

Economic Fundamentals on Exchange Rates under Different Exchange Rate Regimes:
Recent Experiences from the Korean Exchange Rate Regime Change

Byung-Joo Lee
Department of Economics and Econometrics
University of Notre Dame
Norte Dame, IN 46556 USA
574-631-6837
Lee.81@nd.edu

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Abstract:

This paper investigates the structural differences of the free floating exchange rate regime after the economic crisis compared to the managed float exchange rate regime before the economic crisis. This paper focuses on the relationship between exchange rates and economic fundamentals. It is well documented that the exchange rate is very difficult to predict using any theoretical models for the exchange rate determination. Korean exchange rates provide one of the unique opportunities to study the different behaviors or roles, if any, of managed float and free floating exchange rate regimes. Based on the simple monetary model, we found that the Korean exchange rates are more sensitive to the economic fundamentals under the free floating regime than under the managed float regime. Exchange rate path-through into the domestic variable, especially inflation rate, has become more stable under the floating regime than under the managed regime. This finding may contradict the traditional arguments for the managed regime. However, this finding is consistent with the view that the free floating regime is better for the economic growth in the long-run. In short, the fixed or managed regimes are short-run solutions for the economic growth. Exchange rate volatilities under the flexible regime could be reduced if there is a well-functioning future's market.

1. Introduction

After the recent economic crisis and the ensuing dramatic devaluation of their local currencies among many Asian countries, many countries including Thailand, Malaysia, Indonesia and Korea among others, resort to the free floating exchange rate system. They abandoned the hard or soft peg exchange rate systems to adopt the free floating exchange rate system mainly because of their inability to maintain the pegs. Among many other factors of economic crisis, exchange rate regimes have been implicated in most accounts of these countries got into the economic crisis. It is widely believed that the fixed or pegged exchange rate regimes are ultimately destined to collapse, and resulting in the economic crisis. Therefore, the solution to the economic crisis lies in the increased exchange rate flexibility in the long term (Obstfeld and Rogoff 1995, Larrain and Velasco 2001).

Even with the possibility of the ultimate failure of the fixed exchange regime, many developing and emerging countries still favor fixed exchange rate regime to the flexible exchange regime. The advantages of the fixed regime, especially for the developing countries, are well summarized in Frankel (2003). They are: providing a nominal anchor to monetary policy, encouraging trade and investment, precluding competitive depreciation and avoiding speculative bubbles. In short, the fixed exchange regimes provide the stability that the developing countries need desperately to maintain their economic growth. However, as the countries manage to maintain fixed exchange rate with occasional intervention, it is inevitable that there is a large gap between the fixed exchange rate and the economic fundamentals such as expansionary monetary policy, low foreign reserves and current account deficits to support the fixed rate. When this gap finally collapses, it brings the sudden and violent currency depreciation thus results in the economic crisis. This line of reasoning is the basis of numerous analysis of the economic crisis such as Flood and Garber (1984) for the first generation crisis model, Obstfeld (1994) for the second generation crisis model, and Flood and Marion (2002) for the third generation or twin crisis model. Frankel (2003) also provides four advantages of the free floating exchange rate regime: independent monetary policy, automatic adjustment to trade shocks, seigniorage and lender of last resort ability, and ability to

avoid the bad speculative attack. However, as Frankel points out, it is not all clear whether the majority of the developing countries can or willing to take advantages of the free floating exchange rate regime.

There is an increasing trend after the recent economic crisis that many developing countries adopt the free floating exchange rate regimes, but in reality, the officially declared exchange rate regimes are not what they really claim to be. Calvo and Reinhard (2002) investigated wide-geographic areas of 39 countries for the period of January 1970-November 1999, and found that countries that say they allow their exchange rates to float mostly do not. It is the so-called phenomena of the “fear of floating.” From this evidence, it is clear that many of developing countries prefer to have their exchange rates stable regardless of their officially declared exchange rate regime. Then, it begs the next question why they prefer to have fixed exchange rate regime to the flexible regime? It is widely believed as if a mantra that the fixed exchange rate regime will provide the domestic relative price stability and thus promotes the economic growth. However, Levy-Yeyati and Sturzenegger (2003) shows the evidence quite to the contrary. They found that the floating exchange rate regime actually brings higher economic growth than either the intermediate regime or the fixed regime. Dissatisfied with the official *de jure* IMF classification of exchange rate regimes of each country, they developed their own exchange rate regime classification, *de facto* classification, for the period 1974-2000, and found that among the non-industrialized countries, the flexible exchange rate regime provides the higher economic growth while among the industrialized countries, exchange rate regimes do not appear to explain the economic growth in a statistically significant way.

This paper investigates the structural differences of Korean exchange rate under free floating exchange rate regime after the economic crisis compared to the managed float exchange rate regime before the economic crisis. More specifically, we are interested in whether the Korean exchange rates are more closely following economic fundamentals by comparing two different exchange rate regimes in recent years. Even with the well-documented difficulties of explaining exchange movement, there are at least two reasons that it is worthwhile effort to study Korean exchange rate based on the standard monetary model of the exchange rate determination. First, this paper

investigates Korean exchange rates. Korean economy has grown so fast in the last 30 years, and even with the recent economic crisis and setback, Korea has become one of the model economies achieving economic success. Korea attained world's exclusive economic status by joining OECD in 1996, and has become truly one of the key players in international trade. Most of the exchange rate determination analysis mentioned so far focused on the developed countries' major currencies. There are, of course, reasons for this. Exchange rates of the major currencies are mostly freely determined by the market after the 1973 Bretton Woods accord, and their data is readily available. This paper investigates the similar exchange rate behavior focusing on the Korean Won-U.S. Dollar nominal exchange rates. Second, Korean exchange rates provide one of the unique opportunities to study the different behaviors or roles, if any, of managed float and free floating exchange rate regimes. Since the regime change has occurred in relatively recent period, it provides the unique opportunity to empirically verify whether the advantages or disadvantages of different regimes postulated by Frankel (2003). Specifically, one of the advantages of the fixed rate regime is the stability of the domestic price level, thus achieving high economic growth. We will investigate the effect of exchange rate pass-through to the domestic variables such as inflation rate or interest rate under two different regimes.

It is well documented that the exchange rate is very difficult to predict using any theoretical models for the exchange rate determination. It was first documented by Meese and Rogoff (1983). They tested 1970s floating exchange rates for three major currencies, and found that none of the theoretical exchange rate determination models outperform simple random walk model in the root mean square criteria. In short, what they found is that exchange follows closely random walk process, and is unpredictable during their sample period. A recent study by Cheung, Chinn and Pascual (2002) affirms Meese and Rogoff (1983) result that any specific model or theory is not very successful to improve the exchange rate predictability. There have been other studies, such as Mark (1995), Chinn and Meese (1995) and MacDonald and Taylor (1994), claims modest success to predict the exchange rate movements, but their results are largely confined to a particular period or particular currencies. None of their results are robust to predict exchange rates consistently. Engel and West (2003) approached the exchange rate

determination from the reverse causation, and they claims that they were able to predict the economic fundamentals using the exchange rates for the G7 countries. Viewing the exchange rate as the asset price, and influenced by the future expectations, they demonstrated that exchange rate follows a process arbitrarily close to the random walk if (1) at least one underlying fundamental variables is I(1), and (2) the discount factor is near one. If expectations reflect information about the future fundamentals, the exchange rate will likely be useful in predicting future fundamentals.

Next section introduces a simple monetary model of exchange rate determination based on the purchasing power parity. Section 3 describes the data set and presents empirical results. Section 4 concludes the paper with some suggestions on the future direction of the current study.

2. Theoretical framework of exchange rate determination

The theoretical framework of our model is based on the simple monetary model used by various authors, among others, MacDonald and Taylor (1994), Mark (1995), Obstfeld and Rogoff (1996), Mark and Sul (1999), and Wu and Chen (2001). This model consists of four behavioral equations, domestic money market equilibrium, foreign money market equilibrium, purchasing power parity condition and uncovered interest parity condition.

$$(1) \quad m_t - p_t = \lambda y_t - \phi i_t \quad \text{domestic money market equilibrium}$$

$$(2) \quad m_t^* - p_t^* = \lambda y_t^* - \phi i_t^* \quad \text{foreign (ROW) money market equilibrium}$$

$$(3) \quad s_t = p_t - p_t^* \quad \text{purchasing power parity (PPP)}$$

$$(4) \quad i_t - i_t^* = E_t s_{t+1} - s_t \quad \text{uncovered interest parity (UIP)}$$

where,

$m_t (m_t^*)$: domestic (foreign) money supply in natural log

$p_t (p_t^*)$: domestic (foreign) price level in natural log

$y_t (y_t^*)$: domestic (foreign) GDP in natural log

$i_t (i_t^*)$: domestic (foreign) interest rate

s_t : nominal exchange rate (local currency price of one foreign currency) in natural log

$E_t s_{t+1}$: expectation of s_{t+1} at time t .

λ : income elasticity to money demand

ϕ : interest semi-elasticity to money demand

From equations (1) to (3), we have

$$(5) \quad s_t = m_t - m_t^* - \lambda(y_t - y_t^*) + \phi(i_t - i_t^*) = f_t + \phi(i_t - i_t^*)$$

where $f_t = m_t - m_t^* - \lambda(y_t - y_t^*)$ is the economic fundamentals consisting of domestic and foreign countries.

By substituting the UIP equation (4) into equation (5),

$$(6) \quad s_t - f_t = \phi(i_t - i_t^*) = \phi(E_t s_{t+1} - s_t)$$

Under the rational expectations hypothesis with no bubble solutions for the exchange rate process, we will have the fundamental solution for s_t as:

$$(7) \quad s_t = \frac{1}{1+\phi} E_t \left(\sum_{j=0}^{\infty} \left(\frac{\phi}{1+\phi} \right)^j f_{t+j} \right)$$

Exchange rate is expressed as the discounted value of the future economic fundamentals.

This is the characteristics of the monetary model viewing the exchange rate as the asset price of the future economic fundamentals. Assume that the economic fundamentals series $\{f_t\}$ follows a driftless random walk process, $I(1)$. Then, we have $s_t \sim I(1)$,

$\Delta s_t \sim I(0)$. Since $E_t s_{t+1} = s_{t+1} + v_t$, where v_t is a white noise forecasting error, nominal exchange rate and fundamentals, $\{s_t, f_t\}$, must be cointegrated by equation (6).

Rearrange equation (6) to construct the econometric model of the exchange rate changes and fundamentals such that:

$$(8) \quad \Delta s_{t+1} = \beta_0 + \beta_1 z_t + \varepsilon_t$$

where $z_t = f_t - s_t = -\phi(i_t - i_t^*)$ is the nominal exchange rate deviations from the economic fundamentals.

This is the basic model used to perform the exchange rate forecasting ability based on the monetary model. This model has been used by MacDonald and Taylor (1994), Mark (1995) to test the predictability of exchange rates. They claimed the modest success in predicting exchange rates for a longer horizon. Mark and Sul (2001) use panel data set of 19 industrialized countries while Wu and Chen estimated equation (8) using nonlinear Kalman filtering allowing time-varying nature of slope parameter.

In this paper, I adopt the same model for the purpose of linking economic fundamentals to the exchange rates. However, I would like to extend my analysis to examine equation (8) on how economic fundamentals explain exchange rates on the different exchange rate regimes. Korea is a natural subject of my study in a sense that Korea is one of the major export oriented economies and has gone through regime changes in relatively recent period.

3. Korean Exchange Rate Regimes

Korean exchange rate system has evolved through several stages in recent history. Until 1980, the government strictly regulated foreign exchange transactions, and the Korean won was pegged to the U.S. dollar. From 1980, as a result of the introduction of a multiple-basket pegged exchange rate system, the Korean won started to float in reflection of general trends in the international foreign exchange markets, even though it was still tightly managed by the government. The market average exchange rate (MAR) system, as a variant of managed floating exchange rate regime, was first adopted in March 1990. Since then, the Korean won-U.S. dollar rate began to be determined on the basis of underlying demand and supply conditions of the interbank market, although daily fluctuations were limited within certain bands. However, the frequent interventions by the Bank of Korea were also common phenomena, and the exchange rate was still not completely determined by the market. In late 1997, the Korean economic crisis broke out and Korea turned to the IMF for rescue. Taking advantage of the opportunity presented

by the economic crisis, Korea accelerated the speed of capital account liberalization. It shifted to a free-floating exchange rate system on December 1997. The ceiling on foreign investment in Korean equities was entirely abolished in May 1998, and the local bond markets and money markets were completely opened to foreign investors. In June 1998, the Korean government announced a plan to liberalize all foreign exchange transactions in two stages. The first stage of liberalization took effect on April 1, 1999 with introduction of the new Foreign Exchange Transaction Act. The second stage of liberalization took effect on January 2001. The remaining ceilings on current account transactions by individuals have been eliminated.

3.1 Data Description

All our data come from the IMF International Financial Statistics (IFS) CD-ROM. Data frequency is monthly except GDP and GDP deflator data which are available only for the quarterly basis. We converted quarterly data into the monthly frequencies by linearly interpolating quarterly observations into monthly observations.

We used the nominal exchange rates against U.S. Dollars for Australia, Japan and South Korea for the period of January 1980 to December 2003. These exchange rates are nominal domestic currency prices of US dollar at the end of each month. Japan and Australia are also introduced for a comparison purpose to the Korean exchange rate regimes. Japan is the one of the largest trading partners of Korea, and Korea sustained a chronic trade deficit against Japan. In addition to the close economic relationship between Korean and Japan, Japanese Yen is freely floating since the beginning of the Bretton Woods Accord. However, as Calvo and Reinhart (2002) observed, Japanese Yen serves as one of the reserve currencies of the world, therefore, its characteristics of free floating regime may be different from those of small developing countries. In this regard, Australia is chosen because Australian Dollar is also freely floating, but Australian economy is much smaller than that of Japan, and it resembles closely to the typical small developing economies. In Calvo and Reinhart (2002) study, Australian Dollar is used as a bench mark currency for the floating exchange rate regimes. The probability of Australian Dollar fluctuates within the prescribed 2.5% band for the free floating regime is about 70% during the monthly period of January 1984 to November 1999. Therefore,

we also used the Australian Dollar as the bench mark currency to study the characteristics of the free floating regime of the Korean Won.

Other economic variables we use in our analysis are as following: Money supply: M1 measure of nominal money supply. Interest rate: short term government bond rates for Australia and Japan, short term (90 day) deposit rate for Korea, and 3 month treasure bill rate for U.S. General price level: manufacturing output prices for Australia, consumer price indices for Japan, Korea and U.S. Reserves are measured as total reserves minus gold in U.S. dollar terms.

We divide our data into three periods. The first period is from January 1980 to the beginning of the Korean economic crisis, September 1997 (period 1). During this period, Korean exchange rates are managed and controlled by the Bank of Korea. The second period is the crisis period, October 1997 to September 1998, when the first round of financial restructuring completed following the IMF recommendations to recover the economic crisis. During the crisis period, nominal exchange rates were unstable and fluctuated widely, and we exclude this period for our analysis. The last period, starting October 1998 to the end of sample period, December 2003, is the post crisis free floating exchange rate regime (period 2). Korean exchange rates are allowed to move freely during this period with minimal market intervention from the banking authority.

3.2. Empirical Results

First, we will examine the volatilities of two closely related variables for the exchange rate regimes, the nominal exchange rate and the foreign reserves. We compare the rate of return volatilities measured as the variance of the change of the natural log of nominal exchange rates and foreign reserves ($\log S_t - \log S_{t-1} = s_t - s_{t-1} = \Delta s_t$, $\log R_t - \log R_{t-1} = r_t - r_{t-1} = \Delta r_t$), where s_t is the natural log of the nominal exchange rate S_t , and r_t is the natural log of foreign reserves, R_t . Table 1 compares the return volatility of three exchange rates for two distinct periods, before the Korean economic crisis for the managed float regime and after the economic crisis for the free floating regimes. Volatility is measured as the standard deviation of each variable. This table also provides three different, yet similar test statistics to test the equality of the variance

of the returns of nominal exchange rates during this period. These statistics are for the three way equality tests.

Table 1: Volatilities for nominal exchange rates and reserves for each period

	Managed Float Regime, Period1 January 1980 – September 1997		Free Floating Regime, Period2 October 1998 – December 2003	
	Δs_t	Δr_t	Δs_t	Δr_t
Australian Dollar	2.8541	9.4771	3.2037	7.3335
Japanese Yen	3.3865	3.4587	3.4807	2.4418
Korean Won	0.8685	7.5047	2.6289	1.6631
	Test Statistics for $H_0 : \sigma_{AS}^2 = \sigma_J^2 = \sigma_K^2$			
Bartlett	313.920(0.0000)	185.963(0.0000)	4.4275(0.1093)	126.71(0.00)
Levene	80.4854(0.0000)	32.3659(0.0000)	1.4095(0.2471)	25.3006(0.00)
Brown-Forsythe	72.1956(0.0000)	32.2831(0.0000)	1.4737(0.2320)	20.5717(0.00)

Test statistics are for the null hypothesis that volatilities are the same for all three countries. p -values are in the parenthesis.

Table 1 clearly shows that the Korean Won is much less volatile during the managed float regime, and its volatility is much smaller than that of Australian Dollar and Japanese Yen. During the free float regime, Korean Won is still less volatile than those other exchange rates, but their difference is now statistically insignificant. All three test statistics reject the equivalence of return variances during Korean Won's managed float regime, while all three statistics accept that their volatilities are statistically equivalent under the free floating regime. Korean Won fluctuates as freely as other committed floating exchange rates after adopting free floating regime in period 2. Korean foreign reserve holdings are much more volatile under the managed float than those of free floating period. This is also expected results that under the managed float, reserves are often used to maintain stable nominal exchange rates. Therefore, comparing the reserve volatilities of two periods, we can see that the reserves have become much more stabilized under the recent free floating exchange regime.

We can observe from this table that the nominal exchange rates for all three countries have become more volatile in recent years compared to the 1980s and the late 1990s, while the volatilities of foreign reserves shows the opposite trend. Korean exchange rates have become more volatile and reserves have become more stabilized

because of her exchange rate regime changes. In order to investigate whether there have been any other macroeconomic regime shifts to cause other currencies as well as Korean Won more volatility in recent years, we compared the equivalence of return volatility for two periods. Table 2 reports the test statistics for the return volatilities for nominal exchange and foreign reserve before and after the Korean economic crisis.

Table 2: Volatilities for different periods for nominal exchange rate and reserves
($H_0 : \sigma_{i,1}^2 = \sigma_{i,2}^2$)

	Australia		Japan		Korea	
	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2
Exchange Rate	2.8541	3.2037	3.3865	3.4807	0.8685	2.6289
F-test	1.2600(0.3082)		1.0563(0.8298)		9.1617(0.0000)	
Bartlett	1.2268(0.2680)		0.0669(0.7959)		141.4332(0.0000)	
Reserves	9.4771	7.3335	3.4587	2.4418	7.5047	1.6631
F-test	1.6700(0.0109)		2.0063(0.0005)		20.3638(0.0000)	
Bartlett	5.1377(0.0234)		9.1142(0.0025)		106.8419(0.0000)	

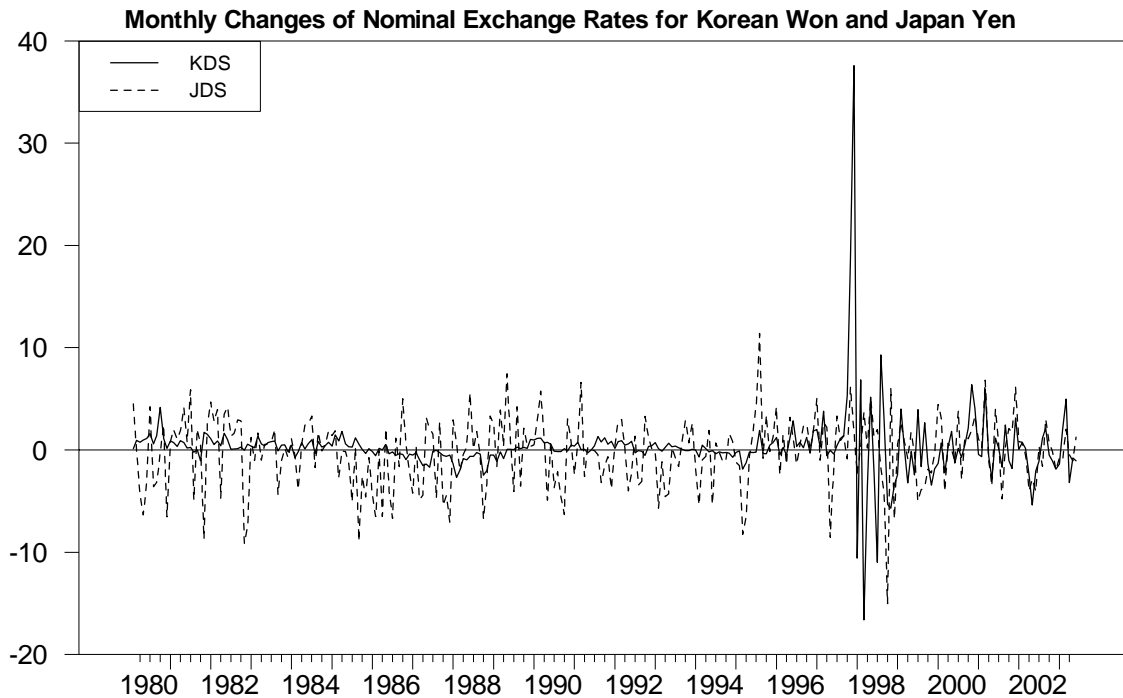
Test statistics are for the null hypothesis that volatilities are the same for all three countries. p -values are in the parenthesis.

Table 2 shows the expected results. Japanese Yen, serving as the reserve currency for the world shows little change in its volatility during these two periods even with the recent Asian economic crisis. Statistics shows little evidence of changes of the Yen volatility. Australian Dollar also showed that the volatilities remain the same between two periods. Korean Won, on the other hand, shows strong evidence of volatility change during this period. Table 2 also reports foreign reserve volatilities for each country for two periods, and its test statistics. We reject the null hypothesis that reserve volatilities remain the same for entire period all three countries. We can see that the reserves for all three countries have become much more stable in recent years compared to the 1980s and early to mid 1990s. However, we can see that the reduction of the reserve volatility is much more noticeable for Korea than the other two countries. The main reason for the stability of the reserves for Korea is the exchange rate regime changes from the actively managed regime to the free floating regime.

The return volatility can be best illustrated using the figure. To avoid the cluttering the figure, Figure 1 plots the returns of only two countries, Korean Won and

Japanese Yen for the entire sample period. Australian Dollar returns can also be plotted in the same figure, but it will clutter Figure 1 a little too much.

Figure 1:



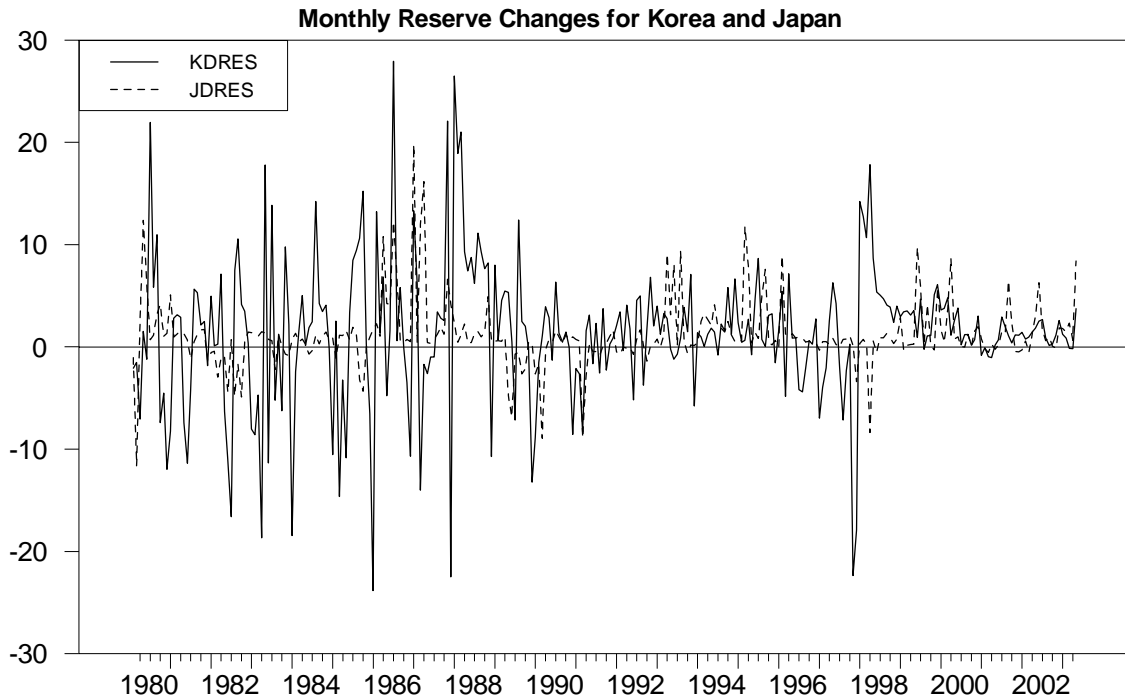
Japanese Yen is more volatile during the period 1 when Korean Won was under the managed float regime. During period 2, Korean Won is under the floating exchange rate system, and the volatility appears to be similar for both currencies. As we have seen from Table 1, they are not statistically different.

Another measure of distinguishing different exchange rate regimes is the change of the reserves. Reserves are often used to control and manage nominal exchange rates under the fixed and managed exchange rate regimes. Figure 2 plots the volatility of reserve changes for Japan and Korea. It is very clear that the Korean reserves were much more volatile than that of Japanese Yen during the managed float regime, and they are also more volatile under the managed float regime than under the free floating regime. This shows clear evidence of exchange rate management schemes. While there are criticisms that Korean exchange rates are still managed and controlled by the central bank, the activity on the reserve tells otherwise. The recent movements of Korean nominal

exchange rate show very similar characteristics of other free floating exchange rates. In fact, Korean reserves remain relatively stable and the changes of exchange rates are comparably active during this period. Australia has relatively volatile reserve changes throughout the period. In fact, even with the free floating exchange rate regime, the probability of reserve changes stay within 2.5% band is only about 50% by Calvo and Reinhart (2002). According to their study, Japan maintains the most stable reserves together with Singapore. Korean reserve levels were highly volatile during the managed regime, but her reserve volatility has decreased significantly under the free floating regime. Korean reserve volatility is even more stable than those of Japan. Table 1 also reports the test statistics for the equality of reserves volatilities for three countries, but they are all rejected for all period. Korean reserves remain more stable than those of free floating regimes of Australia. Absolute comparison of the reserve volatility itself does not seem to be a good measure of distinguishing exchange rate regimes for these three countries.

Instead of comparing the volatilities of different countries, it is more meaningful to compare the reserve volatilities for the different time period. From these statistics, we can see that the reserve volatilities have been reduced significantly in period 2 compared to those of period 1. Since Korea has changed her exchange regime from period 1 to period 2, the reserve volatility of Korea has reduced most dramatically.

Figure 2:



Fundamentals and exchange rate (f_t, s_t)

Korea: before crisis, not cointegrated, floating regime: cointegrated

Japan and Australia: do not have evidence of cointegration.

Meese and Rogoff compared the various exchange rate determination models and found that none of the existing model performs better in terms of predicting the exchange rate behavior than the simple random walk model.

Table 3: Exchange rate behavior ($s_{t+1} - s_t$): ARCH(1) LM test

Country	Australia	Japan	Korea		
Period	All	All	All	Period 1	Period 2
F-statistic	0.3684 (0.5444)	0.9362 (0.3341)	27.4152 (0.0000)	6.3088 (0.0128)	0.7890 (0.3783)
Asym. χ^2	0.3705 (0.5427)	0.9398 (0.3323)	25.0881 (0.0000)	6.1825 (0.0129)	0.8064 (0.3692)

This table reports only ARCH(1) LM tests. Different lag lengths of ARCH model produce qualitatively similar results. p -values are in the parenthesis.

Korean Won shows the ARCH residuals for period 1 and for the entire period, while there is no evidence of ARCH residuals during the free floating period 2. Even though the analysis periods exclude crisis period of October 1997 to December 1998, there are several episodes of ARCH residuals (high volatilities) under the managed float regime during the late 1980s and the middle of 1990s leading to the economic crisis. Australian Dollar and Japanese Yen do not show the ARCH residuals either for the entire period or for two periods separately.

The following two figures, Figures 3 and 4, show that the exchange rates are widely fluctuating around the deviations from the economic fundamentals (z_t is standardized to have mean zero) for Korea and Japan, and it is not an easy task to predict the exchange rates using economic fundamentals. The relationship between exchange rates and the fundamentals for Australia show similar patterns as other countries, but it is not shown here to conserve space. Meese and Rogoff (1983) have shown that none of the theoretical exchange rate determination models outperform simple random walk model in the root mean square criteria. Even with these difficulties, we would like to investigate the relationship between the nominal exchange rates and economic fundamentals focusing on the different behavior of the exchange rate regime changes of the Korean Won, and compares it to other flexible exchange rate regimes.

Figure3:

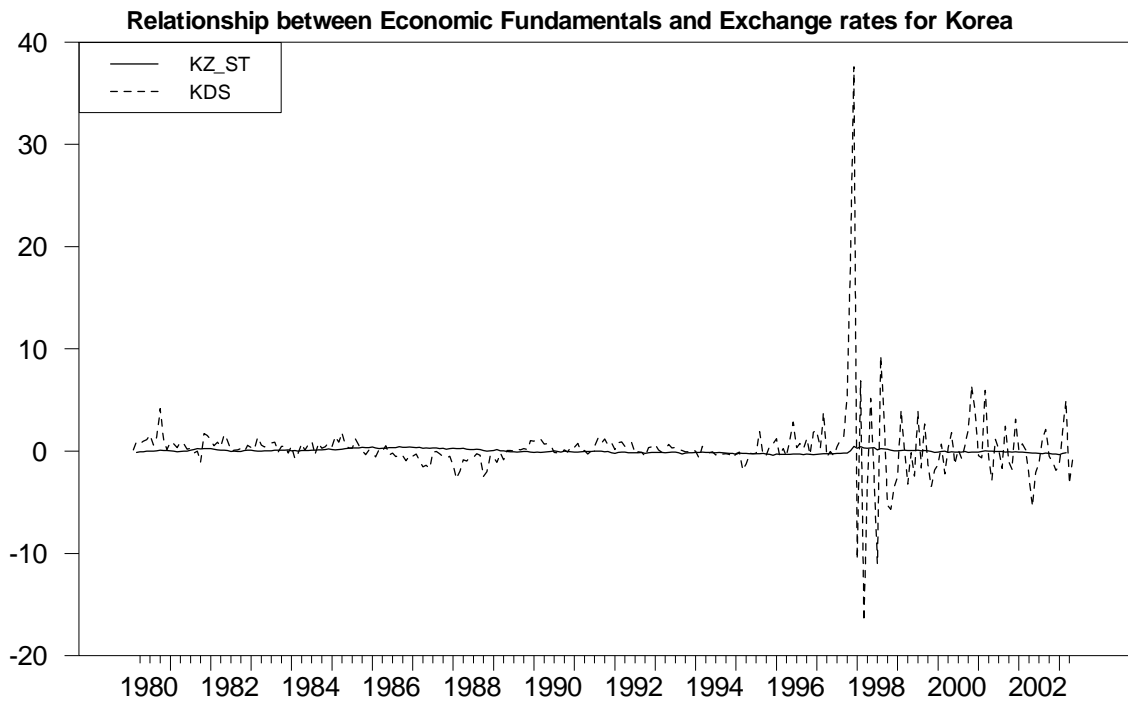
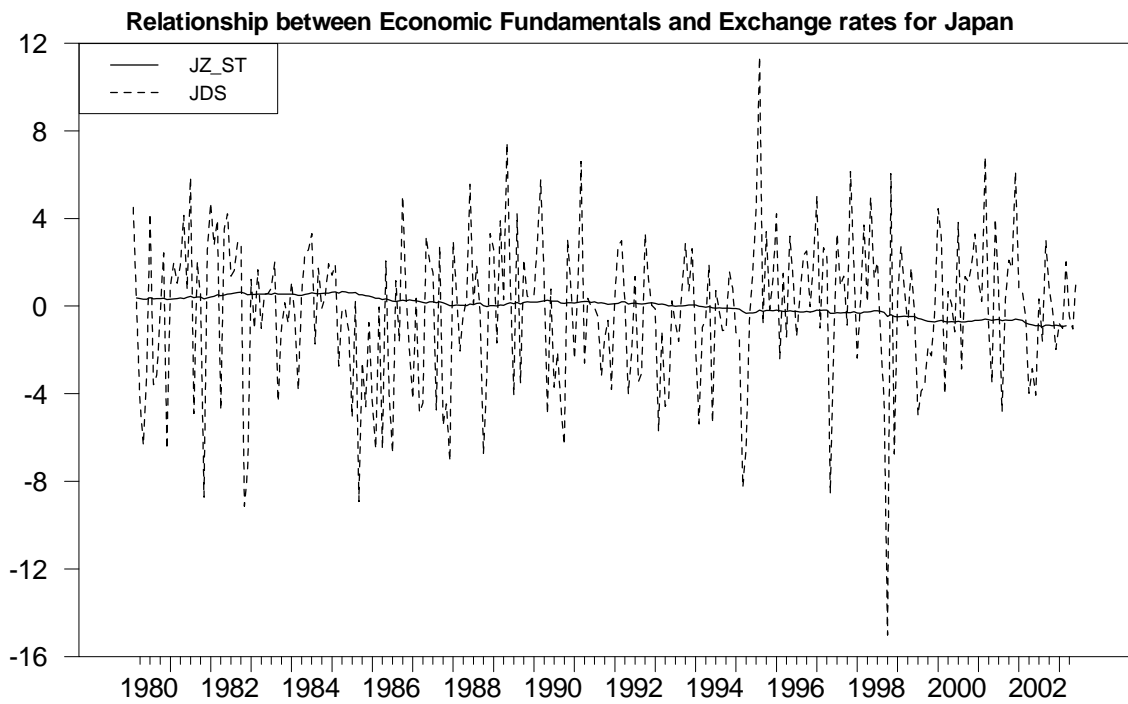


Figure 4:



The basic econometric model to examine the relationship between exchange rates and economic fundamentals is the equation (8) from the monetary model introduced in section 2. Table 4 shows the OLS estimation results for three countries, and Table 5 presents the GARCH(1,1) results for Korea.

Table 4: OLS estimation: $\Delta s_{t+1} = \beta_0 + \beta_1 z_t + \varepsilon_t$

		Korea	Japan	Australia
Period 1 (210)	β_0	7.6374 (1.8104)***	20.3091 (9.7455)**	-4.8247 (4.0508)
	β_1	-1.2151 (0.2961)***	-1.8436 (0.8696)**	-0.6741 (0.5890)
	SSR	146.7716	2345.6732	1706.1781
Period 2 (55)	β_0	37.3255 (18.7351)**	55.6487 (32.9761)*	-12.8023 (20.3014)
	β_1	-6.2151 (3.0986)**	-5.4044 (3.1894)*	-1.6037 (2.5256)
	SSR	358.8634	640.8513	546.2578
Both periods (265)	β_0	8.8816(2.9107)***	8.3921 (5.3762)	-2.8878 (2.2715)
	β_1	-1.4375(0.4772)***	-0.7903 (0.4873)	-0.3869 (0.3184)
	SSR	535.4058	3042.1483	2258.0679
<i>F</i> -statistic		7.6836	2.4306	0.3263

Standard errors in the parenthesis. *, **, *** indicate statistical significance at 10%, 5% and 1%, respectively.

Table 5: GARCH(1,1) estimation for Korean Won: $\Delta s_{t+1} = \beta_0 + \beta_1 z_t + \varepsilon_{t+1}$,

$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \gamma_1 \sigma_{t-1}^2$, where $\sigma_t^2 = \text{Var}(\varepsilon_{t+1} | \Omega_t)$ and Ω_t is an information set at time t .

	Period 1	Period 2	Both periods
β_0	7.1091 (1.4024)***	37.2016 (19.3518)*	5.2785 (1.3142)***
β_1	-1.1248 (0.2287)***	-6.2259 (2.1939)*	-0.8339 (0.2151)***
α_0	0.1240 (0.0410)***	0.8855 (0.3568)**	0.0851 (0.0259)***
α_1	0.6537 (0.1519)***	-0.2240 (0.0828)***	0.9226 (0.0937)***
γ_1	0.3405 (0.0972)***	1.0821 (0.1020)***	0.3997 (0.0370)***

Standard errors in the parenthesis. *, **, *** indicate statistical significance at 10%, 5% and 1%, respectively.

Japanese Yen and Australian Dollar have been floating freely throughout the sample periods while Korean Won has only been allowed to float during period 2. From these tables, Korean Won's fluctuation in response to the economic fundamentals has increased significantly from period 1 to period 2 as expected (-1.22 vs -6.22). Both OLS and GARCH estimates show qualitatively similar results. In addition, we can see that the

impacts of the deviations from the fundamentals to the nominal exchange rates are much bigger in magnitude during period 2 than during period 1. From the OLS results, this appears to be common phenomena for all three currencies (-6.22 vs -1.22 for Korea, -5.40 vs -1.84 for Japan, and -1.60 vs -0.67 for Australia) even though the response to the Australian Dollar is not statistically significant for all periods. Since

$z_t = f_t - s_t = -\phi(i_t - i_t^*)$, β_1 can be interpreted as the interest rate semi-elasticity to the nominal exchange rates. Therefore, we can infer from Table 4 that Korean exchange rate responds to the economic fundamentals much more under the free floating regime than under the managed regime. Table also shows that Korean exchange rate has the greatest interest rate elasticity among three countries. This table reports test statistic for the structural relationship between the change of the exchange rates and the deviations from the economic fundamentals. Chow test statistics are calculated for each exchange rate, and as we have expected, we reject the null hypothesis of the parameter stability between two periods for the Korean Won due to the regime change in these periods. The structural relationship between nominal exchange rates and the fundamentals has not changed during these periods for Japan and Australia.

We now turn our attention to investigate the impact of the exchange rate path-through to the domestic economic variables. From the purchasing power parity condition (PPP) of equation (3), there is a one-to-one relationship between the domestic inflation rate and the nominal exchange rate assuming the constant foreign inflation. Therefore, we would like to see how the change of the nominal exchange rate affects the domestic inflation rate. We will specifically consider the effect of the exchange rate regime into the domestic inflation rate. One of the important objectives of the fixed exchange rate regime is to maintain stable domestic price levels so that it will help to increase foreign trade. However, the intended objective could also prove to be wrong for the developing countries. The rigid exchange regime may drain foreign reserves excessively, and it may bring the further pressure for the depreciation and domestic inflation. The vicious cycle may ultimately result in the economic crisis. First, we will examine the relationship between inflation and the change of exchange rates since 1990s. Figure 5 plots these two variables on time span, and Figure 6 is a scatter gram of these two variables. In Figure 6, the circle represents the plots for the managed exchange regime (1990:03-1997:09)

period before the economic crisis, while the square represents the plots for the free floating regime (1998:10-2003:12) after the economic crisis.

Figure 5:

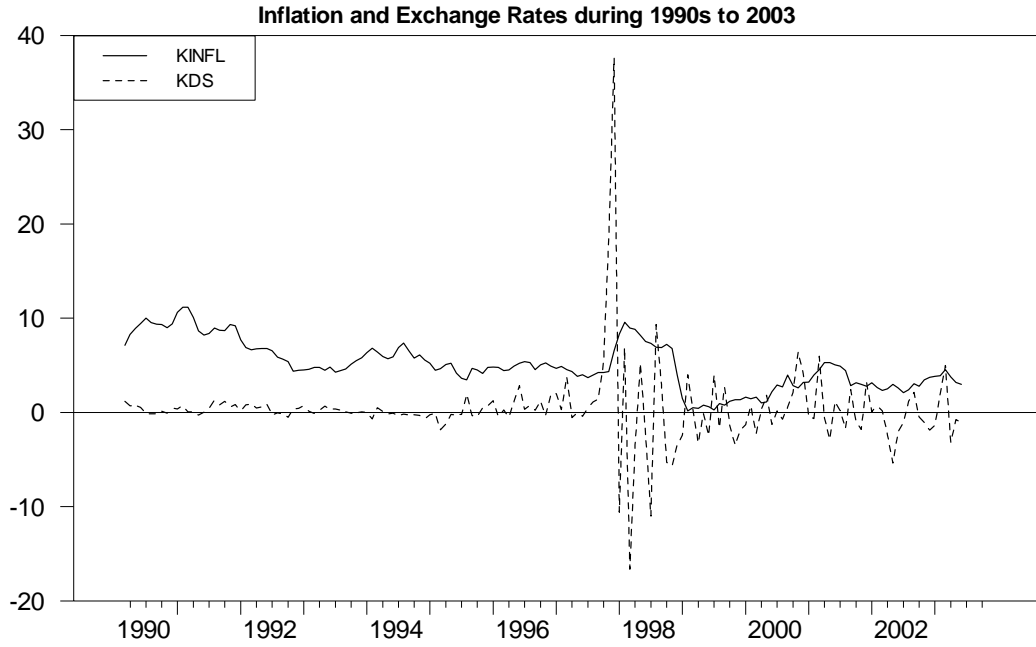
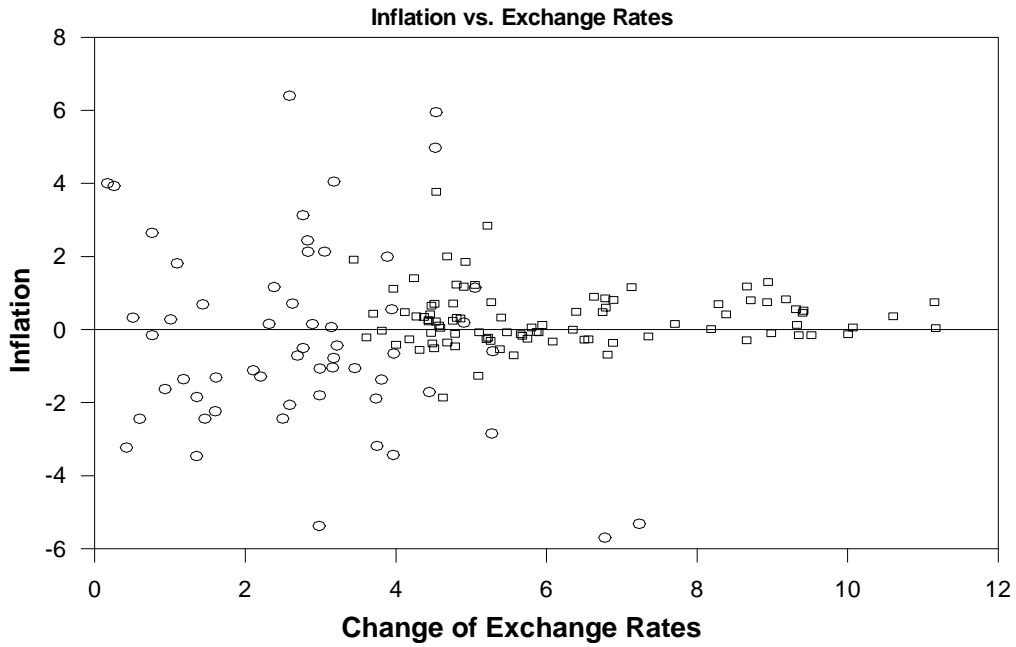


Figure 6:



As we can see from these figures, it is hard to discern any distinguishing features between these two variables. For this analysis, I will limit my data for two distinctive periods of exchange rate regimes, from March 1990 to September 1997 for the market based managed exchange rate regime and from October 1998 to December 2003 for the free floating exchange rate after the turmoil of the economic crisis has settled down a little bit. Inflation rate is regressed on the lagged values of the percentage of money supply and nominal exchange rates. Since inflation rate appears to show strong time trend, I checked whether it has a unit root or not. Traditional Dickey-Fuller test with trend component reject the unit root hypothesis for period 1, period 2 and two periods combined. Therefore, I included the autoregressive of order one error structure in the regression model. The estimated model is:

$$Infl_t = \beta_0 + \beta_1 DM_{t-1} + \beta_2 s_{t-1} + \varepsilon_t, \text{ where } \varepsilon_t = \rho \varepsilon_{t-1} + v_t \text{ and } v_t \text{ is white-noise.}$$

This model is estimated for two periods separately, and both periods combined. The following table presents estimation results.

Table 6: Korean Inflation path-through: $Infl_t = \beta_0 + \beta_1 DM_{t-1} + \beta_2 \Delta s_{t-1} + \varepsilon_t$,

	Period 1	Period 2	Both periods
β_0	5.3107 (1.7416) ^{***}	2.4469 (0.5671) ^{***}	3.7486 (1.5750) ^{**}
β_1	-0.0055 (0.0081)	-0.0077 (0.0124)	-0.0078 (0.0063)
β_2	0.0878 (0.0505) [*]	0.0190 (0.0261)	0.0329 (0.0177) [*]
D-F	-5.9601 (0.0000) ^{***}	-3.6254 (0.0364) ^{**}	-3.8386 (0.0172) ^{**}

Standard errors in the parenthesis. *, **, *** indicate statistical significance at 10%, 5% and 1%, respectively. D-F is Dickey-Fuller statistics for the inflation rate. P-value is in the parenthesis.

From this table, it is interesting to observe that money supply does not noticeably increases inflation rate, while Korean Won depreciation has positively contributed to the inflation rate throughout the 1990s (crisis period is excluded from our analysis). One percent depreciation of the Korean Won contributes about 0.03% increase of the inflation rate. Even more interesting point in these results is that the impact of the exchange rate depreciation is much bigger during the managed float period than that of the free floating

exchange rate period. One percent currency depreciation affects about 0.09% increase of the inflation rate during the managed float regime, but it only increases about 0.02% during the free float regime, and this effect is not even statistically significant. Exchange rate change has much more positive and statistically significant impact on the inflation rate during the pre-crisis MAR exchange rate regime than the after crisis floating exchange rate regime. Changing various lag length of the Δs_t did not alter the basic relationship between the inflation and the exchange rate change.

This is one evidence of showing that the under the floating exchange rate regime, the inflation pressure from the nominal exchange rate is substantially subdued and the government policy to control domestic price level is better achieved under the floating exchange rate regime. There might have been other macroeconomic variables to explain the stable inflation rates during the floating exchange rate regime, but from the empirical evidence shown here, inflation rate has been more stable under the floating exchange rate regime. Korean economy has become stronger and more mature after the recent economic crisis to withstand the fear of floating.

4. Conclusion

This paper investigated the role of the economic fundamentals on the exchange rate determination on different exchange rate regimes focusing on the Korean economy. This paper found that the economic fundamentals have influenced exchange rates much more importantly under the flexible regime than under the managed exchange rate regime. Korean foreign exchange rate appears to be more elastic on the economic fundamentals than those of Japan and Australia. Exchange rate path-through into the domestic variable, especially inflation rate, has become more stable under the floating regime than under the managed regime. This finding may contradict the traditional arguments for the managed regime. However, this finding is consistent with the view that the free floating regime is better for the economic growth in the long-run. In short, the fixed or managed regimes are short-run solutions for the economic growth.

It is true that the exchange rate has become more volatile under the flexible exchange rate system than under the managed regime. While the flexible regime may

help to promote healthy economic growth in the long-run, the exchange rate volatility may prevent foreign investment or stable growth in the short run. In order to overcome these short-run adversities of the flexible exchange rate system, Korean government needs to develop credible future's exchange market to promote stable foreign trade and economic growth. In fact, the volatility of exchange rate under the flexible regime could be avoided under the well-developed future's market.

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