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Stock market co-movement and exchange rate flexibility: Experience of the Republic of Korea

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Stock Market Co-Movement and Exchange Rate Flexibility: Experience of the Republic of Korea

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Abstract

This paper argues that for countries where equity investments dominate cross-border capital flows, the proper framework for analyzing the role of a flexible exchange rate system as a buffer against external shocks is the uncovered stock return parity condition, rather than the uncovered interest parity condition. Estimation of the stock return parity condition shows that it fails to hold in the Republic of Korea largely because of co-movement in the Republic of Korea and United States stock markets. Three global factors are largely responsible for the co-movement: global financial integration, which may be generating a global financial cycle; acceptance of insensitivity of exchange risk by global equity investors; and domestic investors imitating the trading behavior of foreign equity investors.

JEL Classification: F31, F65, G15

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1. INTRODUCTION

In small, emerging market economies where financial markets are open and fully integrated, or even only partially integrated, with the global financial system, theory predicts that flexibility of foreign exchange rates helps insulate the domestic financial market from much of the impact of external shocks, and hence safeguards the independence of monetary policy. This proposition has been extensively debated and empirically examined, but empirical studies are not conclusive regarding its short- or long-run validity.[1]

An International Monetary Fund (IMF) study by Berkmen et al. (2009), analyzing the impact of the 2008 global financial crisis across developing and emerging economies, argues that "exchange-rate flexibility clearly helped buffer the impact of the shock". The IMF continues to stand by its long-held position that "as part of the monetary policy framework, the free floating exchange rate regime should continue to provide an important buffer against external shocks or shifts in market sentiment."[2]

Against these positive assessments, Rey (2013) argues that in an international financial system governed by a global financial cycle in which capital flows, asset prices, and credit growth move together, and which is largely determined by the financing conditions of the centers of global finance, a free-floating regime cannot ensure monetary independence when capital is freely mobile.

Monetary independence is conventionally measured by the degree to which domestic interest rates fail to follow those in the foreign country. The basic theory is the uncovered interest parity condition, which states that if investors are risk neutral and rational in forming expectations, the domestic interest rate should be equal to the foreign interest rate adjusted for changes in the expected exchange rate.

Most of the studies examining the presence and degree of monetary independence estimate various specifications of the uncovered interest parity (UIP) condition in a free floating regime with capital mobility. While such an approach is appropriate in countries where bond markets are large and liquid, it is extraneous to countries where the stock market is large and equity investments dominate cross-border portfolio capital flows. This is the case in many emerging economies.[3] In these economies, external shocks are mostly transmitted to the domestic financial system through the stock market. It is reasonable to assume that expected stock returns are what drive equity capital flows between countries. Therefore, an investigation of the effectiveness of a free floating regime in economies where cross-border equity investments make up a large part of portfolio capital flows would require reformulation of the parity condition in terms of the expected stock return—primarily capital gain—rather than the interest rate.[4]

Since the early 1980s, when the Republic of Korea set about reforming its financial system for market opening, the stock market has attracted a great deal of foreign investment. Indeed, foreign share of market capitalization has averaged more than 30% since 2000, and shot up to over to 40% in 2004–2005. In contrast, bond market capitalization has been less than 8%.

[1] See Lothian and Wu (2011) for a review of the controversy.

[2] See, for example, its New Zealand 2013 Article IV Consultation Preliminary Concluding Statement on 18 March 2013.

[3] A recent study on the Republic of Korea's experience suggests that the uncovered interest parity condition (UIP) does not hold in either the long- or short-run for a number of reasons, including risk premia and non-rationality of expectations formation (Bank of Korea 2013 Monetary Bulletin, January).

[4] See Chiang (2005) for specification of the uncovered stock return parity condition.

A sweeping reform of financial market liberalization in the wake of the 1997 financial crisis set a fast pace for the integration of the Republic of Korea's equity market with the markets of advanced economies, in particular that of the United States (US). However, the pattern of portfolio capital flows, including equities, has been largely asymmetrical in that foreign investors have been relatively free in moving in and out of the Republic of Korea's capital market, whereas domestic investors have not diversified to include many foreign securities. This is because of home bias, lack of information on foreign capital markets, and implicit or explicit regulations on capital outflows.

Reflecting the deeper integration of the Republic of Korea's equity market into the global financial system, stock price indices such as the Korea Composite Stock Price Index (KOSPI), a capitalization-weighted index of all common shares traded on the Republic of Korea Stock Exchange, have moved closely with similar indices such as the Standard and Poor's (S&P) 500 of the US, and the co-movement has become more pronounced since the 1997 financial crisis. In view of the asymmetry in cross-border equity investments between Republic of Korea and foreign investors, however, it is not surprising that the price co-movement has also been unidirectional; changes in the US stock price index move the Republic of Korea's index, but not the other way around.

When two stock markets are integrated, as in the case of the Republic of Korea and the US, floating exchange rates are expected to moderate cross-border equity flows and hence changes in stock prices to help preserve monetary independence. However, in reality, this has not been the case. The effect of changes in the won–dollar exchange rate on equity flows has been small and sometimes ambiguous.

The purpose of this paper is to analyze the effectiveness of the floating exchange rate regime in shielding the Republic of Korea's economy from external shocks since 1997, when the Republic of Korea began removing most of the restrictions on capital account transactions. For this purpose, the next section highlights the dominance of and asymmetry in equity capital flows, and by incorporating these features, estimates the uncovered stock return parity condition for the Republic of Korea. The estimation results show that the condition does not hold. In view of the large number of studies that report the failure of the uncovered interest parity condition, this result should not be surprising.

In an effort to identify causes of the failure, Section 3 examines the degree of co-movement and the causal relation between the stock markets of the Republic of Korea and the US. The degree is high and the causality runs from the US to the Republic of Korea. These are the main reasons why the uncovered stock return parity condition does not hold in the Republic of Korea and why much of the adjustment to external shocks takes places through changes in the Republic of Korea's stock market. To substantiate further these conclusions, Section 3 also reports the results of a vector autoregression (VAR) analysis of four variables—S&P 500, KOSPI, the won–dollar exchange rate, and the 3-year KTB (Korea Treasury bond) interest rate. This is followed in Section 4 by discussions of possible causes of the co-movement between the S&P 500 and the KOSPI. These include global financial integration, the presence of a global financial cycle, and the lack of incentives for global investors to cover currency risk in managing their equity portfolios. Section 5 concludes.

2. FRAMEWORK FOR THE UNCOVERED STOCK RETURN PARITY CONDITION

2.1 Dominance of and Asymmetry in Equity Capital Flows

The Republic of Korea's stock market is open to foreign investors, providing an important channel for foreign capital flows in and out of the country's financial markets. The stock market grew rapidly until 2007, when the total value of the stocks listed in the two major exchanges reached 108% of gross domestic product (GDP). Foreign entities held 31% of that value.

Massive capital outflows during the 2008 global financial crisis brought the market share down to about 27%. Recovery from the 2008 financial crisis has revitalized the stock market and brought back many foreign equity investors. At the end of 2012, foreign holdings of domestic equities amounted to W401 trillion, or 35% of the Republic of Korea's stock market capitalization (excluding the Korean Securities Dealers Automated Quotations [KOSDAQ]).

In contrast, foreign investors held W91 trillion, or 7% of the total market value of won-denominated public and corporate bonds (14% of government bonds) at the end of 2012. This was less than a quarter of their holdings of Republic of Korea stocks. Registration requirements, withholding tax, a limited menu of bonds in terms of maturity, and the paucity of investment grade corporate bonds preferred by foreign institutional investors have all discouraged foreign entry into the Republic of Korea's bond markets.

In value terms, domestic residents' portfolio investments in foreign bonds and equities have been small in comparison to their holdings of domestic securities. Home bias, lack of information on foreign capital markets, high costs of hedging currency risk, and implicit and explicit restrictions on capital outflows have contributed to a weak appetite for foreign securities in the Republic of Korea.[5] As a result, at the end of 2012, domestic residents' total holdings of foreign equities and bonds amounted to $138 billion, which was less than 8% of their holdings of domestic equities and bonds. The small share of foreign securities in domestic investors' asset portfolios has led foreign investors as a group to exercise a great deal of influence on determining the volume as well as volatility of portfolio capital flows.

2.2 Uncovered Stock Return Parity Condition

In the conventional analysis of UIP, the equity market is disregarded on the basis of the Modigliani–Miller theorem on capital structure that bonds and stocks are good, if not perfect, substitutes. Such a theory is imbedded in the Gordon model, where the price of a stock is determined by an infinite stream of dividends that grow at a constant rate. Assuming the cost of equity or the required rate of return for equity investors is equal to the market interest rate, the dividend–price ratio or the yield can be approximated by the interest rate.

In the Gordon model, the expected future stock price does not matter, as it will not affect the current price if it is far in the future. This means that an approximation of equality between the interest rate and the dividend–price ratio may hold in the long run,

[5] Domestic investors are not subject to any formal restriction on foreign portfolio investments. However, the fact that any investment in foreign securities in excess of $10,000 is automatically reported to the tax authorities who may launch investigations into the legitimacy of the funds invested, is a deterrent.

but not necessarily in the short run when most equity investors would care more about changes in expected capital gains and losses than the dividend payments of the stock return.

Furthermore, bonds and equities do not appear to be good substitutes in wealth portfolios. Baele, Bekaert, and Inghelbrecht (2010) find that over the last 4 decades, from Q4 1968 to Q4 2007, the correlation between stock indices and government bond returns in the US has been highly unstable. The correlation between daily stock returns and bond indices was "on average modestly positive," ranging anywhere from +0.60 to –0.60 and displaying sharp changes of 0.20 or more from month to month.

Hong et al. (2011) postulate that the income and substitution effects determine the actual correlation between stock and bond returns. In terms of the data for the US, Japan, the United Kingdom, Germany, and Canada for the period December 1985–December 2007, they find that the correlation is positive for the 1986–1999 period, and negative for the 2000–2007 period. They argue that the size of the financial markets, the growth of the economy, the business cycle, and the volatility of the economy contribute to different sensitivities to the income and substitution effects across countries.

In view of the fact that stocks and bonds are poor substitutes and equity investors are likely to be more concerned about capital gains and losses in the short run, the proper framework for analyzing the effectiveness of free-floating exchange rate regimes is the uncovered stock return parity condition for countries where equities dominate cross-border capital movements. This is because much of the impact of external shocks, such as changes in US monetary policy, is transmitted largely through the stock market. In theory, free-floating regimes could also fully or partially block the effect of such changes on domestic financial markets in a framework of parity condition defined in terms of the stock return, but as we argue below, they are severely limited in their buffering role.

The Republic of Korea's exchange rate system falls short of being free floating. The IMF (2012) classifies the Republic of Korea as having a floating regime. Although many restrictions on foreign exchange trading remain and policy makers intervene intermittently in the foreign exchange market, the degree of flexibility of the won–dollar exchanges is high enough to mitigate the impact of shocks originating outside the country (see Figure 1). In theory, capital flows into the Republic of Korea in response to, for example, a jump in the S&P 500 could, other things being equal, trigger an appreciation of the won–dollar exchange rate to prevent such inflows in full or in part, thereby keeping the Republic of Korea's stock market relatively undisturbed. This has not been the case, however.

To elaborate the weakness of the Republic of Korea's floating exchange rate regime as a buffer, this section constructs the uncovered stock return parity condition between the Republic of Korea and the US specified as

$$\Delta e_{t+1} = \beta_0 + \beta_1 (r_{t+1} - r^*_{t+1}) + \varepsilon_{t+1}, \quad (1)$$

where r_{t+1} and r^*_{t+1} are the expected stock index returns of the Republic of Korea and the US, respectively. Δe_{t+1} denotes change in the expected won–dollar exchange rate, expressed as the log difference between the realized exchange rate at *t+1* and the current exchange rate. ε_{t+1} is an error term, and * denotes the US.

In specifying equation (1), country risk is ignored, and it is assumed that equity investors are risk neutral and are rational in forming their expectations. These

assumptions imply that β_0 is equal to zero and there is an absence of a constant risk premium, so β_1 is equal to 1.

Ignoring the dividend–price ratio, the stock index returns are defined as:

$$r_{t+1} = P_{t+1} - P_t \quad (2)$$

$$r^*_{t+1} = P^*_{t+1} - P^*_t, \quad (3)$$

where P_t is the stock price index in log form. P^*_{t+1} and P^*_t are exogenous variables in log form.

Equation (1) is a stock return (index return) parity condition, where the index return in the domestic equity market is equal to the index return in the US market, adjusted for a change in the expected exchange rate. That is, change in the expected exchange rate is governed by the differential between the stock returns of the 2 countries.

With the assumptions of risk neutrality and rational expectations in force, the exchange rate should adjust for a given expected return differential at time *t* to maintain equilibrium in equation (1). For example, assume that the 1-year return for won-denominated stocks is 5% higher than for dollar-denominated stocks. Risk neutral and rational investors would expect the won to depreciate by 5% over the year to equalize returns on Republic of Korea and US stocks.

Since the main interest of this examination is to test the validity of equation (1), a joint test of the null hypothesis that $\beta_0 = 0$ and $\beta_1 = 1$ is also carried out. If the data cannot reject the null hypothesis, the parity condition for the stock return in equation (1) holds.

The results of an ordinary least squares (OLS) estimation of equation (1) with monthly data for the period June 2003–December 2012, in line with data availability, is presented in column 2 of Table 1.[6] They show that changes in the return differential exert little effect on changes in the expected exchange rate, and that the null hypothesis ($\beta_0 = 0$, $\beta_1 = 1$) is rejected. If the failure of the uncovered interest parity to hold in other countries is any guide, one would expect a similar failure here.

The failure could be attributed to a host of causes including the exclusion of market risk and country risk, as well as the assumption of rational expectations. Accordingly, additional variables conveying the risk premia (interest rate risk, inflation risk, and country risk), along with the crisis dummy (August 2007–March 2009) and the lagged dependent variable, are included as independent variables in equation (4). The short-term interest rate differential and inflation differential between the Republic of Korea and the US are employed to capture the interest rate and inflation risk premia, respectively. For the country risk premium, the spread of the 10-year Republic of Korea government dollar-denominated bond rate over the 10-year US Treasury bond rate is used. As clearly seen in the other five columns of Table 1, the null hypothesis ($\beta_0 = 0$, $\beta_1 = 1$) is rejected again in all specifications, even though values of adjusted R-squared are generally higher.

$$\Delta e_{t+1} = \beta_0 + \beta_1 (r_{t+1} - r^*_{t+1}) + \beta_2 \Delta(i_{t+1} - i^*_{t+1}) + \beta_3 \Delta(\pi_{t+1} - \pi^*_{t+1}) \quad (4)$$

$$+ \beta_4 \Delta s_{t+1} + \beta_5 \text{ crisis dummy} + \beta_6 \Delta e_t + \varepsilon_{t+1}$$

In equation (4), i_{t+1} and i^*_{t+1} are the 3-month interest rates of the Republic of Korea (certificate of deposit rate) and the US (London interbank offered rate [LIBOR]), respectively. π_{t+1} and π^*_{t+1} are the inflation rates of the Republic of Korea and the US,

[6] It is assumed that the investment holding period is 1 month.

s_{t+1} is the spread of the 10-year Republic of Korea government dollar-denominated bond rate over the 10-year US Treasury bond rate, and the crisis dummy captures the crisis period (August 2007–March 2009).

Table 1: Regression Results

	Equation (1)	Equation (4)				
Constant	-0.0011 (0.0033)	-0.0011 (0.0033)	-0.0008 (0.0031)	-0.0009 (0.0025)	-0.0015** 0.0019	-0.0059** (0.0025)
$r_{t+1} - r^*_{t+1}$	-0.0016 (0.0557)	0.0030 (0.0683)	-0.0221 (0.0666)	0.0108 (0.0706)	0.0057 0.0648	0.0019 (0.0579)
$\Delta(i_{t+1} - i^*_{t+1})$		0.0024 (0.0158)	-0.0006 (0.0149)	-0.0077 (0.0152)	-0.0103 0.0134	-0.0122 (0.0144)
$\Delta(\pi_{t+1} - \pi^*_{t+1})$			0.0112 (0.0075)	0.0096 (0.0074)	0.0074 0.0063	0.0114 (0.0081)
Δs_{t+1}				0.0309*** (0.0089)	0.0284*** 0.0092	0.0312*** (0.0092)
Crisis Dummy					0.0202*** 0.0076	0.0276*** 0.0089
Δe_t						-0.2736** (0.1199)
Adjusted R^2	-0.0088	-0.0175	0.0013	0.0958	0.1288	0.1868
Joint Test (F-Statistic)	165.4	110.2	117.9	98.8	118.8	149.1

Note: Figures in parentheses are Newey–West HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors' estimations.

Furthermore, one might also point to the frequent intervention of the Republic of Korea's authorities in the foreign exchange market as an important factor limiting the role of the exchange rate as a buffer. Although the foreign exchange market has not been free from control, the won–dollar exchange rate has displayed a great deal of volatility as shown in Figure 1 of the following section, suggesting that the market intervention has been much less frequent and extensive than before the crisis. While we do not deny the significance of all these factors, we show that there is a far more important cause of the failure: the close co-movement of the Republic of Korea's stock prices with those of the US.

3. PATTERNS OF ADJUSTMENT IN THE REPUBLIC OF KOREA'S FOREIGN EXCHANGE AND STOCK MARKETS

If the exchange rate does not adjust in equation (1), then arbitrage opportunities arise. What then happens to the differential? In this section, it is argued that any differential caused, for instance, by a change in the S&P 500 will mostly be eliminated by a corresponding change in the KOSPI rather than the won–dollar exchange rate. To substantiate this, we provide two types of evidence.

One piece of evidence is the high correlation of the KOSPI with the S&P 500, together with causality running from the latter to the former. This evidence suggests the possibility of mean reversion of the return differentials between the two stock markets. A second piece of the evidence is obtained from VAR analysis.

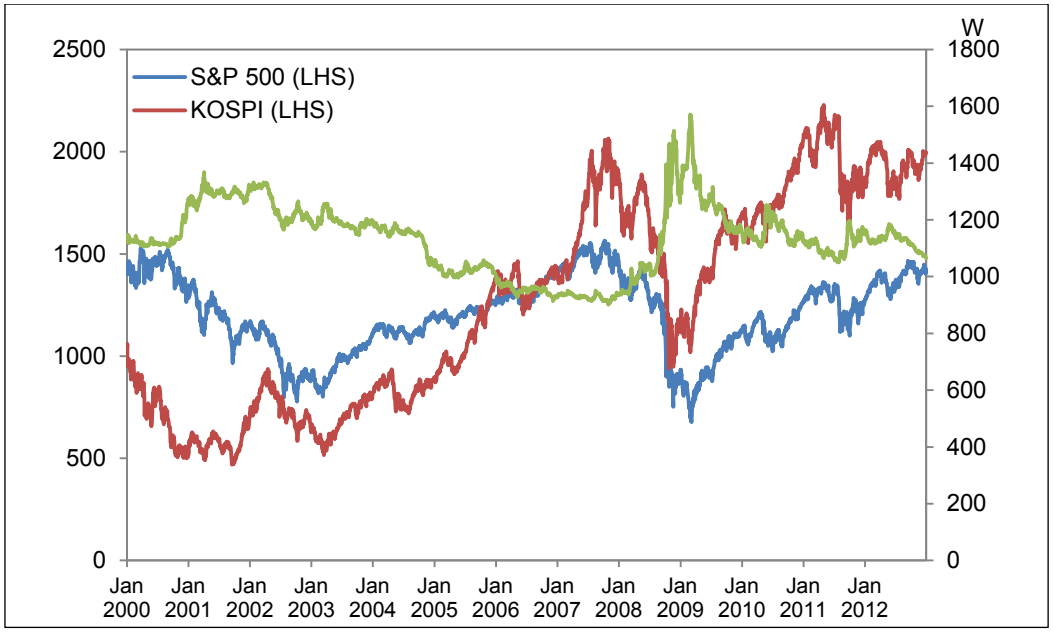
3.1 Co-Movement of the KOSPI with the S&P 500

For almost 2 decades before the 1997 financial crisis, the Republic of Korea was very cautious in allowing foreign investments in domestic financial assets. As a first step toward market opening, foreigners were allowed to invest indirectly in Republic of Korea stocks in the form of beneficiary certificates and through Republic of Korea country funds established exclusively for them. In 1992, foreign investors were allowed limited direct investment of 10% of the total outstanding stocks for each individual issue with a ceiling of 3% per issue for a single foreign investor. Thereafter, the government raised the ceilings several times before lifting them altogether in 1998, except for public corporations.

Although market opening was only partial before the 1997 financial crisis, data shows that since the mid-1990s onward, stock prices of both the Republic of Korea and the US have moved together. The co-movement has become more conspicuous since the 1997 financial crisis, which unleashed an extensive liberal reform of the financial sector. It reflects deeper integration of the two markets, but the causal relation between price movements of the two markets has been unidirectional.

As shown in Figure 1, the S&P 500 and the KOSPI have broadly similar trends. During the period January 2000–July 2007, before the 2008 global financial crisis, the rise of the KOSPI amounted to 0.58 percentage points of a 1 percentage point increase in the S&P 500 with a 1-day lag. During the crisis period from August 2008 to March 2009, this fell to 0.35 percentage points, but rose again to 0.46 percentage points during April 2009–December 2012.

Figure 1: S&P 500, KOSPI, and the Won–US Dollar Exchange Rate



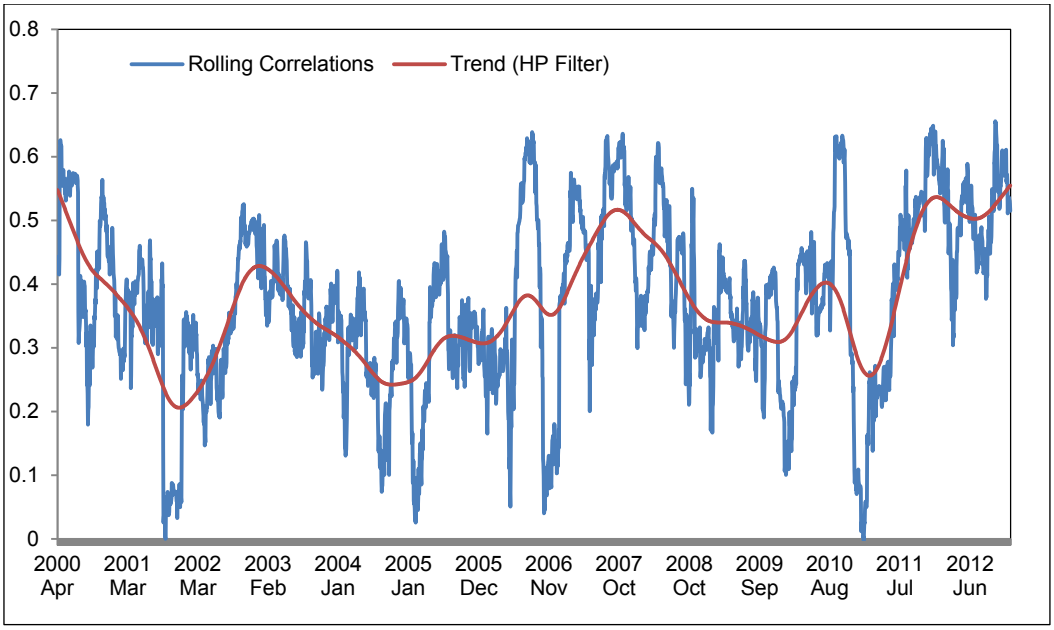
KOSPI = Korea Composite Stock Price Index, LHS = left-hand scale, RHS = right-hand scale, S&P = Standard and Poor's.

Source: Bloomberg.

The coefficient of correlation of the KOSPI with the S&P 500 a day earlier was about 0.35 during January 2000–March 2009. Since then, the coefficient has risen to about 0.44. This is further confirmed by the 3-month rolling correlations in Figure 2, which

show a rising trend in the positive co-movement between the S&P500(t) and the KOSPI(t+1) since 2011.

Figure 2: Rolling Correlations



HP = Hodrick-Prescott.

Note: Based on daily growth rate series. A rolling 3-month window is used.

Source: Authors' calculations.

During the same period, however, changes in the KOSPI have exerted no effect on the S&P 500. Estimates of causality and correlation between the S&P 500 and KOSPI leave little doubt that changes in the former led to similar changes in the latter, but not vice versa (see Tables 2 and 3). The unidirectional causality is not surprising in view of the fact that the Republic of Korea's stock market is too small to have any bearing on such a large, internationalized stock market as that of the US. These results suggest that changes in the return differential between the stock returns of the Republic of Korea and the US are mostly eliminated through changes in the Republic of Korea's stock prices rather than through the foreign exchange market.

Table 2: Cross Correlation between S&P 500(t) and KOSPI(t+j)

Period	j=–5	j=–3	j=-1	j=0	j=1	j=3	j=5
Pre-Crisis Period (Jan 2000–Jul 2007)	-0.045	0.014	-0.006	0.150	0.356	0.058	0.022
Crisis Period (Aug 2007–Mar 2009)	-0.109	0.010	-0.041	0.256	0.355	0.065	-0.067
Post-Crisis Period (Apr 2009–Dec 2012)	-0.037	-0.018	-0.031	0.239	0.438	-0.034	-0.079

KOSPI = Korea Composite Stock Price Index, S&P = Standard and Poor's.

Note: Based on daily growth rate series.

Source: Authors' calculations.

Table 3: Causality between S&P 500 and KOSPI

Causality	Period	t=1	t=2	t=3	t=4	t=5
S&P 500	Pre-Crisis Period (Jan 2000–Jul 2007)	266.159 (0.000)	135.558 (0.000)	98.902 (0.000)	75.414 (0.000)	60.506 (0.000)
↛	Crisis Period (Aug 2007–Mar 2009)	63.764 (0.000)	35.266 (0.000)	29.461 (0.000)	22.260 (0.000)	18.333 (0.000)
KOSPI	Post-Crisis Period (Apr 2009–Dec 2012)	234.078 (0.000)	151.828 (0.000)	100.622 (0.000)	80.772 (0.000)	64.081 (0.000)
KOSPI	Pre-Crisis Period (Jan 2000–Jul 2007)	0.010 (0.920)	1.819 (0.163)	1.006 (0.389)	0.853 (0.492)	0.959 (0.442)
↛	Crisis Period (Aug 2007–Mar 2009)	0.015 (0.904)	1.250 (0.288)	1.127 (0.338)	0.845 (0.497)	1.333 (0.250)
S&P 500	Post-Crisis Period (Apr 2009–Dec 2012)	0.174 (0.677)	3.787 (0.023)	1.413 (0.238)	1.105 (0.353)	1.292 (0.265)

KOSPI = Korea Composite Stock Price Index, S&P = Standard and Poor's.

Notes: Based on daily growth rate series. Figures are F-statistics and those in parentheses are p-values. The null hypothesis is that there is no Granger causality between the variables.

Source: Authors' calculations.

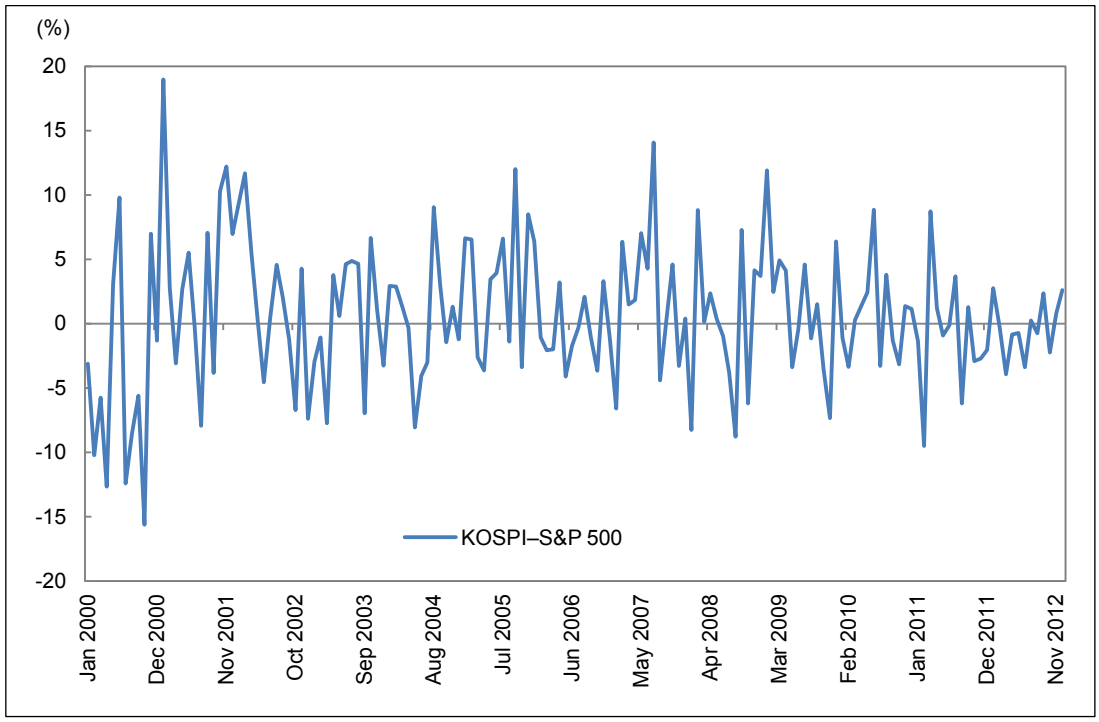
The stock price co-movement suggests the possibility of mean reversion of the return differentials. Figure 3 plots the return differentials between the KOSPI and the S&P 500 for the January 2000–December 2012 period. To substantiate further the possibility, consider the following AR(1) model:

$$X_t = \alpha + \beta X_{t-1} + u_t, \quad (5)$$

where X_t is the return differential between the KOSPI and the S&P 500 at time t, and u_t is white noise. The coefficient of AR(1), β, is found to be 0.032, which is much less than 1. In order to examine the degree of mean reversion, the half-life is calculated as $h = \log(0.5)/\log(\beta)$.[7] In this case, with $\beta = 0.032$, the half-life is 0.2 periods, indicating that deviations from the equilibrium return differential revert to the average very quickly. This result supports the pattern of adjustment where changes in the Republic of Korea's stock prices eliminate the differentials.

[7] The half-life is defined as "the number of periods required for the impulse response to a unit shock to a time series to dissipate by half" (Kim et al. 2007). It is commonly used to measure persistence of a time series.

Figure 3: Stock Return Differentials



KOSPI = Korea Composite Stock Price Index, S&P = Standard and Poor's.

Source: Bloomberg.

3.2 VAR Analysis

To verify further the limits of the Republic of Korea's floating exchange rate regime in shielding domestic financial markets from external shocks such as changes in US monetary policy, this section constructs a VAR(p) model consisting of four variables–the S&P 500, the KOSPI, the won–dollar exchange rate, and the interest rate on 3-year government bonds (the KTB rate).

A VAR(p) model is specified as follows:

$$Z_t = \Gamma_0 + \sum_{i=1}^{p} \Gamma_i Z_{t-i} + \varepsilon_t \quad (6)$$

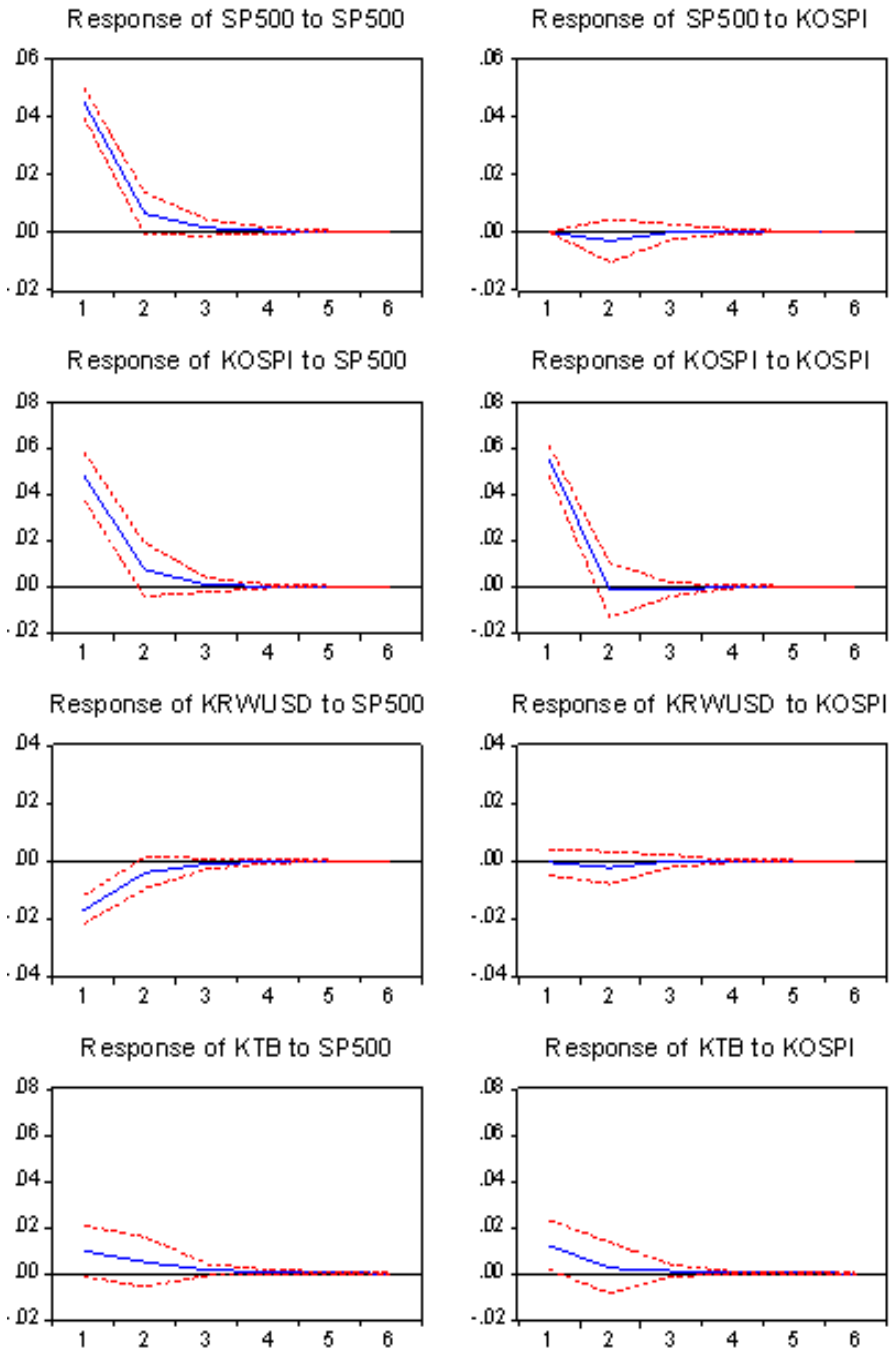
where Z_t is the four-variable vector (S&P 500, KOSPI, won–dollar exchange rate, KTB rate), Γ_0 is the constant, Γ_i represents the coefficients for each of the *i*-th lags, and the error, ε_t, is white noise.

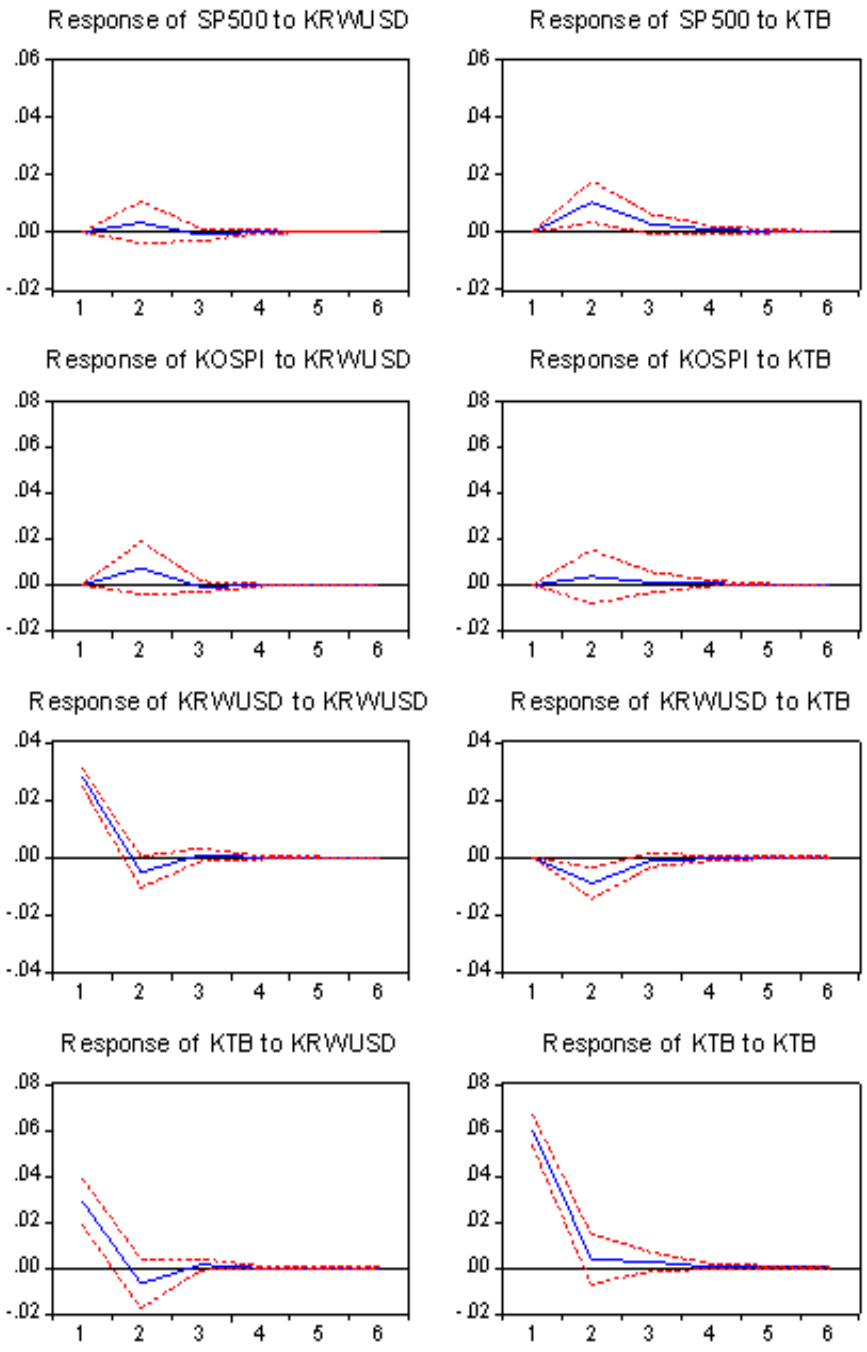
The four variables are placed in decreasing order of exogeneity and their causal relations with other variables. Since VAR analyses are sensitive to changes in the ordering of variables, this section examines different orderings to evaluate the robustness of the results. The period covered runs from January 2000 to December 2012. The data frequency is monthly. The four variables enter as rates of change. Based on the Schwarz Bayesian criterion, a VAR(2) model for monthly data is used.

This model is used to analyze (i) orthogonal impulse responses to trace the effect of an exogenous shock to one variable on other variables, and (ii) decomposition of forecast error variances to determine how much of the forecast error variance of each of the

variables can be explained by exogenous shocks to the other variables. These are in Figure 4 and Table 4.

Figure 4: Orthogonal Impulse Responses





KOSPI = Korea Composite Stock Price Index, KRWUSD = won–US dollar exchange rate, KTB = Korea Treasury bond, SP500 = Standard and Poor's 500.

Notes: The period of coverage is January 2000–December 2012. Frequency of the data is monthly. Data are rates of change.

Source: Authors' estimations.

Shock to the S&P 500

In response to a positive shock to the S&P 500 at time *t*, both indices jump and then decline for the next three periods to return to their initial levels. The patterns of adjustment of the two indices are almost identical. The won–dollar exchange rate appreciates initially, but the degree of response is less than half of that of the KOSPI. The exchange rate recovers from the shock gradually to revert to the original level by

the end of *t*+2. The impact response of the KTB rate to the S&P 500 shock is very small and statistically insignificant.

Shock to the KOSPI

As expected, a shock to the KOSPI has little or no effect on either the US stock index or the won–dollar exchange rate. On the other hand, the KTB interest rate initially rises, but falls back to the original level after *t*+2, suggesting that bonds and stocks are not good substitutes.

Shock to the Won–Dollar Exchange Rate

The responses of the KOSPI and S&P 500 are small and statistically insignificant. The KTB interest rate rises when the won–dollar exchange rate depreciates, although the impact response is short-lived and disappears before *t*+2.

Shock to the KTB Interest Rate

The effects of an exogenous increase in the KTB rate on the two stock indices are negligible, but lead to a strengthening of the won–dollar exchange rate before weakening at *t*+2.

Table 4 presents the results of forecast error variances for the monthly data. It shows that during the first month, about 57% of change in the KOSPI is accounted for by the index itself, 43.4% by the S&P 500, and none by either the exchange rate or the KTB interest rate. Over time, however, the shares of the exchange rate and the KTB rate rise slightly at the expense of the share of the KOSPI.

Table 4: Forecast Error Variance Decomposition

Variance Decomposition of KOSPI / Period (month)	S&P 500	KOSPI	Won–US Dollar Rate	KTB Rate (3-year)
1	43.369	56.631	0.000	0.000
2	43.393	55.363	1.005	0.239
3	43.377	55.345	1.018	0.261
4	43.374	55.340	1.017	0.268
5	43.374	55.340	1.017	0.269
Variance Decomposition of Won–US Dollar Rate	**S&P 500**	**KOSPI**	**Won–US Dollar Rate**	**KTB Rate (3-year)**
1	26.584	0.031	73.386	0.000
2	25.157	0.493	67.675	6.675
3	25.189	0.492	67.587	6.731
4	25.187	0.494	67.566	6.753
5	25.188	0.494	67.565	6.753
Variance Decomposition of KTB Rate	**S&P 500**	**KOSPI**	**Won–US Dollar Rate**	**KTB Rate (3-year)**
1	1.983	3.138	18.023	76.856
2	2.420	3.177	18.724	75.678
3	2.458	3.190	18.711	75.641
4	2.461	3.189	18.711	75.639
5	2.461	3.189	18.711	75.639

KOSPI = Korea Composite Stock Price Index, KTB = Korea Treasury bond, S&P = Standard and Poor's.

Source: Authors' estimations.

As in the case of the KOSPI, the won–dollar exchange rate explains more than 73% of its own change, the S&P 500, 26.6%, and the KOSPI, 0.03%, during the first month. In the second month, the shares of both the KOSPI and the KTB rise and remain unchanged for the next 3 months. Throughout the 5-month period, change in the KTB interest rate is mostly explained by the rate itself (a little over 75%) and the exchange rate (about 19%).

To assess the robustness of the results of the preceding analysis, the ordering of the variables is changed to S&P 500, KOSPI, KTB rate, won–dollar exchange rate. The results are similar to those of the first ordering.

In summary, the orthogonal impulse responses and decomposition of forecast error variance confirm our predictions regarding the effects of exogenous shocks such as a change in the S&P 500 on the KOSPI and on the won–dollar exchange rate. In response to a surge in the S&P 500, the KOSPI jumps and the won–dollar exchange rate appreciates, but the extent of appreciation is relatively small, so has a limited effect on curbing equity capital inflows and hence on the rise in the KOSPI. More precisely, the exchange rate appreciates in response to capital inflows, but if foreign equity investors are not hedging against exchange rate risk so that β in equation (1) is small, the amount of appreciation will be smaller than the free-floating case, which means the adjustment through change in the exchange rate is limited. As a result, the Republic of Korea's stock price index rises, but rises less than the US index does. That is, when $\Delta P^*_t > \Delta P_t$ in equations (2) and (3), it may not appreciate enough to block equity capital inflows to keep P_t unchanged as in the free-floating case. This is the case borne out by our examination of the data.

What would happen to domestic interest rates in the Republic of Korea in the adjustment process? Since stocks and bonds are substitutable assets in wealth portfolios, one would expect that bond prices will rise and interest rates will fall when the stock price index rises. The VAR analysis above shows that the response of the KTB interest rate to a shock to either the S&P 500 or the KOSPI is very weak, confirming the results of other studies quoted in Section 2.2 that stocks and bonds are not good substitutes in asset portfolios of both domestic and foreign investors.

4. CAUSES OF THE CO-MOVEMENT IN THE REPUBLIC OF KOREA AND UNITED STATES STOCK MARKETS

4.1 Financial Market Integration and the Global Financial Cycle

There is extensive literature on the co-movement of stock markets around the world, which finds that stock price indices of advanced economies began moving together as their stock markets achieved deeper integration in the early 1980s.[8] The growing acceptance of economic liberalization has led to the opening of financial markets in the emerging world since the early 1990s, growth in the capitalization of emerging stock markets, increased trade, and similar co-movements of stock price indices in advanced and emerging economies.[9] In their estimation of time-varying cross-country correlations

[8] Shiller (1989) shows that European and US stock prices moved together a lot more than their economic fundamentals.

[9] Johnson and Soenen (2003) show that using daily returns from 1988 to 1999 for Argentina, Brazil, Chile, Mexico, and Canada, and from 1993 to 1999 for Colombia, Peru, and Venezuela, there is a high degree of stock market co-movement between the eight equity markets of the Americas and the stock market in the US. The high degree is ascribed to high shares of trade with the US in these economies. On the other hand, an increase in bilateral exchange rate volatility and a higher ratio of stock market

using a sample of 25 developing countries over the 1990–2004 period, Beine and Candelon (2011) find that financial and trade liberalization had a positive impact on the degree of cross-country stock market linkages.

A brief survey of the recent studies on stock market co-movement by Arouri et al. (2010) finds: (1) significant co-movements are observed among world stock markets, and the degree of cross-market co-movement has significantly increased since 1994, largely a result of increasing market integration; and (2) evidence of a positive relation between correlation and volatility—higher correlations between international stock markets in periods of high volatility or in times of financial trouble.[10]

Most of the studies quoted above point to global integration of financial markets of individual countries as a main cause of the stock market co-movement around the world. In this regard, Didier et al. (2012) and Rey (2013) are most specific. In investigating the factors that determine co-movement between stock market returns in the US and 83 other countries, Didier et al. examine the relative importance of real, financial, and "demonstrative effects" linkages before the 2008 global financial crisis.[11] They find that financial linkages in capital flows among countries with an open financial regime constitute the most significant channel.

In a financially integrated global economy, these financial linkages may generate a global financial cycle set by the financing conditions in the main global centers of international finance—the US being the dominant one—that govern the conditions in the rest of the world regardless of the exchange rate regime (see Rey [2013]).[12] Once the regularity and predictability of the global financial cycle are established, developed and emerging economies would be subject to a common risk element, which would in turn result in a high correlation of flows of capital market instruments, including bonds and equities, with one another and negative correlation with a measure of uncertainty and market risk aversion, such as the Chicago Board Options Exchange Market Volatility Index (VIX).[13] In such a regime, when capital is freely mobile, capital flows, asset prices, and credit expansion co-move across both developed and emerging economies, limiting the effectiveness of free floating regimes in safeguarding independent monetary policy.

One of the implications of Rey's argument is that investment decisions of global equity investors with diversified portfolios of emerging market stocks are guided as much by changes in macroeconomic policies and market conditions in the US as by changes in regional and local economic conditions of emerging economies. This means that foreign equity investors—in particular institutional ones—holding Republic of Korea stocks are likely to pay as much attention to the determinants of and fluctuations in the

capitalization relative to that of the US contribute to lowering the co-movement. For a more recent study, see Arouri et al. (2010).

[10] For a brief review of the literature, see Arouri et al. (2010) and Forbes and Rigobon (2002), who show that adjusting for heteroskedasticity bias, there was virtually no increase in unconditional correlation coefficients, or contagion, during the 1997 Asian crisis, 1994 Mexican devaluation, or 1987 US-market crash. Economic interdependence was the cause of a high level of market co-movement in all periods.

[11] Demonstrative effects linkages refer to investors' reassessment of the risks in other countries associated with vulnerabilities present in a global financial center, such as in the US, and reevaluate the value of their stockholdings.

[12] In the finance literature, to explain the global stock market integration, a number of authors search for world factors common to all stock markets that drive the co-movement in stock prices and the presence of a strong group factor, a world factor constructed from country indices by principal components, value-weighting, or some other method of aggregating the indices (see Blackburn and Chidambaran [2011]).

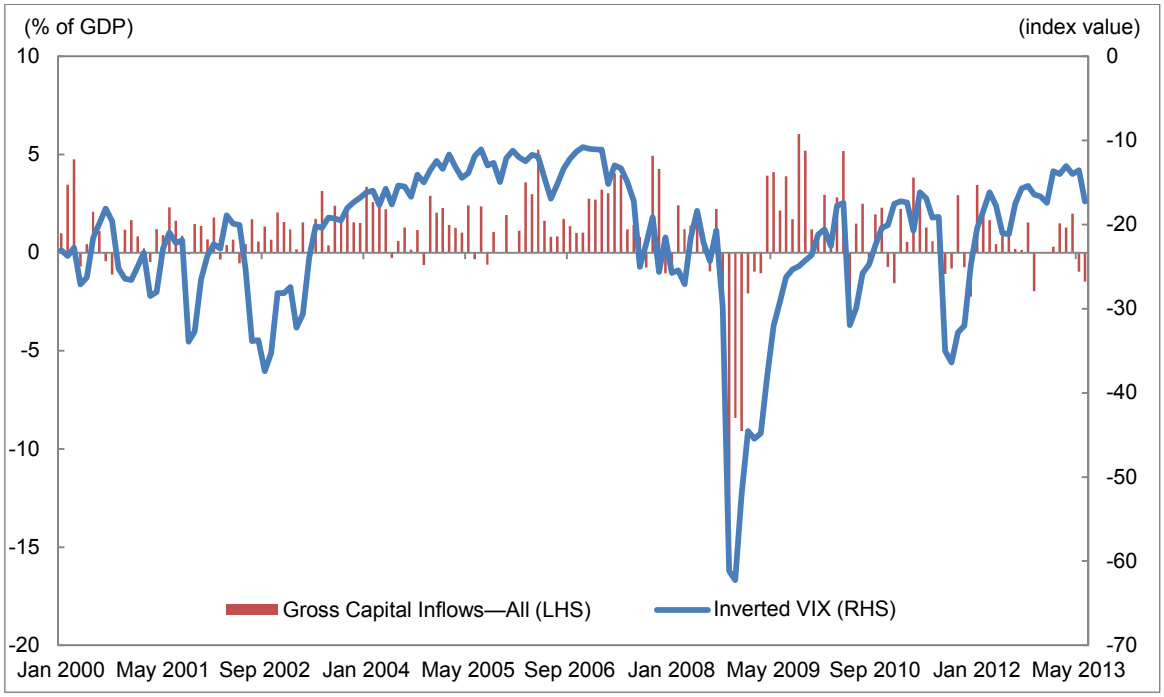
[13] The Volatility Index measures uncertainty and market risk aversion.

risk profile of global financial markets as they do to the Republic of Korea's overall economic developments and changes in financial market conditions.[14]

To examine this possibility, Figure 5 plots capital inflows disaggregated by portfolio equity and bonds as a proportion of nominal US dollar GDP for the period January 2000–December 2012 together with the inverted VIX. Particularly striking is that equity inflows tend to be highly correlated with the inverted VIX, with a correlation of 0.47, compared to 0.22 for bond inflows. This finding gives support to our argument that those foreign investors holding Republic of Korea stocks are likely to be as sensitive to changes in uncertainty and risk aversion in global financial markets as to changes in domestic macroeconomic variables—including the foreign exchange rate—in managing their stock portfolios.

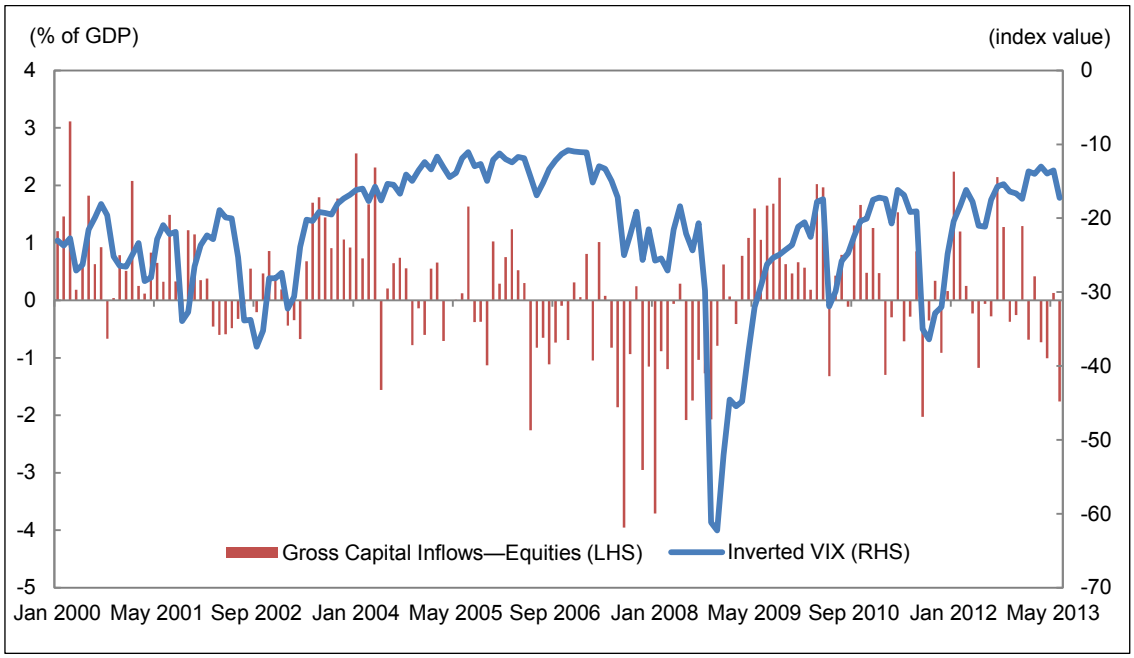
Figure 5: Capital Inflows and the Inverted Volatility Index

(a) Gross Capital Inflows

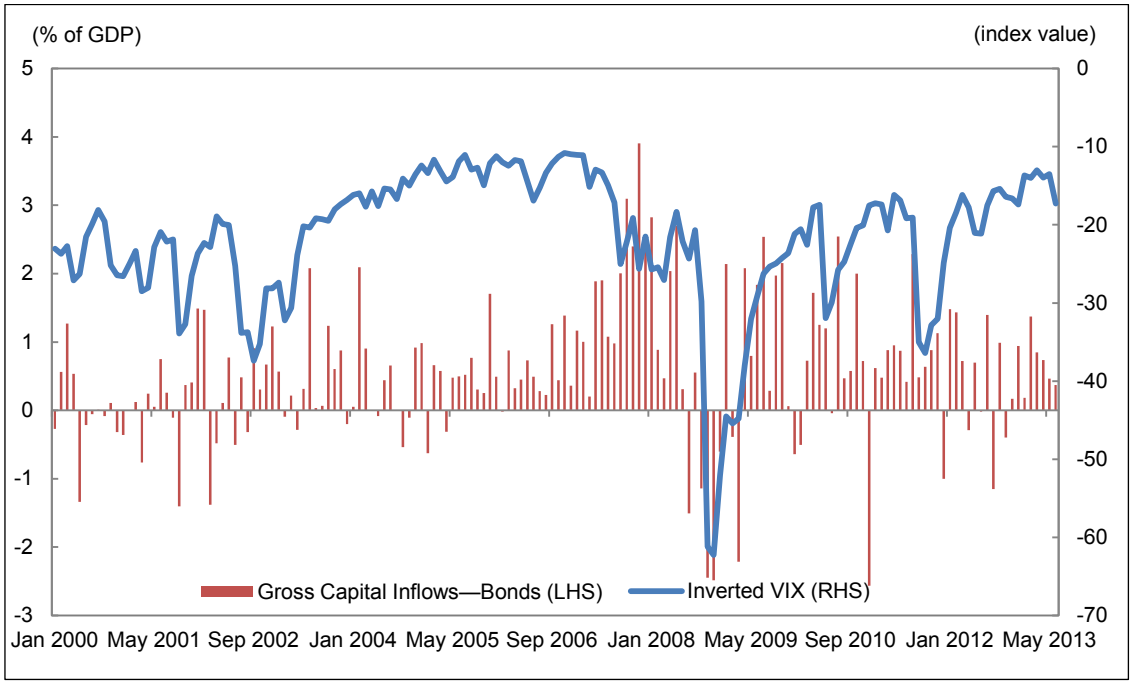


[14] Another implication is that global stock index funds would not benefit from diversification across a large number of countries, because their returns would be highly correlated.

(b) Equity Inflows



(c) Bond Inflows



GDP = gross domestic product, LHS = left-hand scale, RHS = right-hand scale, VIX = Volatility Index.

Sources: Bank of Korea Economics Statistics System; Bloomberg.

4.2 Foreign Stock Investors and Currency Hedging

While Rey (2013) does not provide any empirical evidence that the trilemma reduces to a dilemma—the types of exchange rate regimes do not matter for the pass-through of interest rates from the center country to periphery countries—Ito (2013) points out that Rey's argument may be applicable to long-term interest rates, though not to short-term

interest rates.[15] Even if the presence of the global financial cycle is not as significant as it is made out to be, we argue that there is another factor of equal importance that has driven the co-movement: global investors' insensitivity to, or implicit acceptance of, currency fluctuations.

In opening their economies, many emerging economies have adopted a more flexible exchange rate system since the early 1990s. This regime shift may have changed the degree and pattern of the co-movement. However, few studies examine the possibility that the spread of greater flexibility of exchange rates around the world has reduced spillovers of stock price changes and market volatility across countries, to slow, stop, or even reverse the co-movement. Although recent empirical studies do not address this issue of the causal relation between the co-movement and the exchange rate regime, they appear to assume that exchange rate flexibility has not impeded stock market integration.

This lack of research interest in the causal relation could be attributed to the conflicting evidence on the extent to which global investors care about, and take measures to cover, the currency risk their equity investments are exposed to either in the short or long run. Global investors' acceptance or disregard of currency exposure means that they are by and large unaffected by currency fluctuations in managing their equity portfolios. This is the reason why we believe the Republic of Korea's more flexible exchange rate system since the 1997 financial crisis has not hampered deeper integration of its stock market with that of the US.

As shown in Section 3, changes in the won–dollar exchange rate do not have direct and large effects on domestic investors' holdings of US equities. This is because their exposure to the US stock market is small, so they are likely to find that the cost outweighs the benefit of currency hedging. At the end of 2012, for example, the total market value of foreign stocks including US stocks held by local investors was only 7.6% of their total holdings of Republic of Korea stocks.[16] In response to a fall in the S&P 500, or a corresponding increase in the S&P 500 index return, they may shift out of Republic of Korea stocks and into US stocks, but the amount of the shift would be relatively small, so they may not have incentives to hedge against exchange risk.[17]

As for foreign investors, although they account for a large share of the Republic of Korea's stock market capitalization, they also tend to discount possible losses on unhedged portfolios stemming from exchange rate fluctuations. We present a number of reasons below why global equity investors do not hedge currency risk, certainly not as much as bond investors do.

In the literature on currency hedging, there is considerable disagreement about how international investors should manage currency risk. There are two diametrically opposed views. One view advocated by Perold and Schulman (1988) claims that full hedging is optimal, because foreign currency risk does not offer a commensurate return. Since the expected currency return is zero, currency risk can be removed without suffering any decrease in the long-term return. Currency hedging is a "free lunch." A serious problem with Perold and Schulman's results is that the period covered by their study, 1977–1987, may not be representative of the long-term currency market environment.

[15] See also Ito and Kawai (2012).

[16] Although there are no reliable data, the share of the US stocks is likely to be much small than the total percentage because most local investors buy into foreign equity funds, investing in a large number of foreign stocks denominated in different currencies.

[17] It is assumed here that the expected prices of US stocks do not change initially.

At the other extreme, working with US data, Froot (1993) shows that over investment horizons longer than 2 years, it is not worthwhile to hedge foreign currency positions because the real exchange rate reverts to its mean according to purchasing power parity (PPP) theory. Schmittmann (2010) challenges Froot's results, arguing that over the period January 1975–December 2009 when other countries are taken into account, the case for hedging does not decrease with an increasing investment horizon.

In the short run, real exchange rates matter as they tend to be volatile. If investors are sensitive to short-term volatility over a quarter or a year, they would find it beneficial to hedge. However, Froot (1993) argues that the case for "free lunch" holds in the short run and only if real exchange rates follow random walks. Froot also points out that even in the short run, the accumulation of transactions costs and counterparty risk associated with maintaining a currency hedge over time causes the optimal hedge ratio to decline.

Hedging reduces asset volatility, but increases the correlations among assets in a highly diversified equity portfolio. When both the lower volatility and the higher correlation are taken into account, hedging may not reduce aggregate portfolio risk. For instance, if the share of Republic of Korea equities in global investors' portfolios is relatively small, and the cost of hedging is high because the forward and currency future markets lack liquidity and interest rates are high, it may not be worthwhile to hedge.[18]

When the volatility of the exchange rate rose during 2008 and 2009 in the Republic of Korea, the instability of the won–dollar exchange rate drove risk-averse investors to shorten their investment horizon by increasing the turnover rate of their equity portfolios as a means of minimizing currency risk. A study on the behavior of foreign equity investors in the Republic of Korea (Min 2009) shows a significant increase in the turnover of foreign portfolios of Republic of Korea equities after the US sub-prime crisis of 2007. Measured by the total amount of annual transactions divided by an average of the market capitalizations at the end of the current and previous year, the turnover rate almost doubled from 72% to 138% between 2003 and 2008. It jumped to 117% in 2007 from 84% in the previous year.

A number of recent market studies show that over longer periods, say 10–15 years, the returns on hedged and unhedged global equity portfolios are similar, although they tend to vary in the short run (see Tweedy, Browne Fund Inc. [2010] and Dimson et al. [2012]).[19] Some foreign long-term equity holders act like domestic investors. Once invested, they do not move in or out of the market—at least not as often as theory predicts—in response to changes in the relative stock returns of the Republic of Korea and foreign countries. For example, when they do sell, they usually park their proceeds in the Republic of Korea by investing in bonds or other financial instruments with the expectation of returning to the market. Changes in the won–dollar exchange rate do not affect their investment behavior.

4.3 Herding of Domestic Investors

Although foreign investors account for a relatively large share of the Republic of Korea's stock market capitalization, it is ultimately domestic equity investors who could

[18] Jorion (1989) shows that in the case of US equity investors, 20% was the minimum level of investment in non-domestic assets required to make currency hedging valuable for US investors.

[19] The authors' survey of securities firms in Republic of Korea suggests that foreign institutional investors, who are mostly long-term investors, ignore the currency risk, whereas foreign hedge funds and mutual funds cover their exchange rate risk, but the share of hedged investments varies from 20% to 70%.

determine the trend as well as fluctuations in the Republic of Korea's stock prices. However, in making their decisions, many of the local investors tend to follow the trading of foreign equity investors rather than rely on their own assessments of stock market conditions. This is why foreign equity investors have been able to lead the market.

A large proportion of domestic investors do not have access to reliable information about changes in economic fundamentals or policies of both the Republic of Korea and the US, information needed to guide their expectations of future stock prices. In the absence of this information, they monitor closely and act on US stock price movements as a benchmark for their investments in domestic equities. For instance, a surge in the S&P 500 would mean that it is time to buy because the increase signals a potential inflow of US-equity capital, which would cause a rise in stock prices. If the S&P 500 drops the next day, it is a good time to sell. In this way, foreign equity investors can be said to lead the market.

Since it is costly to gather and assess the necessary information on stock market developments at home and abroad, the Republic of Korea's local investors tend to believe that their global counterparts know what they are doing and hence imitate their trading behavior. When foreign investors buy Republic of Korea stocks, so do domestic investors; when foreign investors liquidate their holdings, many domestic investors follow suit.

5. CONCLUDING REMARKS

This paper has examined the extent to which exchange rate flexibility has been effective in mitigating the impact of external shocks on domestic financial markets in the Republic of Korea. Since introducing a floating exchange rate regime in the aftermath of the 1997 financial crisis, the won–dollar exchange rate has fluctuated over a wide range, even though the Republic of Korea's policy makers have not been averse to intervening in the foreign exchange market to smooth the volatility of the nominal exchange rate.

In a free-floating regime with capital mobility, theory predicts that changes in the exchange rate fend off much of the impact of shocks originating outside the country. This proposition is usually presented in the framework of the uncovered interest parity condition. However, in countries where the stock market is relatively large compared to the bond market and equity investments dominate cross-border capital flows, the parity condition needs to be reformulated in terms of expected stock returns rather than interest rates.

This paper specifies and estimates the uncovered stock return parity condition for the Republic of Korea, and estimation results show that the condition does not hold. Many of the reasons attributed to the failure of unconditional interest parity condition may also apply to the uncovered stock return parity condition. In the context of the Republic of Korea's economy, however, this paper points to the co-movement of stock prices in the Republic of Korea with those in the US as a more important reason. This gives rise to a pattern of adjustment in which the Republic of Korea's stock prices change in response to changes in the differential between the stock returns of the 2 countries. The data show that the differentials are mean reverting.

In this paper, three different factors are presented as forces behind the price co-movement. One factor is global financial integration involving both advanced and emerging economies. This may have generated a global financial cycle in which

financing conditions in the main centers of global finance set the condition for the rest of the world. In a global economy governed by a financial cycle, asset prices, including those of equities and bonds, are bound to move together across economies. If the regularity of the global financial cycle is further substantiated, then it implies that global investors would lose incentives to diversify their portfolios across a wide spectrum of countries because regional and domestic factors do not matter.

In order to gain broader acceptance, the global financial cycle story needs to be subject to the scrutiny of further empirical examination. Whatever the outcome of the additional testing, as long as global financial investors are willing to accept currency exposure of their equity portfolios, exchange rate flexibility has at best a limited effect on constraining the co-movement of stock markets of both developed and emerging economies.

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