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# High-Return Low-Beta Stock Markets: A New Approach with Generalized International Asset Pricing Model

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Given CAPM, the Korean stock market presents an interesting anomaly. This paper develops an expanded asset pricing model which explicitly includes investor size and behavior, market linkage, and informational barriers as explanatory variables. Within the context of this model, the attributes of the Korean stock market are not inconsistent. Variance rather than beta is a better measure of risk when barriers to investment are present.

## I. INTRODUCTION

Prior to 1981, ownership of stock in Korean companies by foreign investors was not possible. The Korean stock market was effectively closed to international investment. In October 1981, the Korean government permitted five mutual funds and two closed end investment companies to commence activities in portfolio management of Korean securities (equities) on behalf of non-residents. This initial opening of the capital market evoked tremendous response from foreign firms and many of them established representative offices in Seoul with a view to actively trade in the Korean market.

With Korea gradually opening up its capital market, foreign investors will be in a position to purchase domestic securities through the conversion of overseas Korean bonds. The capital market has also paved the way for foreign investors to directly assume ownership of Korean blue chip firms such as Samsung Electronics, Dawoo Heavy Industries, Yukong, and Gold Star Company [5].

The characteristics of the Korean stock market overall are also both interesting and not easily explainable. Since the introduction of CAPM (Sharp [8], Lintner [6]), it is well understood that diversification is an important function of portfolio management and that the expected return of a portfolio is a linear function of the systematic risk (beta) associated with the portfolio.

For the period January 1, 1980 to December 31, 1987, the average monthly return on the Korean stock market was 1.74%. This return was the

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second highest among the Pacific Basin countries with only the Taiwan market posting a better return of 2.04%. For the same period the New York stock exchange had a monthly return of 0.99% [7].

Setting the New York Stock Exchange's beta at a benchmark figure of 1.0, one would expect the Korean Stock Exchange to possess a beta higher than 1. Following Rhee's work [7] and using an 8% annual risk free rate, the Korean beta should be close to 3.3. However, the beta of the Korean exchange is estimated to be only 0.16 [7]. With such an attractive return and a low (almost zero) beta, the Korean capital market presents an interesting anomaly. An interesting point to note is that the Korean stock exchange remained unaffected on the day of the world stock market crash (October 19, 1987).

Why the Korean market has exhibited this past behavior is an anomaly not easily explained by previous studies. This paper presents a model, which explicitly includes individual investor influences and asymmetric information and explains this behavior. Informational asymmetry in this case means that there are costs associated with an investment, which are higher for a foreign investor than for a domestic investor. These include the costs of collecting and evaluating information which are over and above any transactions costs which also might be higher for a foreign investor.

## II. PREVIOUS MODELS

Stulz [10] and Black [1] have both developed models dealing with the effect of barriers to international investment. Barriers to international investment can take a variety of forms (both pecuniary and nonpecuniary) and taxes are a way, albeit imperfect, to present them. Black shows that proportional taxes can be used to model barriers to international investment. He further argues that investors do not hold a mixture of national market portfolios, but that the mix of the risky assets is the same for every investor in the country.

Stulz demonstrates that there must exist a beta $B^*$ for any security below which barriers (increased costs of international trade) decrease trade in assets with the least risk. Such assets possess a beta lower than $B^*$ and their expected returns are not large enough to offset the costs of holding them against the barriers.

These models based on CAPM, however, do not explain the anomaly of the high return, low beta Korean stock market. Reasons why this apparent anomaly exist include the following:

1) CAPM may be not applicable or an inappropriate representation of this particular market, i.e., CAPM may only apply to open markets; and
2) additional risk factors are present in international markets which the

model does not take into consideration

These additional risk factors are causes of informational barriers. They include (a) political or country risk (nationalization of industries and/or firms), (b) instability of profit flow (due to uninsurable risk of damage due to political uprising, etc.), and (c) reduced ability to evaluate future cash flow potential from available financial information and/or the quality of management or other company characteristics accurately from a distance. [9]

## III. MODEL

This study provides a General International Asset Pricing Model (GIAPM) where informational asymmetry is an additional barrier to international investment. Through this study the high return low Beta Korean Stock Market and the gap between the previous models and the empirical findings can be narrowed.

Assuming perfect international capital markets with no information or transaction costs, the optimal securities portfolio would be a fully diversified market portfolio containing every security in every country. The marginal cost of holding an additional security would be zero[1]. With imperfect capital markets, this is not necessarily true. The optimal portfolio would be achieved when the marginal cost of the last asset added equals the marginal benefit (the reduction in the standard deviation of the portfolio). In international markets, informational barriers impose additional costs similar to restrictions on capital flows.

This paper examines how international informational barriers alter the optimal diversification portfolio. To simplify this case, the following assumptions are made: (a) there is only one security per country which represents a domestically fully diversified portfolio; (b) securities will be added to the world portfolio with the greatest difference between marginal benefit (MB) and marginal cost (MC), with MB declining and MC rising, until the limit is reached where MB = MC; and (c) this limit will be reached before all countries are included (i.e., the optimal portfolio will exist before the fully diversified world portfolio is achieved).

Let $i$ and $j$ represent different investors and $k$ and $l$ represent countries. Then $W_i$ is the wealth of investor $i$, $N_k$ is the number of shares of country $k$'s fund issued, $P_k$ is the equilibrium price of country $k$'s fund, and $F_k$ is the value of fund $k$. Also $ER_i$ is the expected return of $i$'s portfolio, $\sigma_k^2$ is the variance of country $k$'s fund return, $\sigma_{k,l}$ is the covariance of $k$ and $l$, $VAR(k)$ is the variance of one share of fund $k$, and $COV(k,l)$ is the covariance between the funds of

countries *k* and *l*. To minimize the variance of a portfolio, the following Lagrangian function is differentiated with respect to $\alpha_{k,i}$ and $\lambda_i$.

$$L = \sum_{k=1}^{N_i} \alpha_{ki}^2 \sigma_k^2 + 2 \sum_{k=1}^{N_i} \alpha_{ki} \alpha_{li} \sigma_{kl} + 2\lambda_i [ER_i - \sum_{k=1}^{N_i} \alpha_{ki} ER_k - (1 - \sum_{k=1}^{N_i} \alpha_{ki}) R_f] \quad (1)$$

Rearranging the first order condition and solving for $\lambda_i$.

$$1/\lambda_i = (ER_i - R_f)/\sigma_i^2 \quad (2)$$

which yields a familiar equilibrium expected return for each fund:

$$ER_K = R_f + \left[ \frac{(ER_i - R_f)}{\sigma_I^2} \right] * \sigma_{k,i} \quad (3)$$

Substitute $B_k = \frac{\sigma_{k,i}}{\sigma_i^2}$. Then we get

$$ER_k = R_f + [ER_i - R_f] * B_k \quad (4)$$

Note that $ER_i$ does not include all the assets in the world, (i.e., $N_i < N_w$), which is the optimal portfolio that investor *i* holds. To the extent that $ER_i$ is not the same as $ER_m$, the equilibrium price determination is different from the original CAPM.

To see the impact of informational barriers on the equilibrium price of fund, rearrange equation (3) by substituting $ER_k = (F_{k,1} - F_{k,0})/F_{k,0}$ and $COV(k,i) = \alpha_{k,i} \sigma_k^2 + \sum \alpha_{l,i} \sigma_{k,l}$ and divide by $F_{k,0}$. Then we get

$$F_{k,i} - F_{k,o}(1 + R_j) = \frac{(ER_i - R_f)}{\sigma_i^2} * [F_{k,o} \alpha_{k,i} \sigma_k^2 + F_{k,o} \sum \alpha_{l,i} \sigma_{k,l}] \quad (5)$$

Given that $F_{k,t} = N_k * P_{k,t}$ and divide (5) by $N_k$, we get

$$P_{k,i} - P_{k,o}(1 + R_f) = \frac{(ER_i - R_f)}{\sigma_i^2} [P_{k,o} \alpha_{k,i} \sigma_k^2 + P_{k,o} \sum \alpha_{l,i} \sigma_{k,l}] \quad (6)$$

Note that the investment of investor i in country k is $\alpha_{k,i} = N_{k,i} P_{k,0} / W_i$. Rearrange (6) to get

$$P_{k,l} - P_{k,o}(1 + R_f) = \frac{W_i (ER_i - R_f)}{W_i^2 \sigma_i^2} [N_{k,j} VAR(k) + \sum N_{l,i} COV(k,l)] \quad (7)$$

Equation (7) applies to the fund *k* held by investor *i*, and it is specific to *i* and *k* only. To obtain the price equilibrium, equation (7) is aggregated for country *k*'s fund for all investors who hold it. Thus

$$P_{k,o} = (1 + R_f)^{-1} * CEQ, \quad (8)$$

where *CEQ* [Certainty Equivalent]= $P_{k,l}$ – Risk Premium

$$CEQ = P_{k,l} - \left[ \frac{\Sigma W_i (ER_i - R_f)}{\Sigma W_i^2 \sigma_i^2} \right] * \left[ \frac{\sum W_i (ER_i - R_f)(N_{k,i} VAR(k) + \sum N_{l,i} COV(k,l)}{\sum W_i (ER_i - R_f)} \right] \quad (9)$$

The first bracket is the price per unit of risk and the second term denotes the amount of risk being priced. Therefore the two terms together denote the risk premium. Notice that the price per risk is relevant only to the investor who holds Fund k and investors who do not hold the fund k may face a different price per unit of risk. This is very different from traditional CAPM where everyone faces the same price per unit of risk. The difference comes from the assumption of asymmetric information, which makes a fully diversified portfolio too costly.

Equation (8) also implies that the same investor may face more than one price per unit of risk (unless $N_i = N_W$). This makes investors choose funds in the order of price per unit of risk. The price per unit of risk is a function of both the fund under consideration and the investors who decide to hold the fund in their portfolio.

The unit of risk is measured as the weighted average of the investors when the weights are given as $W_i(ER_i - R_f)$. This implies that the larger the wealth of the investor *i*, the greater investor *i*'s impact on the price determination in country *k*.

To demonstrate the price impact of informational barriers more fully, we examine two extreme cases:

**Case I. Closed Capital Market**

In a closed capital market, foreign investors can not invest in the fund. All the investor in the country *k* should purchase all the available Fund *k*. Domestic investors can not invest outside the country and thus fund *k* is the only choice

.

Under these conditions, the equilibrium price of fund k is

$$P_{k,o} = (1 + R_f)^{-1}[P_{k,l} - \frac{\sum W_i (ER_i - R_f)\, N_k\, VAR(k)}{\sum W_i^2 \sigma_i^2}] \qquad (10)$$

Notice that the equilibrium price of fund *k* is a function of the variance of *k*. This is contrary to the results of traditional CAPM where the beta [which is the sum of covariance] plays the key role in equilibrium price determination. This result intuitively makes sense since we restrict the limitation of diversification to the fund *k* and the variance of the fund *k* plays the key role of the price determination.

**Case II. Open Capital Market (with no informational barriers)**

Assuming a fully open market, all investors hold the fund k and we need to sum up equation (9) for <u>all</u> investors in the world. So we can rewrite the equilibrium price equation by setting: $(ER_i - R_f) = (ER_m - R_f)$ and, $\sigma_i^2 = \sigma_m^2$, $N_i$ becomes $N_m$, and

$$P_{k,o} = (1 + R_f)^{-1} * [P_{k,l} - (N_k VAR(k) + \sum N_l COV(k,l))], \qquad (10)$$

then we have the traditional CAPM. Beta, the average covariance between the funds, now becomes the key factor in determining the risk of the fund.

## IV. COMMENTS

A theoretical model has been presented to examine the impact of the barrier of asymmetric information. It is shown that the difference in the level of openness of a capital market (due to informational barriers) causes the equilibrium price

determination to be different from the traditional CAPM in two ways. First, the more closed the market, the more the variance of the fund is a better proxy for the risk than the beta. As the market becomes more open, the beta becomes a better proxy for the risk of the fund. This is consistent with recent empirical findings in emerging capital markets studies where most are closed or only semi-open [6]. The betas of the countries are very low, but the return and variances are high and positively related. In this case, variance is a better measure of risk that the beta.

Second, the size of the country's market is important. The larger the market, the more that beta, rather than the variance, should be used as the appropriate measure of risk. Japan's capital market is significantly larger and thus displays this characteristic well[2] [6,10].

## V. SUMMARY AND CONCLUSIONS

GIAPM expands CAPM to deal with barriers present in international markets. It further demonstrates that market price equilibrium is a function of market size, investor wealth, and number of investors. This model also shows that the high return, low beta Korean stock market is consistent with CAPM when barrier of informational asymmetry is taken into consideration. To the extent that the barrier of informational asymmetry or other barriers exist, variance is a better measure of risk than beta. GIAPM thus serves to explain some of the discrepancies that exist between earlier models and the empirical findings on the stock markets of the Pacific Basin countries. An empirical test of the GIAPM will be possible within a few years and should shed more light on these new emerging capital markets. As of January 1992 the Korean market has been open to foreign investment. The hypothesis that should be tested is that the explanatory power of CAPM beta should be significantly greater for the post 1/92 period than it has been in the pre 1/92 period. It is also expected that similar results are to be found in other emerging markets with informational and transactional barriers.

## NOTES

1. This is, in fact, demonstrated below in Case II to be a special case of the GIAPM.
2. In their paper, they showed that the values in average realized returns and the standard deviations of the returns for the U.S. and the Japan are similar and relatively stable across the two ten-year sub-periods from 1971 - 1988. The two countries, Japan and the U.S., together counted for sixty to seventy percent of the total world equities for the time period.

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