Fluctuation of Foreign Exchange Rates and Competitiveness of Price*

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By calculating the deviation of exchange rates from the long-run equilibrium exchange rates which maintain the price competitiveness of Korean goods in the world market, we find that the greater the imbalance in current account has become, the larger the gap between the two rates. While undervalued Korean won in the 1980s did harm on the Korean economy, the rapid appreciation in the 1990s along with the liberalization of capital market is also expected to deteriorate the current account deficuts.

I. Introduction

This paper has three objectives. The first is to analyze the deviation of exchange rates from the long-term equilibrium exchange rate and its impacts on the Korean economy. The second is to briefly review the exchange rate policies of Korea during the last two decades. The final objective is to analyze the causes for the changes in exchange rate policies and its impact on exchange rate movements.

Following the brief introduction, a simple model has been set up to estimate long-term equilibrium exchange rates in section II. In this model, long-term equilibrium exchange rates are defined as exchange rates which maintain the price competitiveness of Korean goods in the world market.

In section III, empirical analysis is done with the model. Actual foreign exchange rates over last 15 years are compared with long-term equilibrium exchange rates to analyze the impacts of their deviations from equilibrium exchange rates on the balance of payments. It is shown that the larger the gap between two different exchange rates,

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the greater the imbalance in current account.

In section IV, exchange rate movements over the last two decades are analyzed from the viewpoint of institutional changes in foreign exchange rate policies. With the introduction of the market average foreign exchange rate system and revision of the *Foreign Exchange Control Act*, Korea is moving rapidly towards the liberalization of the foreign exchange rate.

In section V, there are a brief summary and a conclusion.

II. The Model

In this section, a simple model has been set up to estimate the long-term equilibrium exchange rates to maintain price competitiveness of Korean goods in the world market. With one trading partner, price competitiveness is achieved when real exchange rate is held constant. With many trading partners, however, all the exchanges rates with trading partners do matter. Even if the exchange rate of Korea vis-à-vis the U.S. is fixed, the price competitiveness of Korean goods in the world market varies widely with the fluctuation of exchange rates between major trading partners of Korea due to the large amount of capital flow. Therefore, to maintain the price competitiveness, real effective exchange rate should be maintained constant. But this is not sufficient enough to maintain the price competitiveness. With the distinction of traded goods from non-traded goods, price competitiveness is guaranteed only when the real effective exchange rates of traded goods are held constant.

Followings are step by step presentation to show to estimate the change in the foreign exchange rate vis-à-vis the US dollar to make the real effective exchange rate of traded goods constant.

In equation (1), the nominal effective exchange rate is defined as geometric means of foreign exchange rates vis-à-vis trading partners of Korea:

$$I = \prod_{i=1}^{n} (E_i)^{w_i}. \tag{1}$$

Throughout all the equations, subscript i indicates i country. Here, I, E_i and w_i indicate nominal effective exchange rate, exchange rate vis-à-vis i country, and weights of i country which is determined as a share of trade volume of i country to total trade volume, respectively. For convenience, let us assume that E_1 is the exchange rate vis-à-vis US dollar.

After taking the log and differentiating with respect to time, we can derive the rate of change in the foreign exchange rate vis-à-vis the US dollar which make the nominal effective exchange rate constant as follows:[1]

$$\dot{E}_1 = \sum_{i=2}^{n} w_i \dot{E}_{i1}. \tag{2}$$

Here, $\dot{E}_1$ and $\dot{E}_{i1}$ indicate the rate of change in the foreign exchange rate vis-à-vis the US dollar and the rate of change in foreign exchange rate between the U.S. and i country which is also one of our trading partners. Here, an increase in $\dot{E}_{i1}$ indicates that currency of i country depreciates vis-à-vis the US dollar.

As it is well-known, real effective exchange rate is defined as follows:

$$J = \prod_{i=1}^{n} \left(\frac{E_i P_i}{P_0} \right)^{w_i}. \tag{3}$$

Here, J, P_i and P_0 indicate the real effective exchange rate, the price level of i country, and the price level of Korea, respectively. The rate of change in the foreign exchange rate vis-à-vis the US dollar, which maintains the real effective exchange rate constant, is calculated as follows:

$$\dot{E}_1 = (\pi_0 - \pi_1) + \sum_{i=2}^{n} (\pi_1 - \pi_i) + \sum_{i=2}^{n} w_i \dot{E}_{i1}. \tag{4}$$

Here π_0, π_1 and π_i indicate the inflation rate of Korea, of the United States, and of i country, respectively. Finally, let us derive the change in foreign exchange rates which makes the real effective exchange rates of traded goods constant. In equation (5), J^T represents the real effective exchange rate of traded goods:

$$J^T = \prod_{i=2}^{n} \left(\frac{E_i P_i^T}{P_0^T} \right)^{w_i}. \tag{5}$$

Here, superscript T indicates traded goods. Then, the rate of change in the foreign exchange rate vis-à-vis US dollar which makes the real effective exchange rate of traded goods constant is obtained as follows:

[1] $\log I = \log E_1 + w_2 \log(E_2/E_1) + \ldots + w_n \log(E_n/E_1)$. If we derive E_1 which makes $\frac{d(\log I)}{dt} = 0$, then $\dot{E}_1 = w_2 \dot{E}_{21} + w_3 \dot{E}_{31} + \ldots + w_n \dot{E}_{n1}$.

$$\dot{E}_1 = (\pi_0^T - \pi_1^T) + \sum_{i=2}^{n} w_i(\pi_1^T - \pi_i^T) + \sum_{i=2}^{n} w_i \dot{E}_{i1}. \tag{6}$$

Here π_0^T, π_1^T, and π_i^T mean the inflation rate of traded goods of Korea, of the United States and of i country, respectively.

Since there are no data on the inflation rates of both traded and non-traded goods, we relate them with known data such as growth rates of wage and productivity growth rates of both sectors. In the case there is no significant difference in the growth rate of wage between the two sectors, the inflation rate is linked to the inflation rate of traded goods as follows[2]:

$$\pi = \pi^T + \left(\frac{\theta^N}{\theta}\right)(l^T - l^N). \tag{7}$$

Here θ^N, θ, l^T, and l^N indicate the total product of non-traded goods, the total product of both traded and non-traded goods, the growth rate of productivity in traded sector, and the growth rate of productivity in non-traded sector, respectively. In equation (7), superscript N indicates non-traded goods.

Substituting (7) into (6), we derive the rate of change in the foreign exchange rate vis-à-vis the US dollar which makes real effective exchange rates of traded goods constant as follows:

$$\begin{aligned}\dot{E}_1 = [\pi_0 - w_1\pi_1 + w_1\left(\frac{\theta_1^N}{\theta_1}\right)(l_1^T - l_1^N) - \left(\frac{\theta_0^N}{\theta_0}\right)(l_0^T - l_0^N)] \\ + \sum_{i=2}^{n} w_i[\left(\frac{\theta_i^N}{\theta_i}\right)(l_i^T - l_i^N) - \pi_i] + \sum_{i=2}^{n} w_i \dot{E}_{i1}.\end{aligned} \tag{8}$$

From equation (8), we can easily conclude that the rates of change in foreign exchange rate which maintain the price competitiveness depend upon differences in inflation rates between Korea and trading partners, gaps in growth rates of productivity between traded and non-traded sectors, and rates of changes in exchange rates among trading partners.

[2]If the growth rate of wage, w, is the same between two sectors, then i) $\pi^T = w - l^T$, ii) $\pi^N = w - l^N$. Since inflation rate is a weighted average of inflation rate of traded and non-traded sector, iii) $\pi = \pi^T + \frac{\theta^N}{\theta}(\pi^N - \pi^T)$. Substituting i) and ii) into iii), we will have $\pi = \pi^T + \frac{\theta^N}{\theta}(l^T - l^N)$.

III. Empirical Analysis

Using equation (8), we estimated the long-term equilibrium exchange rate which maintains the real effective exchange rate of traded goods constant. First, we limited our trading partners to the U.S., Japan and Germany, not only because these countries are our major trading partners but also because there had been wild fluctuations of exchange rates among these countries throughout 1980s. Also, with the collapse of cold war, there has been a tendency of world economy becoming tripolarized around these countries.

Later we added Taiwan to our trading partners, to take into account the impacts of change in foreign exchange rates of one of Korea's major competitors.

As for the weight of each country, the average share of trade volume of each country to total trade during 1987-90 was calculated and readjusted to make the sum of the weights equal to one.

Finding operational counterparts to the traded and non-traded aggregates in equation (8) is not an easy task. Manufacturing, mining, electricity, gas and water supply were classified as traded sector. Wholesale and retail trade, restaurants and hotels; transport, storage, and communication; finance, insurance, real estate and business services; community, social and personal services were classified as non-traded sector. Although agricultural and fishery sectors are heavily protected, about 52% of the total supply of agricultural and fishery products are imported from abroad. Therefore, we have had problems of classifying the agricultural and fishery sector. In the third column of Table 1, agricultural and fishery products are classified as traded goods, while in the fourth column, half of agricultural and fishery products were assigned to trade sector with the remaining half the non-trade sector. The division chosen is somewhat inevitably arbitrary.

In order to measure the deviation of exchange rates from the long-term equilibrium exchange rate, it is necessary to determine a base year for the estimation of long-term equilibrium exchange rates. Since Korea was in balance of payments equilibrium in 1977 and 1985, those two years are natural candidates for a base year in which price competitiveness was maintained. If we take 1985 as a base year, we come to a conclusion that in 1988 Korean won was already overvalued even though balance of payment surplus reached its peak. Therefore, 1977 was taken as the base year, and the exchange rate of 1977 was regard-

TABLE 1
COMPARISON OF THE ACTUAL EXCHANGE RATE
WITH THE LONG-TERM EQUILIBRIUM EXCHANGE RATE

Year	ER	A	A'	B	B'	CA	GR
1977	484	484	484	484	484	12	9.8
1978	484	499	493	500	494	−1085	9.8
1979	484	562	564	563	564	−4151	7.2
1980	607	674	665	673	664	−5321	−3.7
1981	681	709	695	707	692	−4646	5.9
1982	731	769	767	767	765	−2650	7.2
1983	776	761	776	761	774	−1606	12.6
1984	806	762	774	760	772	−1373	9.3
1985	870	773	765	772	792	−887	7.0
1986	881	649	667	650	668	4617	12.9
1987	823	639	656	638	654	9854	13.0
1988	731	653	676	651	672	14161	12.4
1989	671	711	725	694	718	5055	6.8
1990	708	735	759	729	752	−2179	9.0

Note: 1. Weights for A and A': U.S. (0.5060), Japan (0.4221), German (0.0719).
2. Weights for B and B': U.S. (0.4904), Japan (0.4091), German (0.0679), Taiwan (0.0309).
3. A and B: Long-term equilibrium exchange rate with agricultural and fishery products classified as traded goods.
4. A' and B': Long-term equilibrium exchange rate with half of agricultural products assigned to trade sector.
5. ER: Actual exchange rate.
6. CA: Current accounts (in million dollars).
7. GR: Growth rate of GNP (%).

ed as the long-run equilibrium exchange rate.

Productivities in traded as well as in non-traded sector were obtained by dividing the output of constant price by the number of people employed in each sector.

Column 3 and 4 in Table 1 show long-term equilibrium exchange rate when we limited our trading partners to the U.S., Japan and Germany. If we look at the third column of Table 1 which classifies agricultural and fishery products as traded goods, Korean won had been overvalued during 1978-1982, even though the size of overvaluation had been reduced by the devaluation of exchange rate in 1980 and 1981. In 1983, there was no significant gap between the actual exchange rate and the long-term equilibrium exchange rate which made real effective exchange rate of traded goods of 1983 to be equal to that of 1977. The actual exchange rate almost converged to the long-

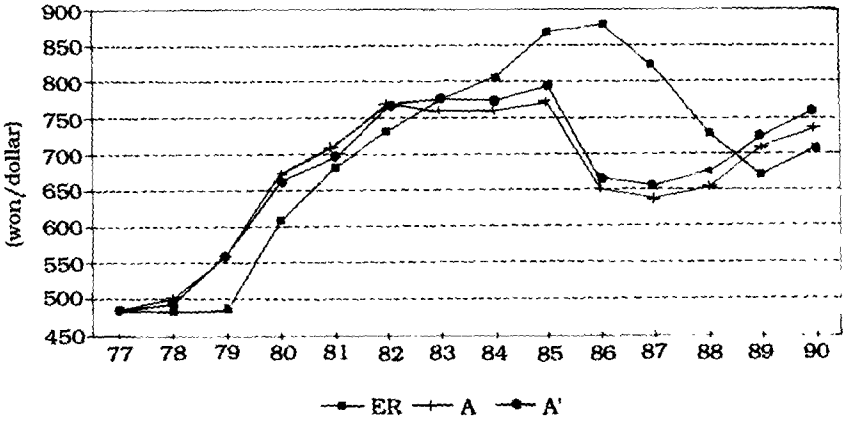

FIGURE 1
COMPARISON OF THE ACTUAL EXCHANGE RATE WITH THE LONG-TERM EQUILIBRIUM EXCHANGE RATE

term equilibrium exchange rate. Because of time lag and the remaining effects of the second oil shock of 1980, balance of payments was in red by a significant amount in 1983. From 1984, there was a reversion in the trend, and Korean won began to be undervalued. Until 1988, the size of undervaluation of Korean won had been quite substantial. This kind of phenomena was mainly due to the rapid appreciation of Japanese yen and Deutsche mark over the period. In the face of appreciation of Japanese yen and Deutsche mark, the actual exchange rate of Korea moved in the opposite direction, depreciating further vis-à-vis the US dollar. Thus it enlarged the size of undervaluation of Korean won. There is no doubt that the undervaluation of Korean won was one of the major factors contributing to the balance of payments surplus of Korea. Until 1985, the current account had been in the red, but it turned into surplus from 1986 and reached its peak in 1988, amounting to US$ 14 billion.

Since Korea never experienced current account surplus, the Korean government failed to cope with the new economic situation with adequate sterilization policies. Therefore, the rapid growth of domestic financial supply caused by the sudden inflow of foreign currency not only overheated the Korean economy, but also led to a speculation on real estates and thereby caused a sky rocketing rise in real estate prices. On the positive side, however, the high economic growth also provided a room to accommodate wage increase demands by laborers

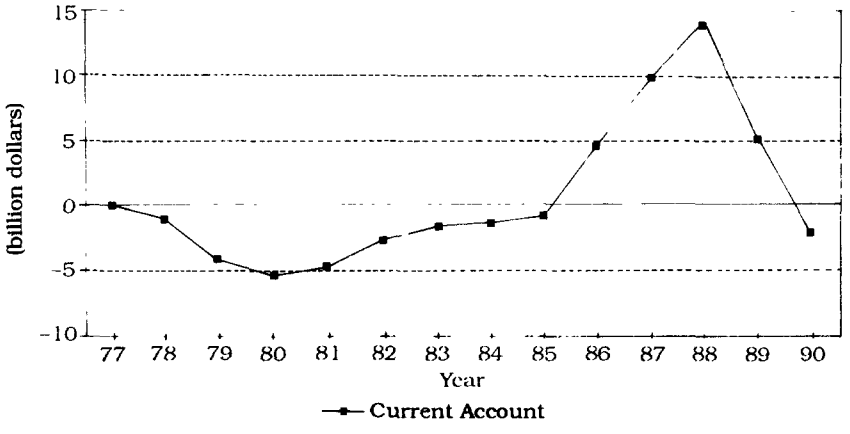

FIGURE 2
TREND OF CURRENT ACCOUNT

during the process of economic and political democratization.

With inflows of hot money and gradual liberalization policies of foreign rate the trend reversed from 1989, and Korean won began to be overvalued again. Overvaluation of Korean won was more evident in 1990 as shown in Table 1 and Korea entered the era of current account account deficits again.

The same trend is also shown in the fourth column of Table 1 in which half of agricultural sector is classified as a traded sector while the remaining half was classified as a non-traded sector. The size of overvaluation of Korean won in 1990, however, was more evident here than when agricultural and fishery sector were classified as a traded sector.

Figure 1 and 2 show that deviations of actual exchange rates from long-term equilibrium exchange rate had significant impacts on the trade balance. We can see the general trend, even though there is no one to one correspondence because of time lag. In early 1980s, when Korean won was overvalued, Korea suffered from balance of payments deficits. In late 1980s, when exchange rates were undervalued, it made a great contribution to the balance of payments surplus. But, again in 1990, when the exchange rate began to appreciate, it deteriorated the balance of payments situation.

Column 5 and 6 in Table 1 show the long-term equilibrium exchange rates when Taiwan is included as a trading partner. There is no significant difference in long-term equilibrium exchange rates whether Tai-

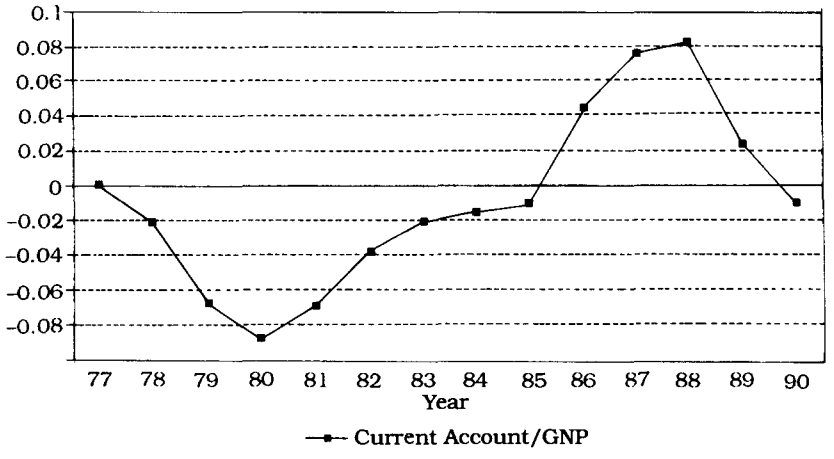

FIGURE 3
TREND OF THE RATIO OF CURRENT ACCOUNT TO GNP

wan is included or not.

IV. Institutional Change in Foreign Exchange Rate Policies

Devaluing its currency from 130:1 to 255:1 vis-à-vis US dollar in 1964, Korea officially adopted a floating exchange rate system. Through the intervention of Bank of Korea in foreign exchange market, however, Korean won in real sense had been pegged to the US dollar until 1980. Therefore, we had better call it fixed exchange rate system pegged to the US dollar rather than floating exchange rate system. This is evident when looking at foreign exchange rate fluctuations in the 1970s. As shown in the second column of Table 1, foreign exchange rates were fixed at 484:1 during 1975-79, while the value of Korean won dropped significantly over the period.

In the face of the second oil shock in 1980, Korea was faced with several problems in maintaining the fixed exchange rate system, pegged only to the US dollar. First, due to the fact that the exchange rate had been fixed in the situation of high domestic inflation relative to abroad, it led to a loss in competitiveness of price and a rapid rise in balance of payments deficits. Furthermore, the second oil shock worsened and enlarged the balance of payments deficits. The second problem arose from pegging Korean won only to the US dollar. After the major countries moved towards the floating exchange rate system in early 1970s,

there had been wild fluctuations in exchange rates. Under the dollar-pegging fixed exchange rate system, even in the case of no changes in the value of won vis-à-vis dollar, competitiveness of price of Korean won varied with the fluctuation of exchange rates among our major trading partners. Especially, when the US dollar was appreciated vis-à-vis other major currencies after the second oil shock, Korean won was automatically appreciated vis-à-vis other major currencies and Korea lost its competitiveness of price. Thirdly, since a large amount of exchange rate adjustment was made in the face of second oil shock, adverse impacts of exchange rate devaluation on the economy were very severe.

To resolve the above problems, the Korean government adopted the flexible multi-currency basket system in February 1980, and the system has been used for ten years. Under the new exchange rate system, the foreign exchange rates were determined on the basis of the Special Drawing Rights (SDR) basket and the trade basket of five major foreign currencies, and of other factors as follows:

$$ER = \beta \cdot \text{SDR basket} + \beta' \cdot \text{trade basket} + \alpha,$$
$$\text{where } \beta + \beta' = 1.$$

Here ER, β, β', and α mean exchange rates, weight of SDR basket, weight of trade basket, and other factors reflecting general economic condition. Since β, β', α and composition of trade basket were determined through the consultation between Bank of Korea and Ministry of Finance, there was room for the government to intervene in the determination of foreign exchange rate under the multi-currency basket system.

The new system worked successfully in the early 1980s, and as shown in Table 1, the gap between the realized exchange rates and the long-run equilibrium exchange rate was reduced significantly. This system, however, did not work well in the late 1980s when the US dollar became depreciated against other major countries. The gap between the realized exchange rates and the long-term equilibrium exchange rates was getting bigger until 1987, and Korea was often criticized as a exchange rate manipulating country. At that time, however, the Korean government did not know how to cope with the new world economic condition. Due to past experience, The Korean government, however, did not have any intention to manipulate foreign exchange rate to keep it undervalued.

As mentioned before, undervalued Korean won in late 1980s did

more harm to the Korean economy. With the realization of adverse impacts of undervalued Korean won and the pressure of foreign countries, the Korean government intervened in the foreign exchange market heavily. As a result, the exchange rate began to appreciate rapidly from 1988. At the same time, the Korean government took actions to reform foreign exchange rate system.

As an effort to move towards a flexible exchange rate system, the Korean government introduced the market average foreign exchange rate system in March 1990 which allowed greater flexibility in the determination of foreign exchange rates. The new exchange rate system replaced the multi-currency basket-peg system as a part of the reform in the foreign exchange policy. Under the new regime, the market average rate is determined by volume-weighted average of the interbank won-dollar exchange rates of the previous business day.

The exchange rate of won vis-à-vis other foreign currencies is calculated by combining the won-dollar market average rate and the exchange rates of dollar against other foreign currencies in international currency market.

Under the new system, the interbank won-dollar exchange rates were allowed to float daily within a range of ± 0.4% around the market average exchange rate to minimize the volatility of exchange rates in the early stage of exchange rate system, Korea is no longer accused of being a exchange rate manipulation country. Recently, the Korean government widened the spread of daily fluctuation to ± 0.6% to enhance the role of market forces in the determination of exchange rates.

To promote the liberalization of foreign exchange and capital transactions, the Korean government if preparing the revision of the Foreign Exchange Control Act. The key aspect of the revision is to replace the current positive system with a negative system. In the positive system, all foreign exchange transactions are prohibited in principle with the exceptions specifically stipulated while in the negative system all the transactions are permitted except those specifically prohibited. The regulations on the foreign exchange concentration system are also relaxed. Debts and securities are exempted from concentration, and non-residents are requested only to register their foreign exchange. Other key points of the reform include the replacement of various regulatory restrictions with more flexible ones, the clarification of the notification procedure regarding capital transactions.

V. Summary and Conclusion

In this study, we calculated the deviation of foreign exchange rates from the long-run equilibrium exchange rates and analyzed the impacts of the deviations on the balance of payments. In the late 1980s, the undervaluation of Korean won undoubtedly made a great contribution to accumulation balance of payments surplus.

In the process of moving towards the liberalization of foreign exchange rate, however, exchange rates converged with the long-run equilibrium exchange rates and later began to be overvalued.

In the process, institutional reforms of foreign exchange rate system also undertook such as the introduction of market average foreign exchange rate system, the relaxation of regulations on foreign exchange concentration system and the revision of the Foreign Exchange Control Act.

With the strict control on the capital movements, impacts of capital transactions on the exchange rates have not been significant up to now. With the opening of stock market to foreign investors from 1992, however, we expect a large amount of capital inflow to Korea since domestic stock prices are believed to be undervalued. There is no doubt that the capital inflow will work in the direction of appreciating Korean won. As the Korean won is now already overvalued, the appreciation of won resulting from capital transactions will further deteriorate the current account deficits. In 1991 alone, the current deficits of Korea is expected to reach US$ 8 billion.

If the liberalization of capital movements had been pursued in the late 1980s when the Korean won was undervalued, we would not need to be concerned about the appreciation of Korean won and the balance of payments problems.

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