Understanding Stock Market Volatility:
The Case of Korea and Taiwan

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Abstract

The Taiwanese stock market has historically been considerably more volatile than the Korean market. This is somewhat surprising given the many similarities of the two markets. One notable difference between the two markets is that trading volume is substantially higher in Taiwan, leading some to believe that the higher volatility in Taiwan is a result of "excessive" speculation. The evidence presented in this paper is somewhat mixed. First, we find no evidence of mean-reversion in the stock market index in either country. Second, we find that Taiwanese stock returns are much more correlated with their earnings than are Korean returns both over time and cross-sectionally. However, during 1987, 1989 and 1990, when Taiwanese stocks experienced extremely large price movements, the cross-sectional correlations between stock returns and earnings were very low, suggesting that at selected times, Taiwanese stock prices may have deviated from their fundamental values.

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The Korean and Taiwanese stock markets have grown very rapidly in the recent past. During the previous 16 years the Korean Composite Index rose about 9 times, from about 100 points at the end of 1977 to about 866 points at the end of 1993, while the Taiwan Market Weighted Index rose about 15 times, from about 390 points at the end of 1977 to about 6,070 points at the end of 1993. The capitalizations of each of these markets have also grown very rapidly. Both markets had capitalizations of about \$US 3 billion at the end of 1977. The market capitalizations of the Korean and Taiwanese markets were about \$US130 billion and US\$190 billion respectively at the end of 1993.

Until recently international investors were unable to invest in Korean and Taiwanese stocks. This situation is rapidly changing, however, and both markets are attracting substantial attention from international investors who are interested in assessing the risk and returns associated with investing in the two markets. The opening of the Korean stock market started in August 1984 with the formation of a U.S. closed-end mutual fund called the Korea Fund.¹ In December 1986 a similar closed-end Taiwanese fund, called the Taiwan Fund was formed and in May 1989 the R.O.C. Taiwan Fund was formed.²

Although these funds allowed international investors to purchase portfolios of Korean and Taiwanese stocks it was not until 1991 in Taiwan and 1992 in Korea that they could buy individual stocks. Starting in January 1992, foreign (non-Korean) investors were allowed to directly invest in Korean equities, although with certain limitations. With these restrictions,

¹The Korea Fund is listed on the New York Stock Exchange (NYSE) and has a capitalization of about \$US 240 million (as of the end of June 1992). The more recently listed Korean Investment Fund is also traded on the NYSE (since February 1992) with a capitalization of \$US 43 million at the end of January 1993. Starting in 1985, foreign investors can also purchase Euro-convertible Korean bonds, and starting in 1992 investors can buy Taiwan global deposit receipts (GDRs).

²Both funds are traded on the NYSE with a total capitalization of about \$US 380 million at the end of 1992.

up to 10% of the shares of each listed Korean company can be owned by foreigners and individual foreign investors can own up to 3% of the total outstanding shares of a single Korean firm. In 1993, there was about US\$3 Billion in foreign capital invested in the Korean stock market.

While it is still difficult for foreign individual investors to directly buy Taiwanese stocks, the market has opened considerably to non-Taiwanese institutional investors. Starting in 1991, foreign institutions that have met the approval of the Central Bank of China (Taiwan) have been allowed to invest in Taiwanese stocks. As of May 1994, foreign institutions have already applied to invest a total that far exceeds the previous limit of US\$7.5 billion, or about 4% of the stock market's current capitalization. Under the new policy announced on May 25, 1994, the ceiling first will be raised to US\$10 billion, and eventually to as much as US\$20 billion, or about 10% of the market's current capitalization.

Except for the greater number of firms that are listed in Korea,³ the Taiwanese and Korean stock markets are very similar in many respects. As we just mentioned, the markets have very similar histories, experiencing parallel growth rates and opening up to international investors at about the same time. The markets are also about the same size, and the industrial makeup of the two markets are very much alike. The listed companies in both economies have a strong export component to their sales with the United States being the largest trading partner for each country.⁴ Many of the large companies in both countries are organized into families or groups, referred to as *Chaebols* in Korea and *Chituan*s in Taiwan. In addition, both countries have experienced an increased openness, politically as well as economically,

³The number of firms listed on the Korea Stock Exchange is about three times that on the Taiwan Stock Exchange. In 1977, there were 231 firms listed on the Korea Stock Exchange while there were 77 listed firms in Taiwan. By the end of 1991, there were 669 firms listed in Korea and only 220 firms listed in Taiwan.

⁴Yet, there is little direct impact of U.S. economic conditions on stock prices in these countries (Bailey (1990)).

that has corresponded with their economic growth.

Despite these similarities, the Korean and Taiwanese markets have very different price volatilities. The monthly standard deviation of the return of the Taiwan Weighted Index was about 12% during the 1978-1991 time period while the corresponding Korean return standard deviation was only about 7%. (See Figure 1 for the historical stock indices in both countries.) In comparison, the monthly standard deviation of the S&P 500 is about 4.5% and a typical large stock in the U.S. would have a monthly standard deviation of about 9%.

The primary purpose of this paper is to examine various explanations for why the Taiwanese market has been so much more volatile than the Korean stock market. Our analysis considers two possibilities that are best understood in the context of a simple discounted cash flow model where discount rates as well as expected cash flows change from month to month: The first possibility is that prices fluctuate more in Taiwan because the "fundamentals" that determine the cash flows of the Taiwanese market are more uncertain than they are in Korea. The second possibility is that changes in "investor sentiment" or the characteristics of shareholders, who ultimately determine the discount rates, are different in the two countries. For example, if Taiwanese investors are more subject to changes in their attitudes towards risk, discount rates and prices will be more volatile than in Korea even if cash flows are no more uncertain.

Existing evidence from the U.S. and U.K. indicates that changing discount rates as well as changing fundamentals about cash flows do in fact contribute to volatility.⁵ However, there is substantial disagreement about how to interpret these changing discount rates. DeLong, Shliefer, Summers and Waldmann (1990) among others attribute at least part of

⁵See, for example, articles by Shiller (1981), Poterba and Summers (1988), Fama and French (1988) and Jegadeesh (1991).

these changes in discount rates to what they call "noise traders" who trade based on irrelevant information (like sunspots) and thus introduce volatility into financial markets. Advocates of this noise trading effect tend to think of trading as being destabilizing and creating volatility (see Summers and Summers (1989)). Others have argued that changing discount rates are simply rational responses to changing levels of wealth and uncertainty.

From our casual reading of the popular press and our conversations with Taiwanese investors we have the impression that the "investor sentiment" or noise trading story is probably the most popular explanation of the high volatility observed in Taiwan. For example, an article in the April 20th 1991 *Economist* entitled "A sobering dawn at the casino" described the situation during Taiwan's most volatile period as follows:

"its index rose from 800 in 1986 to a peak of 12,495 early in 1990. Daily turnover jumped from \$60m to \$3.4 billion. Small punters turned over their holdings every three weeks on average; many quit their jobs to make speculation easier. To serve them, the number of stock brokers increased from 28 to 400, the number of broking accounts from 250,000 to 5m."

Trading costs in Taiwan are extremely low for small investors, and these investors trade a lot. The round-trip commissions for buying and selling stocks in Taiwan are about 0.585% for transaction as little as US\$400. Given that there is on average about 1 brokerage account for every family in Taiwan, one can reasonably assume that there is no shortage of noise traders in Taiwan.⁶ Yearly turnover has in the past exceeded 500% in 1989 and 1990 (see Table 2) and total daily trading volume in Taiwan has at times exceeded the dollar trading volume in the Tokyo market which is more than 20 times as large. Korean investors, in contrast, appear to be much more sober. With the exception of 1989 when yearly turnover exceeded 114%, yearly turnover in Korea has always been below 100%.

⁶The low level of sophistication of the typical Taiwanese investor in this period has been described in a number of articles. For example, an article by Stine (1990) says that "cynics began calling the Taiwan Stock Exchange a hangout for "prostitutes and taxi drivers"."

Although the circumstantial evidence suggests that the higher volatility in Taiwan's market is linked to the low commissions and active trading of its relatively uninformed participants, more detailed evidence is clearly warranted. We provide this evidence with a series of exploratory tests that examine the extent to which return variances in Korea and Taiwan are determined by changes in expected cash flows and changes in discount rates. We first examine both short and long horizons serial correlations for the two indexes to estimate the extent to which the indexes exhibit mean reversion. We then examine the return behavior of various industry portfolios in the two countries. These tests examine, among other things, Roll's (1992) hypothesis that differences in volatility across markets arise because of differences in their industrial compositions. Our final tests estimate the relation between earnings and stock returns in the two countries.

The rest of the paper is organized as follows: Section 1 provides some summary statistics on the return patterns, price/earnings ratios, dividend yields, leverage ratios, trading turnover rates and yearly volatilities in the two countries. Section 2 provides a decomposition of stock returns into a component relating to changes in expected return and a component related to changing fundamentals and suggests some empirical implications. Section 3 presents mean-reversion tests for the two indexes and section 4 examines the variances and covariances of various industry portfolios formed from individual stocks in the two countries. Section 5 examines the relation between reported earnings and stock returns in the two countries and section 6 presents our conclusions.

1. Descriptive Statistics

Table 1a presents the market capitalization, monthly mean returns and standard deviations for the value-weighted (VW) and equally-weighted indexes (EW) of Taiwan and

Korea. For comparison purposes we also include these same statistics for Japan, Hong Kong, Thailand, and Malaysia. The table provides information for the entire sample period of 1978-1991 as well as the two subperiods of 1978-1984 and 1985-1991. For Hong Kong our data is available from 1980-1991. The returns in Table 1a are calculated based on price movements in the local currencies. Table 1b calculates these same average returns and standard deviations for the U.S. dollar return series for each country.⁷ Please note that in some cases, table 1a and table 1b report average returns and standard deviations calculated over different dates. This is due to the availability of the U.S. dollar exchange rates in Korea and Thailand.

The figures in these tables indicate that the standard deviations are not affected by the currency fluctuations. However, the means are affected by the strengthening and weakening of the respective currencies. During the 1985-1991 subperiod, the Taiwanese dollar and the Japanese yen appreciated substantially, while the Korean won, the Malaysia ringgit, the Hong Kong dollar and the Thailand baht were quite stable. During the first subperiod, the Korean won, the Thailand baht and the Hong Kong dollar depreciated considerably, while Taiwanese dollar, Japanese yen and Malaysia ringgit were quite stable. As a result, the arithmetic mean returns, which were somewhat higher in Taiwan than in Korea in terms of local currency, are substantially higher when returns are measured in a common currency.

Two things that become immediately apparent from the data provided in Table 1 are that East Asian stocks in general did quite well in this time period and that the small firm effect seems to hold for each of the countries in the region. For the entire time period, the EW index outperformed the VW index in each of the countries, while their standard deviations are generally not significantly different. With the exception of Hong Kong, the

⁷All the data for this analysis was provided by PACAP.

standard deviations for the countries are dramatically higher in the second subperiod. This is particularly true for Taiwan, where the standard deviation of the VW index is three times higher in the second time period.⁸

Taiwan is clearly the outlier here in terms of its volatility, especially in the second time period. The standard deviation of Taiwan's monthly return is even higher than Thailand's standard deviation despite the fact that Thailand's market is much smaller and less diversified than Taiwan's market. Taiwan's return standard deviation is also larger than Hong Kong's return standard deviation despite the fact that Hong Kong's market is much less diversified and contains a large number of firms in the very volatile property and financial sectors.

The remainder of our analysis will focus on Korea and Taiwan, the two countries with the most similar economies and capital markets, yet with very different volatilities. Additional summary statistics for these countries are presented in Table 2. This table provides information for the two countries on the average debt/assets ratios, price/earnings ratios, returns, dividend yield, return on equity, trading turnover rate and the monthly volatility of their indices for each of the years in our sample.

The table reveals that the extreme volatility as well as turnover in Taiwan began in 1987. A similar shift appears to have also occurred in Korea around 1987, however, the shift is substantially less pronounced. The relation between volatility and turnover over the entire sample period is significantly positive for both countries with rank order correlations of 0.49 for Korea and 0.77 for Taiwan. We do not think it is possible, however, to determine the

⁸This difference is highly significant as indicated by an F ratio of 6.81. The F ratio is the squared ratio of two standard deviations, i.e. $(0.1586/0.0520)^2$.

direction of causality between volatility and turnover, and will not pursue this issue further.⁹ The correlation between the volatilities of the two markets are also very high with a rank order correlation of 0.65, suggesting that there is a common factor generating changes in volatility in the two countries.

The evidence in table 2 suggests that differences in the volatilities of the two countries as well as how they change over time are not related to their financial leverage ratios. The debt ratios measured by book values of debt and equity have been declining over time in both countries and have been consistently higher in Korea than in Taiwan. The leverage ratios in Korea seem to be very high relative to most other countries we are aware of, and given the high leverage ratios in Korea, their stock market volatility actually seems quite low. Indeed, after adjusting for leverage, the Korean market is no more volatile than the U.S. market, which is surprising given its smaller size and breadth.

Table 2 also reveals that dividend yields are somewhat higher in Korea. This implies that dividends that will be realized in the distant future contribute relatively more to the valuation of Taiwan stocks than they do to the valuation of Korean stocks. The higher volatility in Taiwan might therefore arise from the fact that dividends in the distant future are more difficult to predict than the dividends that will be realized over the next one to three years. Indeed, stocks with low dividend yields are generally more volatile than stocks with high dividend yields.

The seventh column of Table 2 reports the ratio of earnings (net income) to the book value of equity.¹⁰ These reported earnings numbers are substantially more volatile in Taiwan

⁹Price changes are likely to create turnover for a number of reasons. See Karpoff (1987) for a review of a number of arguments.

¹⁰Here we measure return on equity (ROE) by dividing net income by book value of equity instead of market value of equity to avoid the impact of the swing of stock prices on the measure of ROE. We also used the market value of equity to measure ROE but not report here. This is then the earnings yield, which is just the

than in Korea which is consistent with the higher return volatility in Taiwan. One possibility is that reported earnings are more volatile in Taiwan because operating leverage is higher in Taiwan. Given the higher labor costs, production in Taiwan is generally more capital intensive than in Korea, and as a result, the degree of operating leverage is higher in Taiwan. Labor rules will similarly affect volatility, since the treatment of labor as a fixed or variable cost depends on the difficulties associated with hiring and firing workers. If operating leverage is in fact higher in Taiwan, then we would expect Taiwan to have more volatile earnings.

It is also possible that the differences in earnings volatility reflect differences in accounting treatments rather than true differences in economic earnings. Taiwan is similar to Japan in that the earnings numbers disclosed in a firm's financial statements must be the same as those reported for tax purposes. Korea, however, is more like the U.S., where firms keep two sets of books, one for tax purposes and one to disclose to their shareholders. As a result, Taiwanese firms tend to minimize their earnings, so that they can minimize their taxes, while Korean firms tend to want to maximize their reported earnings so that they look good to their shareholders. This at least partially explains the lower Price/Earnings ratios in Korea. For similar reasons, Korean firms may also have a greater tendency to want to smooth their earnings, which would suggest that the less volatile earnings in Korea may not necessarily reflect less volatile fundamentals.

2. The Components of Volatility

In this section we decompose returns into a component due to what we will refer to as fundamentals about the firms and a component due to what we will refer to as investor

reciprocal of the P/E ratio. In fact, this measure produces even more volatile ROE for Taiwan.

tastes or sentiment. Market fundamentals relate to information about future dividends while investor sentiment relates to information about required rates of return. To put the latter component within the context of the noise trader stories of Delong, Shleifer, Summers and Waldmann (1990) one might think in terms of noise traders generating both volume and volatility because of fluctuations in the rates of return they require from their investments. They move into the market when they require a relatively low rate of return and move out of the market because their required rate of return increases. However, changing investor sentiment need not imply irrationality. Rates of return can change over time as a result of changing productivity and changing levels of wealth and risk aversion.

Our decomposition is related to a similar decomposition considered in Campbell (1991) and Campbell and Mei (1993). However, since our goal is to simply provide a framework and a bit of motivation for our empirical work, we have made a number of assumptions to improve tractability.

Consider, the constant growth model specified in the following equation:

$$P_{i,t} = \frac{D_{i,t+1}}{r_{i,t} - g_{i,t}} = \frac{D_{i,t} (1 + g_{i,t})}{r_{i,t} - g_{i,t}} \quad (1)$$

where $P_{i,t}$ is the current stock price for stock i , $D_{i,t}$ is the current dividend, $D_{i,t+1}$ is the expected dividend next period, $r_{i,t}$ is the required rate of return (or the expected return), and $g_{i,t}$ is the expected growth rate. Following Campbell, we construct a linear approximation of the above equation by defining the one-period log holding period return on stock i as,

$$h_{i,t+1} \equiv \log(P_{i,t+1} + D_{i,t+1}) - \log(P_{i,t}),$$

and then approximate the above equation using a first-order Taylor series expansion, as follows:

$$\begin{aligned}
h_{i,t+1} &\approx \bar{r}_i + \frac{(g_{i,t+1} - g_{i,t})}{\bar{r}_i} - \frac{(r_{i,t+1} - r_{i,t})}{\bar{r}_i(1 + \bar{r}_i)} + \frac{(r_{i,t} - \bar{r}_i)}{1 + \bar{r}_i} \\
&\equiv [\bar{r}_i + d_i(r_{i,t} - \bar{r}_i)] + b_i \Delta g_{i,t+1} - c_i \Delta r_{i,t+1}
\end{aligned} \tag{2}$$

where $\bar{r}_i$ is the mean required rate of return.

There are two stochastic terms in the above equation; a term representing changes in the discount rate and a term representing changes in the expected growth rate in dividends. To simplify interpretation we assume that all stocks follow a one-factor model and that all stocks have a beta of one. Given these assumptions, we have that $\Delta r_{i,t+1} = \Delta r_{m,t+1}$ and $\text{Cov}(\Delta r_{i,t+1}, \Delta r_{j,t+1}) = \text{Var}(\Delta r_{m,t+1})$. What makes the above decomposition interesting is that while both economy-wide and firm-specific factors affect the changes in the growth rate of future dividends, changes in the discount rate is determined exclusively by economy-wide factors.

The volatility of the log realized return conditional on Φ_t can be derived from equation (2) as,

$$\begin{aligned}
\text{Var}(h_{i,t+1} | \Phi_t) &= b_i^2 \text{Var}(\Delta g_{i,t+1}) + c_i^2 \text{Var}(\Delta r_{m,t+1}) \\
&\quad - 2b_i c_i \text{Cov}(\Delta g_{i,t+1}, \Delta r_{m,t+1})
\end{aligned} \tag{3}$$

This equation expresses the variance of returns as a function of the variance of changes in the expected dividend growth rate, which is determined by changes in the fundamentals of the firm, and as a function of the variance of changes in the discount rate, which is determined by changes in risk preferences and changes in the risk-free rate. The decomposition of the variance into these two components is important for two reasons. The first is that changes in the discount rate is driven by macro-factors, so that discount rate changes should be highly correlated across stocks in a given market. However, changes in the expected growth rate of future dividends are generated by a firm-specific as well as an economy-wide factor so this

factor should be less correlated across stocks. The second reason is that under the assumption of rational expectations, changes in expected cash flows must be serially uncorrelated. Thus, evidence of serial correlation must be regarded as evidence of changing discount rates.

Some of the empirical tests in the following sections provide evidence on the relative extent to which volatility is generated by these two factors. We do this by analyzing correlations as well as serial correlations between portfolio returns both within the countries and across countries. The following equation expresses the correlation between two portfolios of stocks from the same country under the simplifying assumption that $\Delta g_{i,t+1}$ and $\Delta r_{m,t+1}$ are uncorrelated,¹¹ and that the two portfolios have the same parameters (b , c) as well as the same value of $\text{Var}(\Delta g_{i,t+1})$. We then have

$$\begin{aligned} \rho_{ij} &= \frac{\text{Cov}(h_i, h_j)}{\sqrt{\text{Var}(h_i) \text{Var}(h_j)}} \\ &= \frac{c^2 \text{Var}(\Delta r_{m,t+1}) + b^2 \rho_{g_i, g_j} \text{Var}(\Delta g_{t+1})}{c^2 \text{Var}(\Delta r_{m,t+1}) + b^2 \text{Var}(\Delta g_{t+1})} \end{aligned} \quad (4)$$

where ρ_{g_i, g_j} is the correlation coefficient between the changes in the growth rates of firms i and j . This equation implies that if discount rates become more volatile, correlations between portfolios within the country will increase since $\partial \rho_{ij} / \partial \text{Var}(\Delta r_{m,t+1}) > 0$ when $0 < \rho_{g_i, g_j} < 1$. This also implies that the volatility of the market portfolio will increase.

Since the Korean and Taiwanese markets were generally closed to foreigners during our sample period it is likely that the required rates of return in the two markets move together only imperfectly which would have the effect of lowering the correlation between Korean and Taiwanese portfolios. To see this, again assume that all the parameters are the

¹¹This may be a strong assumption. However, the results will not change for a small positive correlation. A small positive correlation is consistent with overreaction arguments. If investors become overoptimistic when fundamentals improve (a plausible story) and pessimistic when fundamentals deteriorate, there will be a positive correlation.

same for portfolio i and j and that the variances for both markets are the same. We can express the correlation between the returns of two portfolios from different countries as,

$$\begin{aligned}\rho_{ij} &= \frac{\text{Cov}(h_i, h_j)}{\sqrt{\text{Var}(h_i) \text{Var}(h_j)}} \\ &= \frac{c^2 \rho_{m_d, m_f} \text{Var}(\Delta r_{m, t+1}) + b^2 \rho_{g_i, g_j} \text{Var}(\Delta g_{t+1})}{c^2 \text{Var}(\Delta r_{m, t+1}) + b^2 \text{Var}(\Delta g_{t+1})}\end{aligned}\quad (5)$$

where ρ_{m_d, m_f} is the correlation coefficient between the returns on the domestic and the foreign markets. Equation (5) differs from equation (4) by the fact that $\rho_{m_d, m_f} < 1$. If ρ_{m_d, m_f} is sufficiently low, then increases in the volatility in the discount rate in the two countries will have the effect of lowering the correlation between portfolios of Korean and Taiwanese stocks.

The serial correlation for portfolio i can then be expressed as follows:¹²

$$\begin{aligned}\rho_{i, t, t+1} &= \frac{\text{Cov}(h_{i, t}, h_{i, t+1})}{\text{Var}(h_{i, t})} \\ &= \frac{-b_i c_i [\rho_{g_t, r_{t+1}} + \rho_{g_{t+1}, r_t}] + c_i^2 \rho_{r_t, t+1}}{\text{Var}(h_{i, t})}\end{aligned}\quad (6)$$

where $\rho_{r_{t+1}}$, ρ_{g_{t+1}, r_t} , and ρ_{g_{t+1}, r_t} are the serial correlation for changes in the discount rate and cross serial correlations between changes in the dividend growth rate and changes in the discount rate. Notice that the serial correlation can be positive or negative depending on the signs and magnitudes of $\rho_{r_{t+1}}$, ρ_{g_{t+1}, r_t} , and ρ_{g_{t+1}, r_t} . A positive serial correlation for changes in the discount rate contributes to a positive serial correlation in stock returns. On the other hand, a positive cross serial correlation between changes in the dividend growth rate and changes in the discount rate contributes to a negative serial correlation in stock returns.

¹²Note that given the assumption of rational expectations, changes in the expected growth rates in dividend must be serially uncorrelated.

3. Speculation and Excess Volatility

This section presents estimates of univariate regression tests that examine the extent to which returns are serially dependent. As we discussed in the last section, evidence of serial dependence implies that part of the volatility of returns can be due to changing discount rates. Indeed, a growing literature suggests, based on the kind of univariate tests used below, that a large fraction of the U.S. market's volatility is due to changes in required risk premiums rather than just changes in information about future cash flows.¹³ Given the relative isolation of the Korean and Taiwanese markets, one might expect that them to be subject to greater month to month changes in the discount rate than in larger more open markets.

Offsetting the potential for increased volatility caused by the isolation of the Korean and Taiwanese markets is the strong governments in these countries that tend to act to reduce volatility. The governments do this through their influence on taxes on capital gains and dividends, margin requirements, price limits, interest rates and trading costs. The Taiwanese and Korean governments are probably both relatively active in using these policy tools to affect stock prices. However, in addition, the Korea government more directly affects market prices by putting pressure on the large institutional investors to buy and sell to either support a falling market or to cool off what they consider to be an overheated market. The Korean government also tries to dampen volatility by expanding or restricting the supply of shares by encouraging or discouraging initial public offerings (IPOs) during upswings and downswings (see Loughran, Ritter, and Rydqvist (1993)).

If required risk premiums are mean-reverting, then market returns will also tend to be

¹³See for example Shiller (1981), Campbell and Shiller (1989), Poterba and Summers (1988) and Fama and French (1988).

mean-reverting. In other words, part of the volatility is due to temporary price changes that are later reversed. This implies that over long horizons, returns should exhibit negative serial correlation. However, over short horizons returns could exhibit positive serial correlation, caused for example by noise traders following what DSSW refer to as positive feedback trading rules (i.e., buying stocks following price run-ups). Government stabilization efforts can lead to positive serial correlation in short horizons as well as in long horizons.

Jegadeesh (1991) presents a very simple and yet powerful test that estimates the extent to which market prices are mean-reverting. The regression, expressed below, estimates the relation between monthly returns and lagged returns aggregated over various intervals depending on the alternative hypothesis.

$$\text{Model 1: } R_t = \alpha_K + \beta_K \sum_{i=1}^K R_{t-i} + \varepsilon_{K,t} \quad (8)$$

where K is the aggregation interval in months for the independent variable. Given that returns may be expected to behave differently in January, we also considered the alternative specification given below:

$$\text{Model 2: } R_t = \alpha_K + \alpha_{K,J}D_J + \beta_K \sum_{i=1}^K R_{t-i} + \beta_{K,J}D_J \sum_{i=1}^K R_{t-i} + \varepsilon_{K,t} \quad (9)$$

where D_J is the January dummy variable ($D_J = 1$ when $t = \text{January}$, and 0 otherwise).

Under the hypothesis that prices are mean reverting, the coefficients β_K and $\beta_{K,J}$ are negative. If one believes that price reversions occur very quickly, then the aggregation interval should be very short. In this case, the mean-reversion will have a relatively strong effect on monthly volatilities. However, in the case where price reversions occur very slowly, risk premiums also change slowly and hence contribute very little to monthly volatilities.

Equations (8) and (9) are estimated for both the whole period (1978-1991) and the

second subperiod (1985 - 1991). Since we need lags of 72 months, it is not possible to estimate equations (8) and (9) for the 1978-1984 subperiod. Tables 3a presents estimates of these regressions for the entire 1978-1991 period using aggregation intervals of $K = 1, 2, 3, 6, 12, 24, 36, 48, 60,$ and 72 months. The estimated coefficients are adjusted for small sample bias by adding to the OLS estimates the factor $1/(N-K)$ where N is the number of time-series observations in the sample period. The White t -statistics are presented in parentheses.

In contrast to the estimates provided by Jegadeesh for the U.S. and U.K. markets, our coefficient estimates are generally positive suggesting that the Taiwan and Korean markets may be underreacting rather than overreacting to information. The coefficients are large in magnitude, and for the case of Korea, are statistically significant for the 12 and 24 month aggregation intervals. For example, using the Korean EW index, the coefficient for the regression with the 12 month aggregation interval is .058. This implies that the expected monthly return on the Korean EW index, conditioned on a 20% return over the past 12 months, would be about 1.16% greater than it would be conditioned on a 0% return over the past 12 months.

Since the Taiwanese index does not look that much different than the Korean index in this respect one cannot conclude from this data that changing risk premiums explain the higher volatility in Taiwan. In addition, the regressions in Table 3b which include only the 1985-1991 subperiod are virtually the same as those for the whole period which is inconsistent with the view that the higher volatility in Taiwan during the second period can be attributable to increased mood swings or large changes in required rates of return during this time period.

4. The Covariance Structure of Industry Portfolios

In this section we examine the return characteristics of industry portfolios in the two countries. Examining these portfolios provides a number of insights about the determinants of volatility in these markets. First, the portfolios allow us to test whether the industrial structure of the Taiwanese and Korean markets explain the higher volatility observed in Taiwan. The tests along these lines are motivated by Roll (1992), who suggests that industrial composition can explain a large portion of the differences in volatility across countries. Roll explores this issue only indirectly since he limits his analysis to the returns of market indexes. We can get a more accurate assessment of the effect of industry composition on the volatilities of the Korean and Taiwanese markets by examining the returns of individual industry portfolios in the two countries. The covariance structure of these industry portfolios also provide additional evidence about the degree to which changes in required rates of return create volatility.

Our analysis examines the seven industries that have adequate representation on both the Korean and Taiwanese exchanges. The requirement for picking the industry is that there are at least seven companies in the same industry with the financial statements available for the period of 1981 to 1991.¹⁴ These industries include Textiles, Plastics and Rubbers, Foods and Beverage, Pulp and Paper, Nonmetallic, Machinery, and Construction. For each of these industries, there were more firms listed in Korea than in Taiwan indicating that industry portfolios, for the two countries, containing all the available firms would be somewhat more diversified, and perhaps for this reason, less volatile in Korea. To avoid this problem the industry portfolios are constructed to have the same number of firms selected to be of

¹⁴Although the survival requirement for the industry portfolios can bias the mean returns of the portfolios it should not significantly bias the standard deviations of the portfolio returns or the correlations between the returns.

approximately the same size in the two countries.

Table 4 contains the standard deviations and the average correlations for these two sets of seven industry portfolios. The standard deviations reported in this table are almost uniformly higher for the Taiwanese firms, especially in the second half of the sample period. In addition, the average correlations between the industry portfolios are substantially higher in Taiwan. What this means is that a higher proportion of the portfolio return variances in Taiwan are due to the variance of a common factor. The higher correlations in combination with the higher standard deviation also implies that an equally-weighted portfolio of these industry portfolios is more volatile for Taiwan than Korea. Hence, the evidence presented in this table clearly indicate that the greater volatility of the Taiwan index is not *solely* caused by the differences in the industrial compositions of the two economies.

Roll's method for assessing the effect of industrial structure on index returns requires that industry factors are an important determinant of international returns. For example, the analysis assumes that the returns of a portfolio of chemical stocks in France are highly correlated with the returns of a portfolio of chemical stocks in Germany. Table 4, Panel D, examines these correlations for the seven common Taiwan and Korean industries. We find that for the entire sample period the returns on these industry portfolios are positively correlated, but the correlation is quite low. In fact, in most cases, the returns of an industry portfolio in Korea (Taiwan) is no more correlated with the returns of the corresponding industry portfolio in Taiwan (Korea) than it is with the Taiwanese (Korean) market index. What this suggests is that there seems to be a common factor generating the returns in the two countries, and this single factor accounts for almost all of the correlation between the

industry portfolios in the two countries.¹⁵ Apart from this, there seems to be no industry factors that are common between Korea and Taiwan.

An analysis of the returns in the two subperiods reveals that the correlations between Taiwanese and Korean returns occur only in the first subperiod. In the second subperiod, where the volatilities are substantially higher,¹⁶ the correlations between the returns in the two countries are indistinguishable from zero. In unreported regressions we examined the correlation between these markets including leads and lags. We found that in the second subperiod, where there is almost no contemporaneous relation between the Korean and Taiwanese markets, the Taiwanese market returns respond to Korean market returns with one and two month lags. There is no evidence, however, of the Korean market reacting with a lag to the Taiwanese market or of the Taiwanese market reacting with a lag to Korean stock returns in the first subperiod where there is a significant contemporaneous relation.¹⁷

The within country correlations also change across these time periods. For both countries, these correlations are much higher in the second subperiod, indicating that in the 1985-1991 subperiod, industry portfolios tended to move together much more. What this means is that from the first to the second period, the volatilities of the common factors in both Korea and Taiwan increased more than the volatilities of the individual industry portfolios.

In the second time period, the correlation between the returns of the industry portfolios in Taiwan was extremely high, averaging over 90%, which certainly contributes significantly

¹⁵This result is closely related to Costello's (1993) finding that productivity growth is highly correlated across industries within a country but much less correlated across countries for any specific industry.

¹⁶The F ratio tests indicate that variances are significantly higher in the second subperiods for all seven industries in Taiwan, but only three industries in Korea.

¹⁷We also examined the lead-lag relations between the seven Taiwanese and Korean industry portfolio returns. The results are similar to those found in the market as a whole.

to the high volatility of the Taiwan market index during this time period. However, we cannot determine with any degree of confidence whether this increase in volatility is related to fundamentals or whether its caused by month to month fluctuations in required rates of return. As shown in section 2, the observed increase in within market correlations and decreases in across market correlations in the second period is consistent with fluctuations in required rates of return.

5. Volatility and Fundamentals

As we earlier showed in Table 2, earnings volatility in Taiwan is substantially higher than in Korea, suggesting that operating leverage may be higher in Taiwan. Specifically, the standard deviation of aggregate Net Income/Equity is 5.56% in Taiwan, while it is 1.52% in Korea. From this evidence one might conclude that the Taiwan market is much more volatile than the Korean market since Taiwanese earnings are much less predictable. However, this explanation assumes that the earnings numbers reported in each country provide accurate as well as equivalent information about the values of their respective stocks. As we mentioned earlier, Korea and Taiwan have very different earnings conventions so this assumption is likely to be violated. Korean firms may thus have less volatile earnings because they make accounting choices that allow them to smooth their earnings more than Taiwanese firms.

If Korean firms do in fact smooth their earnings, then we would expect to observe some persistence in earnings changes in Korea. Large increases or decreases in actual economic earnings would result in only a partial adjustment to accounting earnings with the complete adjustments occurring over the next few years. Because of this persistence, stock price responses to equivalent earnings increases in Korea (if they do smooth) should be much greater than the corresponding responses in Taiwan (assuming they do not smooth). In the

next subsections we estimate both time-series and cross-sectional models to evaluate how stock prices react to earnings in Korea and Taiwan.

5.1. The Time-Series Relation Between Earnings and Stock Returns

Table 5 presents estimates of univariate time-series regressions of the yearly returns of the VW and EW indices on various earnings ratios for both Korea and Taiwan. The three earnings ratios we examine are operating income/total assets, earnings/book value of assets and earnings/lagged market value of assets. If accounting earnings reflect 'true' economic earnings and follow a random walk, then the last specification is probably the best.¹⁸ If, however, earnings are smoothed so that changes exhibit some persistence then small increases in reported earnings are likely to lead to large stock price increases. This would then result in an expected drop in the ratio of earnings to the lagged market value of equity the following year, creating a bias in the above mentioned regression. In this case, it might be more appropriate to use operating income in the numerator and the book value of assets as the denominator.

The results of these regressions indicate that for both countries, stock returns are more highly correlated with earnings than with operating income.¹⁹ However, when the VW index is used as the dependent variable, the relations between earnings and market returns are all insignificant for Korea. In all cases, the adjusted R-squares for the Taiwanese regressions are higher than they are for their Korean counterparts. For Taiwan, the adjusted R-squares of the regressions are higher when the market value denominator is used. For example, the adjusted

¹⁸See Ohlson (1992) for a discussion of the relation between earnings and stock returns.

¹⁹This might be due to the fact that earnings include profits due to realized gains on properties and stock. Perhaps, in years in which stock prices went up, these realized gains were higher increasing reported earnings. Hence, the direction of causality from earnings to stock prices may be partially reversed.

R-square for the Taiwan regression of stock returns on the ratio of earnings to the lagged market value of equity is 62.73%. In contrast, for Korea, the adjusted R-squares are higher when the book value denominator is used. In fact, the regressions are completely insignificant when the market value denominator is used. This evidence is consistent with the Korean earnings numbers being smoothed.²⁰

Of course, given the small sample size, it is difficult to make strong conclusions based on this evidence. However, given that a large portion of the year to year volatility in Taiwan can be explained by aggregate earnings fluctuations, it does not look like a majority of the year to year fluctuations in stock prices are unrelated to fundamentals. We are even less confident about our inferences regarding Korea. Apparently, the Koreans smooth their earnings much more than the Taiwanese and probably because of this, their reported earnings are less tied to actual economic earnings. As a result, it is more difficult to assess the extent to which stock return volatility is determined by fundamentals in Korea.²¹

5.2. The Cross-sectional Relation Between Earnings and Stock Returns

In this subsection we continue our analysis of earnings quality in Korea and Taiwan by examining the cross-sectional relation between earnings and stock returns. As we mentioned earlier, if the Taiwanese earnings are more volatile because they include extraneous noise or if the Korean earnings have been substantially smoothed, then we expect stronger

²⁰The coefficient estimate on the earnings/book value of assets variable is higher in the Korean regression than in the Taiwanese regression, which is also consistent with the Korean numbers being smoothed. However, given our small sample, although this difference is large, it is not statistically significant.

²¹In unreported regressions we examined the time-series relations between the Korean and Taiwanese monthly returns and macro-variables in the two economies. Specifically, we looked at interest rates, money supply changes, inflation rates, GNP growth, and exchange rate changes. In Taiwan, inflation exhibits a strong positive relation with stock returns and in Korea exchange rate changes are strongly related to stock returns. The other variables were not statistically significant.

stock price responses to earnings in Korea. Our analysis in this section is closely related to a number of papers in the accounting literature that examine stock price responses to accounting earnings (see Lev (1989) for a review of this literature). Following this literature, we estimate the following cross-sectional regression for each calendar year:

$$R_{it} = \alpha_t + \beta_t E/P_{it} + \varepsilon_{it} \quad (10)$$

where R_{it} is the yearly stock return and E/P_{it} is earning yield and is defined as the net income divided by lagged stock price.

The estimates of these regressions for the individual years are presented in Table 6. Note, however, that because the stock returns are likely to be correlated, the reported t-statistics for the individual year regressions are probably substantially overstated. At the bottom of the table we provide the average value of the regression coefficients across years. The t-statistics provided for these averaged coefficients are probably more reliable than the cross-sectional t-statistics given in the individual year cross-sectional regressions. (See Fama and MacBeth (1973) for a detailed discussion.) These t-statistics are calculated from the time-series standard deviations of the coefficients which are uncorrelated under the assumption that stock returns are serially uncorrelated.

The results presented in this table indicate that the earnings response coefficient (β) as well as the regression adjusted R-squares are much higher on average in Taiwan. These results are inconsistent with the hypothesis that earnings reported in Korea have been smoothed more (or include less noise) than reported earnings in Taiwan.

The earnings response coefficients in Taiwan turn out to be very high on average, exceeding those coefficients estimated in each of the countries examined by Alford, et. al. (1993). This evidence is inconsistent with the conventional view that Taiwanese earnings are

extremely unreliable and generally are not taken seriously by security analysts evaluating Taiwanese stocks. However, our evidence does provide an explanation for why that view may be currently so prevalent. During 1987, 1989 and 1990, when the Taiwanese market was extremely volatile (increasing more than 90% in the first five months of 1989 and then falling more than 70% through the end of September 1990), we find only a weak cross-sectional relation between earnings and stock return variation (in 1990 the correlation is essentially zero).²² In 1991, the last year in our sample, we again find a positive cross-sectional relation between reported earnings and stock returns in Taiwan.²³

6. Conclusion

The Taiwanese stock market has been extremely volatile, especially since 1986, leading many to believe that this market is driven by excessive speculation and irrationality. Lending support to this view is the extremely large volume of trade on the Taiwanese exchange which for the most part comes from relatively unsophisticated individual investors. A comparison with Korea also supports this view of excessive speculation and volatility in Taiwan. The Korean market is very similar to the Taiwanese market in many respects. However, the Korean market, which has considerably less trading volume, has experienced much less volatility.

This paper finds only mixed support for the idea that the volatility in Taiwan is related to excess speculation. We do not, for example, detect any evidence of negative serial

²²We initially conjectured that a large fraction of the return variance in Taiwan may be due to the 1989 and 1990 time period when the market appeared to not be reacting to fundamentals (i.e. earnings). However, we find that the standard deviation of the Taiwan market return is still very high in years where the cross-sectional regression suggests a high correlation between earnings and returns.

²³We replicated the results in Table 5 using operating income instead of net income. The results were not qualitatively different.

correlation in Taiwanese stock returns, which would have been a clear indicator of excess volatility. The short sample period and low power of autocorrelation tests do not allow us to rule out the existence of a speculative bubble that peaked in early 1990. In addition, the decrease in the monthly correlation between Korean and Taiwanese stock returns, corresponding to the increased volatility, does suggest that part of the increased volatility may not have been related to fundamentals.

We find that Taiwanese stock returns are much more correlated with their earnings than are Korean returns both over time and cross-sectionally, which would be inconsistent with the notion that Taiwanese stocks are less tied to fundamentals. Important exceptions to this relation occurred during 1987 when the market more than tripled in value before collapsing during the October crash, 1989 when the market increased 90% in a 5-month period, and 1990 when the Taiwanese market fell more than 70% over a nine month period. During those years the cross-sectional linkage between earnings and stock returns almost completely disappeared.

It may be impossible to conclusively establish whether a particular market is either too volatile or not volatile enough, especially with such a short time-series. Indeed, there are dozens of papers that have analyzed the volatility of the U.S. market using much longer time-series and the results are still being debated. Perhaps, by looking at a number of different markets, at different stages of development, we will increase our understanding of the determinants of stock return volatility.

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Table 1a

Monthly Arithmetic Mean Returns, Standard Deviations and Capitalization of Stock Indices

Time Period	Korea		Taiwan		Japan		Thailand		Hong Kong*		Malaysia	
	EW	VW	EW	VW	EW	VW	EW	VW	EW	VW	EW	VW
<i>Panel A: Monthly Mean Returns</i>												
1978-1991	2.07%	1.57%	2.79%	2.35%	1.54%	1.05%	2.35%	1.80%	2.70%	1.91%	2.05%	1.62%
1978-1984	1.80%	1.07%	1.22%	1.27%	1.51%	1.23%	0.80%	0.69%	2.14%	1.46%	2.75%	1.96%
1985-1991	2.34%	2.07%	4.35%	3.43%	1.57%	0.87%	3.90%	2.92%	3.08%	2.23%	1.35%	1.29%
<i>Panel B: Monthly Standard Deviations</i>												
1978-1991	6.72%	6.90%	12.72%	11.82%	5.08%	4.94%	7.68%	7.24%	9.34%	9.15%	8.18%	7.83%
1978-1984	5.16%	5.75%	6.35%	5.20%	2.86%	3.05%	5.09%	4.72%	9.58%	10.55%	7.70%	7.67%
1985-1991	8.01%	7.89%	16.74%	15.86%	6.61%	6.30%	9.37%	8.99%	9.21%	8.09%	8.62%	8.01%
<i>Panel C: Capitalization (U.S. dollars)</i>												
Dec. 1993	\$130		\$190									
Dec. 1991	\$ 96		\$121		\$2,980		\$35		\$148		\$58	

*Note: Due to data availability, the whole period for Hong Kong is from February 1980 - December 1991, while the first subperiod is from February 1980 to December 1984.

Table 1b

Monthly Arithmetic Mean Returns, and Standard Deviations:
in terms of U.S. Dollars*

Time Period	Korea*		Taiwan		Japan		Thailand*		Hong Kong*		Malaysia	
	EW	VW	EW	VW	EW	VW	EW	VW	EW	VW	EW	VW
<i>Panel A: Monthly Mean Returns</i>												
1978-1991	2.04%	1.59%	3.02%	2.58%	1.93%	1.44%	2.51%	1.97%	2.37%	1.58%	1.97%	1.54%
	[2.22%]	[1.77%]					[2.66%]	[2.12%]				
1978-1984	1.44%	0.75%	1.17%	1.23%	1.46%	1.18%	0.46%	0.54%	1.33%	0.65%	2.72%	1.93%
	[2.05%]	[1.35%]					[0.92%]	[1.01%]				
1985-1991	2.44%	2.18%	4.86%	3.94%	2.40%	1.70%	3.98%	2.99%	3.09%	2.23%	1.21%	1.15%
	[2.34%]	[2.07%]					[3.90%]	[2.91%]				
<i>Panel B: Monthly Standard Deviations</i>												
1978-1991	7.21%	7.24%	12.93%	12.04%	6.57%	6.57%	7.80%	7.41%	9.85%	9.80%	8.46%	8.15%
	[6.99%]	[7.04%]					[7.67%]	[7.32%]				
1978-1984	5.36%	5.74%	6.57%	5.45%	5.52%	5.49%	4.33%	4.21%	10.69%	11.81%	8.22%	8.28%
	[5.27%]	[5.64%]					[3.73%]	[3.78%]				
1985-1991	8.27%	8.12%	16.92%	16.06%	7.48%	7.52%	9.28%	8.92%	9.21%	8.10%	8.67%	8.05%
	[8.01%]	[7.89%]					[9.37%]	[8.99%]				

*Note: Due to data availability, the whole period for Korea, Thailand, and Hong Kong is from 1980 - 1991, while the first subperiod is from 1980 to 1984. The numbers in brackets are the statistics based on the local currency return series.

Table 2

Debt/Asset Ratio, P/E Ratio, Total Yearly Returns,
Dividend Yield and Net Income on Equity of Industry Firms

Panel A: All Firms: Korea

Year	#Firm	Total Debt/TA	P/E	Return	Dividend Yield	ROE	Trading Turnover	Std. Dev. (Monthly)
1981	256	0.81	7.79	48.95%	11.92%	6.34%	83.89%	8.09%
1982	259	0.81	5.98	8.40%	8.28%	7.77%	61.53%	3.99%
1983	260	0.80	4.19	1.78%	5.43%	9.88%	50.58%	4.84%
1984	267	0.79	8.10	22.91%	4.93%	6.48%	61.21%	2.78%
1985	286	0.81	14.28	23.23%	5.66%	4.69%	55.55%	3.47%
1986	296	0.80	12.90	70.78%	4.41%	7.83%	79.44%	7.38%
1987	313	0.79	17.11	83.21%	3.15%	8.61%	74.84%	9.64%
1988	398	0.73	21.36	71.42%	2.29%	8.64%	82.75%	8.13%
1989	505	0.67	21.27	-6.03%	1.50%	7.07%	114.27%	5.71%
1990	571	0.70	19.03	-21.63%	1.63%	5.87%	67.23%	9.69%
1991	568	0.72	14.88	-10.02%	1.74%	5.88%	83.65%	7.40%

Panel B: All Firms: Taiwan

Year	#Firm	Total Debt/TA	P/E	Return	Dividend Yield	ROE	Trading Turnover	Std. Dev. (Monthly)
1978	80	0.65	14.22	21.79%	3.31%	10.19%	293.60%	7.68%
1979	88	0.65	9.44	3.77%	3.41%	14.06%	126.78%	7.66%
1980	93	0.64	11.92	16.69%	4.00%	9.82%	107.84%	5.55%
1981	99	0.62	26.93	2.56%	3.73%	3.76%	103.07%	3.57%
1982	105	0.61	-127.22	-14.15%	4.71%	-0.63%	67.64%	3.33%
1983	106	0.61	26.12	63.77%	3.12%	4.67%	142.79%	7.98%
1984	105	0.59	13.68	22.04%	2.49%	10.05%	95.40%	4.85%
1985	100	0.56	19.39	5.26%	2.90%	6.54%	68.09%	5.91%
1986	111	0.51	14.15	27.07%	2.06%	10.09%	162.11%	3.79%
1987	122	0.49	14.50	143.84%	1.85%	15.92%	267.47%	25.72%
1988	143	0.45	20.48	131.79%	1.20%	18.07%	332.63%	18.27%
1989	159	0.42	43.47	76.87%	0.82%	14.35%	590.13%	9.90%
1990	176	0.44	33.25	-53.79%	0.95%	7.37%	506.04%	22.80%
1991	185	0.43	31.01	0.56%	0.95%	9.04%	321.90%	11.46%

Notes:

Debt/TA: Total debt/Total assets, both measured at the end of the year.

P/E: Price/Earnings ratio, price measured at the end of the year, while earnings measured during the year.

Total Return: total holding period return including dividend.

Dividend Yield: dividend divided by price.

ROE: Net income divided by book value of equity at the end of the year.

Table 3a

**Regressions of 1-Month Returns against Lagged Multiperiod
Returns: Equally Weighted and Value-Weighted Indices of
Korea and Taiwan Stocks: 1978-1991**

The regression model below is fitted using monthly returns on the equally weighted and value-weighted indices of stocks on the Taiwan and Korea Stock Exchanges.

$$\text{Model 1: } R_t = \alpha_K + \beta_K \sum_{i=1}^K R_{t-i} + \varepsilon_{K,t}$$

$$\text{Model 2: } R_t = \alpha_K + \alpha_{K,J}D_J + \beta_K \sum_{i=1}^K R_{t-i} + \beta_{K,J}D_J \sum_{i=1}^K R_{t-i} + \varepsilon_{K,t}$$

where D_J is the January dummy variable ($D_J = 1$ when $t = \text{January}$, and 0 otherwise), and K is the aggregation interval in months for the independent variable. The estimates of the slope coefficients are reported below. They are adjusted for small sample bias by adding to the OLS estimates the factor $1/(N-K)$ where N is the number of time-series observations in the sample period. The White t -statistics are presented in parentheses. The b is the average of the corresponding coefficients, while the R^2_{adj} is the average of the adjusted R^2 .

Panel A: Equally Weighted Index												
K	1	2	3	6	12	24	36	48	60	72	b	R^2_{adj}
Korea Stocks												
All	0.077 (0.64)	0.084 (0.92)	0.049 (0.73)	0.036 (1.01)	0.058 (2.06)	0.036 (2.59)	0.024 (2.12)	0.014 (1.38)	0.009 (0.89)	0.019 (1.83)	0.046	0.006
β_K	0.058 (0.48)	0.077 (0.83)	0.060 (0.85)	0.040 (1.10)	0.046 (1.66)	0.032 (2.33)	0.021 (1.89)	0.011 (1.05)	0.007 (0.69)	0.017 (1.63)	0.037	0.033
$\beta_{K,J}$	0.322 (0.64)	0.027 (0.06)	-0.264 (-1.43)	0.179 (0.86)	0.150 (2.23)	0.047 (0.73)	0.027 (0.48)	0.037 (0.89)	0.020 (0.45)	0.019 (0.51)	0.056	
Taiwan Stocks												
All	0.050 (0.34)	0.028 (0.29)	0.023 (0.30)	0.040 (0.79)	0.032 (1.12)	0.020 (1.27)	0.013 (1.02)	0.011 (1.04)	0.009 (0.88)	0.016 (1.62)	0.024	-0.003
β_K	0.080 (0.52)	0.043 (0.42)	0.049 (0.56)	0.040 (0.78)	0.022 (0.74)	0.016 (0.97)	0.010 (0.74)	0.010 (0.86)	0.008 (0.76)	0.016 (1.49)	0.029	-0.000
$\beta_{K,J}$	-0.466 (-1.69)	-0.247 (-1.42)	-0.209 (-1.95)	0.255 (2.49)	0.133 (3.11)	0.053 (1.80)	0.039 (1.49)	0.020 (0.73)	0.016 (0.54)	0.016 (1.52)	-0.039	

Table 3a - Continued

Panel B: Value-Weighted Index												
K	1	2	3	6	12	24	36	48	60	72	b	R ² _{adj}
Korea Stocks												
All	-0.048 (-0.60)	0.044 (0.62)	0.010 (0.19)	0.033 (0.91)	0.041 (1.69)	0.029 (2.04)	0.017 (1.49)	0.010 (0.94)	0.008 (0.72)	0.014 (1.49)	0.016	-0.000
β_K	-0.066 (-0.84)	0.041 (0.56)	0.018 (0.32)	0.031 (0.84)	0.032 (1.29)	0.025 (1.82)	0.015 (1.33)	0.007 (0.66)	0.004 (0.38)	0.014 (1.40)	0.012	0.009
β_{KJ}	0.216 (0.47)	-0.174 (-0.70)	-0.154 (1.023)	0.148 (0.80)	0.129 (1.50)	0.039 (0.58)	0.018 (0.28)	0.032 (0.67)	0.051 (1.58)	-0.002 (-0.06)	0.030	
Taiwan Stocks												
All	0.128 (0.77)	0.060 (0.50)	0.033 (0.37)	0.046 (0.77)	0.039 (1.15)	0.021 (1.26)	0.009 (0.72)	0.008 (0.71)	0.008 (0.81)	0.014 (1.50)	0.037	0.000
β_K	0.154 (0.90)	0.080 (0.64)	0.064 (0.63)	0.040 (0.65)	0.029 (0.81)	0.016 (0.87)	0.010 (0.86)	-0.006 (-0.51)	0.008 (0.72)	0.011 (1.13)	0.041	0.009
β_{KJ}	-0.589 (-2.36)	-0.543 (-2.79)	-0.292 (-0.54)	0.228 (2.94)	0.147 (3.34)	0.085 (2.59)	0.078 (4.21)	0.054 (1.70)	0.004 (0.11)	0.046 (1.61)	-0.078	

Table 3b

**Regressions of 1-Month Returns against Lagged Multiperiod
Returns: Equally Weighted and Value-Weighted Indices of
Korea and Taiwan Stocks: 1985-1991**

The regression model below is fitted using monthly returns on the equally weighted and value-weighted indices of stocks on the Taiwan and Korea Stock Exchanges.

$$\text{Model 1: } R_t = \alpha_K + \beta_K \sum_{i=1}^K R_{t-i} + \varepsilon_{K,t}$$

$$\text{Model 2: } R_t = \alpha_K + \alpha_{K,J} D_J + \beta_K \sum_{i=1}^K R_{t-i} + \beta_{K,J} D_J \sum_{i=1}^K R_{t-i} + \varepsilon_{K,t}$$

where D_J is the January dummy variable ($D_J = 1$ when $t = \text{January}$, and 0 otherwise), and K is the aggregation interval in months for the independent variable. The estimates of the slope coefficients are reported below. They are adjusted for small sample bias by adding to the OLS estimates the factor $1/(N-K)$ where N is the number of time-series observations in the sample period. The White t -statistics are presented in parentheses. The b is the average of the corresponding coefficients, while the R^2_{adj} is the average of the adjusted R^2 .

Panel A: Equally Weighted Index												
K	1	2	3	6	12	24	36	48	60	72	b	R^2_{adj}
Korea Stocks												
All	0.162 (0.97)	0.142 (1.20)	0.072 (0.85)	0.067 (1.58)	0.075 (2.50)	0.046 (3.24)	0.031 (2.59)	0.016 (1.37)	-0.003 (-0.22)	-0.004 (-0.32)	0.053	0.018
β_K	0.131 (0.79)	0.129 (1.07)	0.080 (0.92)	0.066 (1.57)	0.060 (2.02)	0.039 (2.84)	0.027 (2.26)	0.015 (1.22)	-0.003 (-0.21)	-0.006 (-0.47)	0.054	0.040
$\beta_{K,J}$	0.745 (1.20)	0.266 (0.48)	-0.375 (-1.59)	0.517 (1.30)	0.203 (3.71)	0.091 (1.44)	0.060 (0.88)	0.029 (0.50)	0.013 (0.38)	0.044 (1.04)	0.159	
Taiwan Stocks												
All	0.017 (0.10)	0.014 (0.12)	0.019 (0.21)	0.038 (0.64)	0.030 (0.89)	0.023 (1.34)	0.008 (0.62)	0.005 (0.40)	0.000 (0.01)	0.003 (0.33)	0.016	-0.009
β_K	0.053 (0.30)	0.035 (0.29)	0.052 (0.48)	0.033 (0.54)	0.020 (0.58)	0.019 (1.06)	0.005 (0.37)	0.004 (0.28)	-0.001 (-0.06)	0.003 (0.24)	0.022	-0.016
$\beta_{K,J}$	-0.592 (-1.94)	-0.418 (-2.94)	-0.230 (-1.97)	0.309 (2.56)	0.139 (2.59)	0.064 (1.70)	0.051 (1.72)	0.032 (1.05)	0.030 (0.95)	0.031 (0.96)	-0.060	

Table 3b - Continued

Panel B: Value-Weighted Index												
K	1	2	3	6	12	24	36	48	60	72	b	R ² _{adj}
Korea Stocks												
All	-0.041 (-0.36)	0.066 (0.69)	0.002 (0.03)	0.049 (1.00)	0.062 (2.01)	0.039 (2.41)	0.022 (1.74)	0.005 (0.43)	-0.014 (1.00)	-0.022 (-1.64)	0.017	0.007
β_K	-0.074 (-0.68)	0.062 (0.61)	-0.003 (-0.04)	0.053 (1.07)	0.048 (1.52)	0.032 (1.96)	0.018 (1.40)	0.003 (0.25)	-0.014 (-0.90)	-0.002 (-0.16)	0.012	0.007
β_{KJ}	0.750 (0.88)	-0.135 (-0.32)	-0.257 (1.053)	0.351 (0.99)	0.205 (2.44)	0.109 (1.66)	0.064 (0.97)	0.037 (0.68)	0.003 (0.06)	0.029 (0.80)	0.116	
Taiwan Stocks												
All	0.110 (0.60)	0.054 (0.40)	0.033 (0.37)	0.049 (0.72)	0.042 (1.08)	0.026 (1.39)	0.004 (0.27)	-0.004 (-0.34)	-0.007 (-0.52)	-0.001 (-0.09)	0.031	-0.004
β_K	0.142 (0.75)	0.080 (0.57)	0.064 (0.63)	0.044 (0.63)	0.032 (0.80)	0.020 (1.05)	-0.003 (-0.19)	-0.010 (-0.71)	-0.011 (-0.88)	-0.005 (-0.44)	0.035	-0.002
β_{KJ}	-0.656 (-2.33)	-0.763 (-4.69)	-0.292 (-0.54)	0.223 (1.88)	0.156 (3.06)	0.103 (2.30)	0.110 (3.85)	0.080 (2.04)	0.076 (2.02)	0.067 (2.09)	-0.090	

Table 4

Standard Deviations and Average Correlations for
Seven Industries in Korea and Taiwan

<i>Panel A: Standard Deviations (1978-1991)</i>								
	#1	#2	#3	#4	#5	#6	#7	Market
Korea	6.2%	8.8%	7.9%	6.9%	7.9%	8.8%	12.0%	6.7%
Taiwan	14.3%	13.2%	14.4%	13.0%	12.0%	12.2%	13.4%	12.7%
<i>Panel B: Standard Deviations (1978-1984)</i>								
	#1	#2	#3	#4	#5	#6	#7	Market
Korea	3.8%	9.0%	6.6%	5.4%	7.4%	9.7%	11.0%	5.2%
Taiwan	7.1%	7.0%	7.5%	7.1%	6.4%	7.4%	9.0%	6.4%
<i>Panel C Standard Deviations (1985-1991)</i>								
	#1	#2	#3	#4	#5	#6	#7	Market
Korea	8.0%	8.6%	9.0%	8.0%	8.4%	7.7%	12.8%	8.0%
Taiwan	18.8%	17.2%	18.8%	16.9%	15.7%	15.6%	16.7%	16.7%
<i>Panel D: Average Correlation Coefficients</i>								
Time Period	Within Korea	Within Taiwan	Between Korea & Taiwan		Between Same Industry			
1978-1991	0.607	0.882	0.087		0.089			
1978-1984	0.478	0.775	0.198		0.208			
1985-1991	0.712	0.904	0.050		0.051			

Notes:

- Industry #1: Textiles (# of firms = 16)
- Industry #2: Plastics & Rubbers (7)
- Industry #3: Foods & Beverage (10)
- Industry #4: Pulp & Papers (7)
- Industry #5: Nonmetallic (8)
- Industry #6: Machinery (12)
- industry #7: Construction (7)

Table 5

Stock Returns and Earnings: 1982-1991

$$R_{mt} = \alpha + \beta \text{ Earnings}_t + \varepsilon_t$$

where R_{mt} is the yearly value-weighted market index returns and Earnings_t are measured by (1) Operating Incomes/Book Value of Total Assets (OI/TA), (2) Net Incomes/Book Value of Equity (NI/EB), and (3) Net Incomes/Market Value of Equity (NI/EM).

	$\beta(\text{OI/TA})$	R^2	$\beta(\text{NI/EB})$	R^2	$\beta(\text{NI/EM})$	R^2
<i>Panel A: Equally Weighted</i>						
Korea	0.092 (1.34)	7.35%	0.121 (2.00)	23.17%	0.011 (0.70)	-5.95%
Taiwan	0.262 (2.53)	34.95%	0.079 (4.01)	60.21%	0.086 (2.11)	27.76%
<i>Panel B: Value Weighted</i>						
Korea	0.078 (1.22)	4.69%	0.069 (1.12)	2.48%	0.015 (0.23)	-11.78%
Taiwan	0.274 (3.09)	46.11%	0.069 (3.41)	51.51%	0.109 (4.02)	62.73%

Table 6

Cross-sectional Regressions of Stock Returns on Earnings Yields: 1979-1991

$$\text{Return}_{it} = \alpha_t + \beta_t E/P_{it}$$

Year	Korea					Taiwan				
	N	β	$\bar{R}^2$	Prob	Residual Std. Dev.	N	β	$\bar{R}^2$	Prob	Residual Std. Dev.
1979						79	0.975 (3.477)	0.254	0.000	0.318
1980						85	1.146 (5.367)	0.249	0.000	0.370
1981						88	0.179 (0.551)	-.008	0.583	0.386
1982	249	0.189 (5.419)	0.103	0.000	0.358	94	0.784 (5.050)	0.209	0.000	0.226
1983	250	0.416 (10.545)	0.307	0.000	0.307	99	1.668 (8.112)	0.398	0.000	0.441
1984	254	0.546 (8.216)	0.208	0.000	0.451	92	1.123 (6.470)	0.310	0.000	0.229
1985	264	0.090 (2.359)	0.017	0.019	0.332	84	1.502 (8.085)	0.437	0.000	0.210
1986	273	0.275 (4.300)	0.060	0.000	0.515	89	1.203 (7.286)	0.372	0.000	0.300
1987	276	0.384 (2.828)	0.025	0.005	0.724	95	-0.627 (-0.745)	-.005	0.458	0.762
1988	307	-0.364 (-1.560)	0.005	0.120	0.653	106	6.918 (8.022)	0.376	0.000	0.943
1989	396	0.506 (4.900)	0.055	0.000	0.195	133	-6.316 (-1.846)	0.018	0.067	1.520
1990	507	0.072 (3.908)	0.027	0.000	0.125	150	1.797 (2.264)	0.027	0.025	0.193
1991	538	0.184 (6.425)	0.070	0.000	0.276	165	3.970 (8.329)	0.294	0.000	0.263
Average		0.230	0.089				1.247*		0.225	
t-value		(2.729)					(3.638)			

* The two outliers, 1988 and 1989, are excluded from the average and t-value calculations. These two outliers do not have a large effect on the average, but they affect the standard deviation substantially.

$$E/P_t = NI_t/MV_{t-1}$$

Taiwan and Korea Stock Indices: 1977-1991

Figure 1