealistic at all.¹

We further assume that the dollar denominated price for the imported inputs (overseas intermediated inputs) is not affected by the changes in the value of the Korean won, given that Korea is a small open economy. That is, unlike overseas sales (exports), there is only a quantity adjustment effect. The change in the earnings can thus be written as follows:

$$\begin{aligned}
(1) \Delta \Pi &= (\Delta e P_{-1}^x Q_{-1}^x + e_{-1} \Delta P^x Q_{-1}^x + e_{-1} P_{-1}^x \Delta Q^x) - (\Delta e P_{-1}^m Q_{-1}^m + e_{-1} P_{-1}^m \Delta Q^m) \\
&= (\Delta e P_{-1}^x Q_{-1}^x + e_{-1} \frac{\Delta P^x}{P^x} P^x Q_{-1}^x + e_{-1} P_{-1}^x (\frac{\Delta Q^x}{Q^x}) - (\Delta e P_{-1}^m Q_{-1}^m + e_{-1} P_{-1}^m (\frac{\Delta Q^m}{Q^m}))) \\
&= (\Delta e / e_{-1}) \{ e_{-1} P_{-1}^x Q_{-1}^x [1 + (\frac{\Delta P^x}{P^x} \frac{e}{\Delta e}) + (\frac{\Delta Q^x}{Q^x} \frac{e}{\Delta e})] - e_{-1} P_{-1}^m Q_{-1}^m [1 + (\frac{\Delta Q^m}{Q^m} \frac{e}{\Delta e})] \} \\
&= (\Delta e / e_{-1}) \{ X_{-1} [1 + T_x + E_x] - M_{-1} [1 + E_m] \}
\end{aligned}$$

where $X_{-1} = e_{-1} P_{-1}^x Q_{-1}^x$, $M_{-1} = e_{-1} P_{-1}^m Q_{-1}^m$, $T_x = (\frac{\Delta P^x}{P^x} \frac{e}{\Delta e})$, $E_x = (\frac{\Delta Q^x}{Q^x} \frac{e}{\Delta e})$, and $E_m = (\frac{\Delta Q^m}{Q^m} \frac{e}{\Delta e})$

We now decompose further the intermediary imports into consumer goods, capital goods and raw materials. Let a_j be the share of the intermediary import j relative to total intermediary imports M , and E_{mj} be the elasticity of the intermediary import j (with $j=1, 2, 3$). Then we can rewrite the above equation as follows.

¹ As of 2000, 85% of Korean exports and 81% of Korean imports are settled in the US dollar.

$$(1') \Delta \Pi' = (\Delta e / e_{-1}) \{ X_{-1} [1 + T_x + E_x] - M_{-1} \sum_{j=1}^3 a_j [1 + E_{mj}] \}$$

It is to note that for a given value of overseas sales and overseas intermediary inputs, the lower the exchange rate pass-through to export price is and the higher the foreign demand elasticity of exported goods is, the effect of the exchange rate fluctuation on corporate earnings (operating profit) will be larger. Also, the lower the demand elasticity of imported intermediate goods is, the effect of the exchange rate fluctuation will be higher (in so far as $E_m < 1$).

2. Data at the Sectoral Level

To calculate the changes in corporate earnings due to a change in the value of the Korean won, it is essential to dispose of the data regarding total sales, overseas sales and overseas intermediate inputs by industry, together with the parameter values such as T_x , E_x and E_m .

The data are obtained from the following sources. First of all, the data for total sales and overseas sales is obtained from the survey on the 'Financial Statements' published annually by the Bank of Korea. However, the data on overseas sales is not officially published and thus has been directly obtained from the BOK internal data. Also, the data about the intermediary input costs has been obtained from the same survey. Because the data for overseas intermediary input (imports) costs are not reported in this survey, they have been indirectly calculated from the Input and Output Tables published every five years by the Bank of Korea. In fact, the overseas intermediary input cost is estimated in two steps. First, the share of overseas intermediary inputs to the total intermediary inputs is calculated from the I-O Table. It is then multiplied by the intermediary input costs in the survey. In addition, the overseas intermediary inputs are further classified into consumer goods imports, capital goods imports and raw materials imports.

<Table 1> The share of overseas sales and intermediary inputs

	Share ¹	Share of overseas sales ²			Share of overseas inputs ³		
	2001	1996	1998	2001	1996	1998	2001
Manufacturing	100.0	31.0	45.1	38.2	16.4	18.1	18.5

Food	6.5	7.0	9.2	9.2	9.1	9.7	9.3
Textiles	9.1	50.5	72.2	57.0	13.2	14.3	12.5
Apparels & leather	4.7	40.7	57.6	45.2	27.8	31.2	32.1
Paper & wood	1.3	7.8	17.5	16.8	40.7	43.1	42.5
Oils & fuels	6.3	25.0	30.5	29.4	53.9	59.3	67.1
Chemicals	8.5	31.1	36.8	36.2	17.8	18.1	20.7
Iron & metals	5.3	23.8	37.6	26.0	15.6	16.7	16.4
Machinery	1.9	9.2	19.3	21.4	10.7	10.9	12.1
Electronics	31.9	62.0	71.7	66.3	29.1	29.0	28.0
Motor vehicles	12.4	28.9	54.1	39.6	10.0	9.1	10.0

Note 1: as a percentage of total export

2: share of overseas sales relative to total sales

3: share of overseas intermediary inputs relative to total intermediary inputs.

Source: Financial Statement Analysis and Input-Output Statement, each year, Bank of Korea

Table 1 breaks down the changes in export shares brought about by exchange rate fluctuations in the Korean won by industry. First of all, looking at the electronics sector, which is the largest export sector in Korea, with its export share (31.9%), shows that its share of exports relative to total sales rose to 71% in 1998 from 58% in 1990 following the depreciation of the Korean won in 1998 and declined to 66% in 2001 following the subsequent appreciation of the Korean won. In the case of automobile sector, the second largest export industry in Korea, its share of export to total sales rose to 54% in 1998 from 18% in 1990 but had declined to 40% by 2001. Compared to the electronics industry, the automobile industry turns out relatively less sensitive to the exchange rate fluctuation. In the case of the chemical industry, however, there seems to be no big increase in the share of exports (overseas sales) despite the exchange rate fluctuation. Moreover, the export share remained limited all through the period. Finally, in the case of textile industry, the export share rose sharply to 72% in 1998 from 40% in 1996 reflecting the sharp depreciation of the Korean won. In contrast, there were no noticeable changes in the share of overseas intermediary inputs to total intermediary inputs for most of the industries.

3. Parameter Estimation

We now estimate the rate of pass-through to export price, export elasticity and import elasticity.

First of all, we examine some recent studies carried out in Korea (Kang and Oh (2001), Lee and Han (2001), and Kim (1988)). Kang and Oh (2001) estimated the price

and volume elasticities of 20 major export and import commodities for the period 1988-2000, using the dynamic OLS method. The data used was the quarterly export and import unit prices and volumes. Lee and Han (2001) analyzed the export and import behaviors (prices and volume functions) for 20 commodities during the period 1988-2000 on the basis of the traditional OLS method. Kim (1988) similarly estimated the export and import behaviors by commodities but his estimation period covers only the pre-crisis period 1985-1997. Unlike these studies estimating the price and volume elasticities of export and import commodities, there are quite many studies focusing only on the pass-through of the exchange rate to export prices in Korea. (See for example Choi(2000) for the survey of recent empirical studies). In particular, Choi (2000) tried to estimate the rates of the exchange rate pass-through to export prices for major Korean export commodities during the first quarter of 1981 to the 4th quarter of 2000. The estimation method used was the error correction model. These studies present the point estimates for the pass-through rate of exchange rate, export and import elasticities with respect to the exchange rate. When these estimation results are compared with each other, however, there is wide variety between them, not to mention the estimation periods and methods, which makes it extremely difficult to get a consistent estimate for these parameters (For the comparison of these results, see Moon and Lee (2003)). Thus, we re-estimate these parameters using quarterly data about export and import prices denominated in the US dollar and export and import volumes. Moreover, following Lee and Han (2001), we apply OLS estimation. The advantage of this method is that it provides long run parameter values. The basic estimation equations are as follows.

$$(1) \quad \ln X_{Pi} = \alpha_0 + \alpha_1 \ln USR + \alpha_2 \ln YEN + \alpha_3 \ln PPI + e_t$$

$$(2) \quad \ln X_{Qi} = \beta_0 + \beta_1 \ln X_{Pi} + \beta_2 \ln WM + e_t$$

$$(3) \quad \ln M_{Qi} = \gamma_0 + \gamma_1 \ln(USR * MPi / DP) + \gamma_2 \ln GDP + e_t$$

where X_{Pi} : unit export price (in the US dollar) for the commodity i , X_{Qi} : export volume for the commodity i , M_{Qi} : import volume for the commodity i , MPi : unit import price (in the US dollar) for the commodity i , USR : exchange rate of Korean won vis-à-vis the US dollar, YEN : exchange rate of Korean won vis-à-vis the Japanese Yen, PPI : producers' price for the commodity i , WM : world import volume index, DP : Domestic producers' price, GDP : gross domestic income, e_t : error term

Estimating these equations, we obtain the point estimates for the pass-through rate of exchange rate to export price, export and import demand elasticities. Table 3 summarizes these results. First of all, concerning the exchange rate pass-through, the pass-through rate turned out -0.85 for the manufacturing sector in general. The pass-through rates to export prices are very significant, having theoretically expected correct signs for manufacturing in general and most of the industries. Second, concerning the demand elasticity of export volume, we obtain theoretically expected negative coefficients for the manufacturing sector in general and for most of the individual industries. The demand elasticity of export volume with respect to the exchange rate is calculated through the multiplication of the pass-through rate and the elasticity of export volumes with respect to prices. Third, concerning the demand elasticity of import volumes, the import volume has a negative coefficient with respect to the exchange rate for the whole imports and for imports by sector. These coefficients are also significant except for consumer goods. In a nutshell, the estimation coefficients have significantly correct signs for the manufacturing sector in general and most of the individual industries.

<Table 3> Estimated Parameters

	Pass-over	Elasticity of export volume		Elasticity of import
		export price	exchange rate	
Export (total)	-0.85(-9.97)	-0.53(-6.65)	0.45	
Food	-0.72(-7.08)	-0.60(-3.23)	0.43	
Oil & fuels	-1.89(-9.82)	-0.40(-2.23)	0.76	
Textiles	-0.68(-5.39)	-0.29(-1.98)	0.20	
Apparels	-0.35(-14.96)	-1.81(-4.18)	0.63	
Paper	-0.75(-8.17)	-0.56(-2.64)	0.42	
Chemicals	-1.10(-7.93)	-0.69(-4.24)	0.76	
Iron & metals	-0.89(-7.75)	-0.57(-3.57)	0.51	
Machinery	-0.83(-9.83)	-0.71(-7.62)	0.59	
Electronics	-0.96(-9.39)	-0.97(-13.76)	0.93	
Motor vehicles	-0.33(-5.83)	0.34(0.67)	0	
Import (total)				-0.95(-4.31)
Raw materials				-0.41(-2.59)
Capital goods				-1.43(-8.72)
Consumer goods				-0.20(-0.60)

Note 1: Because the export unit prices are taken as independent variable and export volume as the dependent variable, the export elasticity with respect to the exchange rate was calculated by the multiplication of the exchange rate pass through rate and the coefficient of the export unit price.

IV. The Impact of exchange rate fluctuation on the corporate earnings of key industries

Given the pass-through of the exchange rate to the export price and the demand elasticities of export and import volumes, the effect of the exchange rate fluctuation on the corporate earnings is easily calculated. Table 4 summarizes the impact of a 10% depreciation of the Korean won on the operating profits of companies by industry over the 4 year period after the currency crisis

<Table 4-1> Changes in the operating profits due to the 10% depreciation of the Korean won

Unit: Billion Korean won

	1998		1999		2000		2001	
	Operating profit	Exchange rate effect	Operating profit	Exchange rate effect	Operating profit	Exchange rate effect	Operating profit	Exchange rate effect
Manufacturing	25,683	6,594	30,764	9,341	39,828	8,946	29,853	8,598
Food	1,912	-107	2,240	-71	2,562	-77	2,578	-44
Textiles	1,700	738	1,495	959	1,585	839	1,301	782
Apparels & leather	1,040	725	356	908	916	765	1,395	581
Paper & wood	588	-241	958	-245	1,174	-271	1,078	-260
Oil & fuel	2,393	-1,118	1,902	-1,222	2,142	-1,302	1,357	-1,916
Chemicals	4,323	362	4,153	566	4,150	486	3,999	493
Iron & metals	2,258	227	2,863	515	3,763	260	3,259	240
Machine & equipment	887	265	583	292	1,016	321	1,127	403
Electronics	7,054	4,287	9,565	5,974	12,483	6,776	2,763	6,103
Motor vehicles	-1,161	1,236	425	1,447	2,131	1,337	4,210	1,591

<Table 4-2> Changes in the operating profit rates due to the 10% depreciation of the Korean won

Unit: %

	1998		1999		2000		2001	
	Profit rate	Exchange rate effect	Profit rate	Exchange rate effect	Profit rate	Exchange rate effect	Profit rate	Exchange rate effect
Manufacturing	6.11	1.59	6.62	2.22	8.52	1.93	5.52	1.84
Food	6.34	-0.39	7.06	-0.23	7.55	-0.24	7.31	-0.13
Textiles	4.94	2.32	4.29	2.79	4.55	2.41	3.93	2.24

Apparels & leather	5.49	3.86	1.76	4.80	4.50	3.79	6.53	2.85
Paper & wood	4.89	-2.03	7.04	-2.04	9.03	-1.99	7.58	-2.00
Oil & fuel	7.58	-3.70	6.04	-3.87	6.40	-4.14	3.06	-5.72
Chemicals	10.49	0.97	9.50	1.37	9.56	1.11	8.20	1.14
Iron & metals	6.02	0.62	7.70	1.37	10.05	0.70	7.76	0.64
Machine & equipment	5.47	1.37	2.91	1.80	5.83	1.61	5.99	2.31
Electronics	9.28	6.66	10.71	7.86	15.46	7.59	2.78	7.56
Motor vehicles	-3.05	2.52	0.83	3.80	3.91	2.61	6.49	2.92

Table 4 (4-1 and 4-2) shows that a depreciation of 10% in the exchange rate of the Korean won helped to increase the operating profit of the whole manufacturing industry by 6-9 trillion won and the operating profit rate (measured in terms of total sales) by 1.6-2.2%. Taking into consideration that the operating profit (and profit rate) of the manufacturing industry was about 25-39 trillion won over this period, it implies a reduction of the operating profit (and profit rate) by 25-30%.

First, we can compare our result to similar studies carried out in Korea. There are not many studies in this regard (Lee (2002) and Suh (1999)). When compared to the result of Lee (2002) using the balance sheet data of 350 large companies listed in the Korean stock market, our study under-estimates a little bit the effect of a depreciation on the earnings. According to Lee's study, a depreciation of 10% in the exchange rate of the Korean won increases the operating profit of the whole manufacturing sector by 8.5 trillion dollars. This is due to the fact that Lee's study does not consider the effect of a fluctuation in exchange rate on the pass-over rate, demand elasticities of export and import. Compared to the result of Suh (1999), however, our result shows that the effect of the exchange rate depreciation on the earnings of Korean manufacturing companies is 4 times larger.

We can also compare our result to the result obtained for Japan. Then, the effect of the exchange rate depreciation is far more sensitive in Korea than in Japan. For instance, according to Ikee Masuda (1997), a depreciation of 10% in the exchange rate of the Japanese yen (against US dollar) results in an increase in the profit rate of Japanese mining and manufacturing companies by 11.4%, which is 2.5 or 3 times lower than the Korean figure of 25-30%. Thus, Korean manufacturing firms are in a better (worse) position than Japanese when there is a depreciation (appreciation) of the exchange rate. Two main reasons could be indicated in this regard.

First, most Korean trade is still denominated in the US dollar, while yen-denominated settlement accounts for a substantial part of Japanese trade (35-40% for export and 20% for import). Secondly, many Japanese companies have shifted their production bases overseas and increased the use of imported raw and processed

materials, while this phenomenon is relatively recent in Korea.

Concerning the sectoral effect of the exchange rate depreciation, it is important to note that the depreciation led to a downfall in the earnings in some sectors, however this is not true in most cases. For instance, it turns out that the depreciation caused a fall in earnings in some industrial sectors such as food and beverages, wood and papers and petrol products. These sectors generally import a lot of intermediary inputs from abroad. Among the sectors positively affected by the depreciation of the Korean won, the electronics and motor vehicles, the two most important export industries in Korea, are the sectors that benefited most from the depreciation of the Korean won. The textile sector also benefited much from the depreciation of the Korean won.

On the basis of the Table 4, we calculate how much the depreciation of the Korean won during the currency crisis period contributed to the recovery of corporate earnings. As mentioned, the Korean won depreciated by 47.7% from 949 won to 1403 won during 1998. It then appreciated by 15.2%, reaching 1189 won in 1999 and again by 5% reaching 1130 won in 2000. During 2001, the Korean won recorded again a depreciation of 14.2%. Depending on these movements of the Korean won, the earnings of Korean manufacturing firms sharply fluctuated. During 1998, the Korean won depreciated by 47.7%, helping to increase the earnings of Korean firms by 31.4 trillion won, which was greater than the operating earnings of the whole manufacturing industry in Korea, 25.6 trillion won. It means that the recovery to profitability after the crisis can be completely attributed to the depreciation of the Korean won.

In contrast, the exchange rate appreciation during 1999 and 2000 brought about a reduction in earnings by 14.1 trillion won and 4.4 trillion won. Taking into account the increase in earnings brought about by the depreciation of the Korean won in 1998, there remains still an increase in earnings of 10 trillion won. Finally as a result of the depreciation of the Korean won in 2001, there was again an increase in earnings equal to 12.2 trillion won.

<Table 5> Summary of changes in exchange rate and corporate earnings after currency crisis

Unit: trillion won

	1998	1999	2000	2001
Manufacturing	31,452	-14,198	-4,473	12,209
Food	-512	107	38	-62
Textile	3,518	-1,457	-419	1,110
Apparels	3,457	-1,380	-382	824
Paper & wood	-1,147	373	136	-369
Oil % fuel	-5,331	1,858	651	-2,721
Chemicals	1,727	-860	-243	700
Iron & metal	1,085	-783	-130	340
Machinery	1,264	-444	-161	573
Electronics	20,450	-9,081	-3,388	8,666
Motor vehicle	5,898	-2,199	-668	2,260

V. Conclusion

This paper estimates that a depreciation of the Korean won which reached 47% during the year 1998 increased the operating profits of the whole manufacturing industry by about 31 trillion Korean won. Given that the operating profit of the whole manufacturing industry was only 25 trillion Korean won in 1998, this implies that the recovery to profitability after the crisis was due entirely to the depreciation of the Korean won. In fact, with its open and highly export-oriented economy, Korea could benefit more from the depreciation of its currency than any other country in the world. This leads us to identify what was the most important factor behind the rapid recovery of the Korean economy. Expansionary fiscal and monetary policy, strong commitment to economic reforms, capital account liberalization, increased flexibility in the labor market, especially adjustment in employment and wages, all these elements are considered to contribute to the recovery. Although it would be difficult to deny the role of these factors, there is no doubt that the sharp depreciation of Korean won was the principal driving force behind the quick, strong and broad recovery. All other factors seem dwarfed. The results suggest specifically that the corporate and banking sector reforms and government macroeconomic policies put in place in Korea during the currency crisis have little to do with the rapid recovery of the Korean economy. There is then nothing special about the recovery in the Korean economy.

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Appendix: Estimation Results

Equation of the exchange rate pass over

	C	LnUSR	lnYEN	PPi	R ²	ADF
Manufacturing	10.72 (39.34)	-0.85 (-21.41)			0.89	-3.00*
Food	9.1 (15.95)	-0.72 (-7.08)		0.005 (3.89)	0.69	-2.65*
Oil & fuel	16.06 (13.23)	-1.89 (-9.82)		0.008 (10.40)	0.67	-3.36*
Textiles	10.81 (26.77)	-0.68 (-5.39)	-0.20 (-1.86)		0.80	-3.17*
Apparels	7.07 (45.00)	-0.35 (-14.96)			0.81	-2.11
Paper	9.27 (17.33)	-0.75 (-8.17)		0.004 (4.29)	0.71	-4.38*
Chemicals	11.24 (16.11)	-1.1 (-7.93)		0.01 (3.45)	0.73	-3.71*
Iron & metals	10.05 (18.07)	-0.89 (-7.75)		0.007 (3.07)	0.82	-3.81*
Machinery	9.26 (27.42)	-0.81 (-9.83)		0.01 (3.16)	0.77	-2.83*
Electronics	8.89 (10.01)	-0.96 (-9.39)		0.03 (13.42)	0.97	-3.87*
Motor vehicles	4.85 (18.56)	-0.33 (-5.83)		0.02 (5.04)	0.39	-1.93

Note: 1) * means that there exists a unit root at the significance level of 10%.

Export volume equation

	C	LnWM	LnXP	R ²	ADF
Manufacturing	2.70 (5.17)	1.47 (24.85)	-0.53 (-6.65)	0.98	-3.51*
Food	6.32 (6.50)	0.38 (5.52)	-0.60 (-3.23)	0.58	-3.50*
Oil % fuel	-2.05 (-2.66)	2.95 (24.46)	-0.04 (-2.23)	0.92	-2.52
Textiles	2.48 (2.50)	1.20 (10.09)	-0.29 (-1.98)	0.92	-4.13*
Apparels	15.73 (6.79)	-1.03 (-7.47)	-1.81 (-4.18)	0.54	-8.48*
Paper	1.24 (1.12)	2.08 (23.87)	-0.56 (-2.64)	0.94	-4.13*
Chemicals	0.97 (0.99)	2.39 (22.00)	-0.69 (-4.24)	0.96	-0.69
Iron & metals	3.91 (4.26)	1.15 (14.09)	-0.57 (-3.57)	0.93	-3.16*
Machineary	1.83 (3.36)	2.07 (38.67)	-0.71 (-7.63)	0.98	-4.08*
Electronics	4.72 (6.84)	1.43 (10.85)	-0.97 (-13.76)	0.98	-2.93*
Motor vehicles	-4.74 (-2.03)	2.7 (19.89)	0.34 (0.69)	0.88	-2.98*

Note: 1) * means that there exists a unit root at the significance level of 10%.

Equation of import volume

	C	ln(USR*MPi/DP)	lnGDP	R ²	ADF
Total	-5.89 (-2.85)	-0.95 (-4.31)	1.45 (20.30)	0.94	-4.94*
Consumer goods	-20.71 (-5.70)	-0.2 (-0.60)	2.30 (16.35)	0.91	-3.70*
Raw materials	-7.86 (-6.12)	-0.41 (-2.59)	1.31 (22.88)	0.92	-6.53*
Capital goods	-1.52 (-0.82)	-1.43 (-8.72)	1.35 (17.09)	0.95	-4.27*

Note: 1) * means that there exists a unit root at the significance level of 10%.