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ABSTRACT

A Study of the Price and Volatility of Closed-End
Country Fund Shares and Net Asset Value

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Two factors are known to affect closed-end country fund premiums/discounts: international investment ownership constraints and investor sentiment. This is an analytical and empirical investigation into which really explains changes in premiums/discounts to net asset value, the variance of fund share prices, and the variance of net asset values.

To my family

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Introduction and Literature Review

A closed-end investment company neither issues new shares nor redeems outstanding ones. Hence investors must buy or sell existing shares at market price on an open market such as the NYSE. Closed-End Country Funds (CECFs) are closed-end mutual funds invested in the assets (typically common stocks) of a foreign country.

CECFs trade like ordinary stocks in the domestic stock market. Fund share price is determined not only by net asset value (NAV), as is the case with open-end country funds, but also by the supply and demand for equity ownership in the foreign country. Closed-end country funds can provide domestic investors with access to foreign markets. If the foreign and domestic markets are segmented such as through an investment restriction on domestic ownership of foreign assets, then CECFs can trade at substantial premiums or discounts to NAV.

There are two principal schools of thought regarding CECF premiums and discounts. One school has focused on the effect of international asset restrictions on the actions of foreign and domestic investors using formal utility-based models. The other school has chosen to emphasis changes and differences in investors' expectations.

Agency costs, tax liabilities, and asset illiquidities have been used to explain closed-end fund discounts.

Closed-end fund premiums are often explained as arising from an investment restriction as in Eun and Janakiramanan [1986]. --hereafter EJ-- EJ derive a closed-form solution for international asset prices when there is an investment restriction. Bonser-Neal, et, al. [1990] --hereafter BBNW-- find empirical evidence consistent with EJ's model.

Lee, Shleifer, and Thaler [1991] --hereafter LST-- argue that closed-end fund discounts are a proxy for small investor sentiment. Considering the fact that the major owners of closed-end funds are small investors, it is plausible that this sentiment systematically affects all closed-end fund share prices. Therefore, they assert that closed-end fund premiums move together following investor sentiment changes.

This dissertation contains three essays. In the first essay, I extend EJ's international asset pricing model by imposing randomness on the supply side in order to find the volatility implication. In the second essay, based on Lucas' [1974] asset pricing model, I derive closed-form solutions for international asset prices when there are investment ownership constraints. In the third essay, I investigate the factors affecting Closed-End Country Fund premiums/discounts and premium/discount volatilities by adopting BBNW's [1990] dummy regression and LST's [1991] investor sentiment hypothesis.

In the remainder of this introductory chapter, I review the

theories and explanations of closed-end fund premiums and discounts.

Explanations of closed-end fund discounts/premiums.

The market price of closed-end fund shares is largely determined by the demand and supply of shares at a point in time. Therefore, the closed-end fund share price is not necessarily the same as its net asset value based on the underlying securities held by the fund and fund shares can sell at a discount or premium to net asset value. The premium(discount) is usually defined as positive(negative) value of (P-NAV)/NAV or ln(P/NAV) where P is CECF share price and NAV is net asset value.

Several traditional theories have been put forth to explain the closed-end fund discount/premium puzzle. These include

1) Agency costs: Boudreaux [1973] argues that if management fees are too high or future portfolio management is expected to be bad, then agency costs could result in a closed-end fund discount.

2) Unrealized capital gains of the fund portfolio: According to Malkiel[1977], this is a reason for the existence of closed- end fund discounts since unrealized gains must ultimately be taxed at the rate of a purchaser of the fund shares.

3) Illiquidity of assets: There are two hypotheses to explain observed fund discounts based on asset illiquidity. The 'restricted stock' hypothesis says that the fund with

the letter stock[1] has a market value which is lower than its complement.

The 'block discount' hypothesis says that the achievable gains are lower in a closed-end fund because of the block trading necessary to sell off the assets upon liquidation.

4) Manager's ability to predict security prices: Thompson [1978] argues that the expected productivity of fund management is responsible for the discount/premium.

5) Lack of aggressive advertising: Wisenberger Service cites a lack of aggressive advertising and sponsorship as a possible reason for the discounts.

None of these explanations appear capable of fully explaining the existence of closed-end fund discounts/premiums,

especially for Closed-end Country Funds (CECFs) which often sell at substantial premiums to Net Asset Value.

Some recent studies seem to provide more plausible explanations. One representative study is Lee, Shleifer, and Thaler's [1991] "Investor sentiment and the closed-end fund puzzle". These authors use a model in which markets are not semi-strong form efficient to explain the average discount on domestic closed-end funds. In their model, irrational noise traders are accountable for a larger fraction of fund share trades than of trades on assets

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[1]Letter stock is a restricted stock which can sell only with a letter attached.

underlying the shares. These noise traders impose additional risk on fund shares relative to their underlying assets. Thus, funds trade on average at discounts. Also, as noise traders become excessively optimistic, closed-end funds sometimes sell at premiums, especially at inception. Delong et al [1990] and LST [1991] find that domestic closed-end fund premiums occur only at IPO and suggest that the CECF discount reflects the noise trader risk. LST [1991] conclude that closed-end fund discounts are a measure of the changing sentiment of individual investors toward closed-end funds.

Another interesting study is Bonser-Neal, Brauer, Neal, and Wheatley's [1990] "International Investment Restrictions and Closed-End Country Fund Prices". The purpose of BBNW's study is to examine whether changes in closed-end country fund premiums are related to announcements of changes in international investment restrictions. In particular, they test whether an announcement of liberalization of a restriction is associated with decline in the premium and announcement of tightening of a restriction with a rise in the premium.

In the real world, however, the existence of investment restrictions does not always create a premium. Some closed-end funds are sold at premiums and some funds are sold at discounts. Therefore, BBNW [1990] looked at the relationship between changes in the restriction and changes in the

price/(net asset value) ratio. BBNW's conclusion is thatgovernment regulation can be effective in segmenting markets.

International asset pricing theory with investment restrictions

Several CAPM-based international asset pricing models have incorporated the effects of investment restrictions on foreign and domestic asset prices.

Black [1974] & Stulz [1981] studied the effects of international investment barriers that take the form of taxes on holding foreign assets. In Black's model, investors are taxed on long positions in foreign assets but are subsidized in short positions. In Stulz's model, investors are taxed on both long and short positions. Both models foresee that the expected return on a foreign asset held long will exceed the expected return on a domestic asset of equal risk by the rate at which domestic holdings of the asset are taxed. This assures that the after-tax returns are the same. Closed-end country funds represent long positions taken indirectly by domestic investors in foreign assets. While the underlying shares of these funds are foreign assets, the funds' shares are domestic assets. Thus, these models imply that barriers that increase the cost for a domestic investor of holding foreign assets will raise the return required on their shares.

Hietala [1989] studied the Finnish stock market in which Finnish investors can hold only Finnish shares while foreign investors can hold both Finnish and foreign shares.

Finnish stocks are divided into restricted (for Finnish investors only) and unrestricted shares. By using an equilibrium asset pricing model, Hietala explains the premium on the unrestricted shares. The premium arises if and only if the price of the unrestricted stock is decided by foreign investors. This is true if the foreign investors require a lower premium on this stock than do domestic investors.

Errunza & Losq [1985] derive a closed-form solution for the case when domestic investors are legally prohibited from investing in foreign assets while foreign investors are not prohibited from investing in the domestic market. They show that the required return on the foreign securities is higher than the return required under no such restrictions.

Recently, Bergström et. al. [working paper] studied asset pricing with inflow and outflow constraints in the Swedish market. In Sweden, there exists a switch-currency constraint which forces Swedish investors to pay a premium for foreign assets. The analysis of the switch-currency constraint is extended by adding Eun and Janakiramanan's delta constraint on foreign holdings of domestic (i.e. Swedish) assets. Consistent with the model, Swedish investors pay a premium for foreign assets and foreign investors pay a premium for Swedish assets.

The existence of both types of premiums suggest, however, that markets are segmented as a result of the ownership constraints.

Eun & Janakiramanan's [1986] model defines a specific form of barrier to international investment. Their 'delta constraint' represents a binding limit on the proportion of foreign shares which can be held by domestic investors. When delta constraint is binding in the foreign market, domestic investors must buy stocks from other domestic investors. This constraint is applied only to domestic investors and not to foreign investors. In other words, domestic investors cannot hold foreign securities beyond a maximum value so that the ownership constraint is effective. In contrast, foreign investors are allowed unrestricted access to the domestic market. This investment restriction proxy is measurable. They derive a closed-form solution for international asset pricing in a two-country, two-agent (Domestic and Foreign investors) setting when the market is imperfect due to an investment restriction on foreign ownership. The restriction on domestic investment in foreign assets results in domestic investors paying a premium for closed-end country fund shares. Conversely, foreign investors price these shares at a discount relative to unrestricted equilibrium prices.

In other words, when there is an ownership constraint on the fraction of foreign assets which can be held by domestic investors, there are two groups of foreign shares: restricted shares that only foreigners can buy and unrestricted shares that both domestic and foreign investors can buy. The foreign government establishes limits on the fraction of shares that are unrestricted, and when these limits are securing, the unrestricted shares sell at a premium relative to the restricted shares. This premium depends on the covariance matrix of returns and on investor preferences. They show that the prices of foreign assets for the domestic and for the foreign investors can be expressed as a function of the proportion of foreign equity ownership allowed.

In their model, two different prices rule for foreign assets reflecting a premium offered by domestic investors above the full integration prices and a discount below the full integration price required by the foreign investors. Both the premium and the discount are determined by the severity of the delta constraint. The tighter the restriction, the greater the domestic premium and the foreign discount on unrestricted shares.

According to this international asset pricing theory, closed-end country fund (CECF) premiums/discounts seem to be due to investment ownership constraints. CECF share prices can be viewed as foreign asset prices for domestic investors and net asset values can be viewed as foreign asset prices for foreign investors. If δ constraint is binding, CECF should sell at a premium over NAV and as delta constraints become less binding, the CECF premium over NAV should fall.

In this research, I test the implications of Eun and Janakiramanan's model for CECF price and volatility for the long run and short run with and without controlling for investor sentiment and differential risk aversion.

Both change in the delta constraint and change in investor sentiment is likely to affect the CECF premium. Therefore, it is difficult to believe that CECF premium behavior can be fully explained with only one of these factors.

There is empirical evidence that CECF prices respond to information in announcements of changes in investment restrictions, presumably because such information is relevant to diversification-oriented investors. This implication was tested by BBNW [1990]. Based on the hypothesis that premiums decrease as investment restrictions are loosened, they tested how premiums/discounts change around 23 announcements of changes in investment restrictions. They report significant correlations between premiums/discounts and tightenings/loosenings over the 3-week period surrounding such announcements. Tightening of investment restrictions causes an increase in CECF premiums and loosening of investment restrictions does the opposite.

I have several concerns regarding this study. First, BBNW use only 23 events and many of them are questionable in terms of their influence over CECF prices. Second, it is not clear whether a loosening of capital outflow constraints decreases or increases the premium. [2] Third, even after adjusting for expected dividends and missing variables BBNW still found insignificant results for two of the five funds they tested.

After adding eight more events in Essay III, I calculate a world CECF premium change index based on 14 country funds and run a regression of the world-adjusted premium change over the dummy variables as was done by BBNW to see if the excess premium/discount change can be explained by investment restriction changes[3]. I report results which do not support BBNW and the empirical evidence strongly suggests that premiums/discounts changes are subject more to U.S. investor sentiment than to changes in the delta constraint.

If a foreign securities market is segmented due to investment restrictions, domestic investors have an incentive to pay a premium over unrestricted equilibrium prices in order to capture the diversification benefit offered by foreign securities. However, a distinction should be made between direct investment in foreign securities markets and indirect investment through CECFs.

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[2]Bergström et al [1990] find that a binding switch currency constraint (capital outflow constraint) makes foreign securities less attractive. This constraint and the delta constraint (capital inflow constraint) operate in different directions.

[3]Lee et al [1992] find that CECF premiums move together with investor sentiment changes.

With both direct and indirect investments, changes in investment restrictions are likely to affect CECF premiums over NAV. With indirect investment, NAVs are determined by foreign market price changes while CECF prices are more highly correlated with domestic share prices.

Bailey and Lim [1992] find that, while foreign market index returns are not correlated with U.S. returns, CECF returns are strongly correlated with the U.S. market returns. Similarly, Lee et al [1993] find that after controlling for foreign market fundamentals, changes in CECF prices co-move with U.S. market returns. This suggests that investors must buy foreign equity to achieve the full diversification benefit. CECFs are not effective diversification vehicle into foreign markets.

Investor sentiment hypothesis

In an early example of the expectational school, Malkiel [1977] suggests that closed-end country fund premiums or discounts result not from any market imperfections but rather from investor fascination or disappointment with foreign securities. In this view, the effects of investment restrictions on the premiums of the closed-end country funds may be small. Some recent evidence (e.g. BBNW [1990]) suggests that changes in investment restrictions affect closed-end country fund premiums significantly. LST [1991] use the term 'investor sentiment' in a modern version of Malkiel's behavioral explanation.

In a recent study, Lee, Kim, and Bodurtha [working paper] showed that after controlling for foreign market fundamentals, the stock prices of country funds co-move with U.S. market returns, but their net asset values do not.

What they found are :

1. CECF premiums/discounts move together.
2. CECF premiums/discounts are not correlated with U.S. market returns while CECFs are.
3. Changes in NAV are strongly positively correlated with foreign market returns and the NAVs are not correlated

with U.S. market returns. This is consistent with Bailey and Lim's [1992] finding that CECFs are not useful for diversification purposes. Investors should directly participate in local markets rather than use CECFs to achieve the diversification benefit.

Under Lee et al's view, some of the time noise traders are optimistic about returns on these securities and drive up the prices relative to fundamental values. Unlike other assets, in case of CECFs the fundamental values are observed. Therefore, noise traders' sentiment can be captured by the magnitude of premiums/discounts. In this way, investors with changing return expectations create stochastic changes in CECF premiums/discounts. If the same investors are investing in both the underlying securities and in fund shares, then any changes in sentiment affects both the NAV and share price resulting in no change in premiums/discounts. Therefore, changes in premiums/discounts reflect not the aggregate effect of investor sentiment changes but the differential effect of the sentiment of the CECF-investing clientele relative to the investing clientele of the underlying assets. An index of CECF premiums/discounts provide a measure of the differential sentiment of U.S. investors relative to their foreign counterparts.

When domestic investors are bullish about stocks in general, they bid up the price of foreign country funds relative to their NAV, as well as the price of other assets in which they hold large positions. If this sentiment is wide-spread, it will be priced in equilibrium. Arbitrage across market is costly, so local sentiments persist and are priced in equilibrium.

Essay I. Eun and Janakiramanan's model and its extension

In this essay, I briefly review Eun and Janakiramanan's [1986] theoretical model of investment restrictions and CECF share prices. I then extend this model of CECF premiums/discounts to derive the relation between the volatility of CECF prices and NAVs.

1. Eun and Janakiramanan's theoretical model

Eun and Janakiramanan's [1986] model has two basic assumptions.

1. There is a domestic country with a domestic agent and a foreign country with a foreign agent.
2. There is an investment restriction on domestic ownership of the foreign market and no restriction on foreign ownership of the domestic market.

Pratt-Arrow's absolute risk aversion measure is given by $A^k = -U^{k''}(w^k)/U^{k'}(w^k)$, where k represents either a foreign investor (f) or a domestic investor (d). Similarly, Let foreign and domestic securities represented by k = F and k = D, respectively. Other variables include :

U^k : Utility of agent k.

CEQ^k : Certainty equivalent of end-of-period wealth for investor k.

W^k : The investible wealth of investor k at time 0.

W^k : The random and normally distributed end-of-period wealth of investor k.

L^k : Amount invested in the risk-free asset by investor k.

r : 1 + risk-free rate (same risk-free rate assumed for both investors).

N_K : Vector of number of shares of the domestic (K = D) and foreign (K = F) securities outstanding.

n_K^k : Vector of number of shares of domestic (K = D) and foreign (K = F) securities outstanding owned by agent k. (k ∈ (f, d))

P : Current price vector distributed as multivariate normal.

V : End-of-period Price vector covariance matrix distributed as multivariate normal.

μ : Expected price vector.

EJ adopt a negative exponential utility function as follows.

$$U^k(W^k) = -\exp[-A^k\tilde{W}^k],\ A^k > 0. \qquad (1)$$

Investors maximize their expected utility of end-of-period wealth $E[U^k(W^k)]$. Since W^k is normal and the prices of the securities F and D are joint-normally distributed, expected utility can be expressed as,

$$E[U^k(\tilde{W}^k)] = -\exp[-A^k[\overline{W}^k - \frac{A^k}{2} var(\tilde{W}^k)]]. \quad (2)$$

Therefore, agent k's optimal investment is to maximize the certainty equivalent of end-of-period wealth,

$$Maximize\ CEQ^k\ (Certainty\ Equivalent) = \overline{W}^k - \frac{A^k}{2} var(\tilde{W}^k). \quad (3)$$

$$W^k = n_D^{k'} P_D + n_F^{k'} P_F + L^k. \quad (4)$$

Subject to the budget constraint,

Expected end-of-period wealth is given by

$$\overline{W}^k = n_D^{k'} \mu_D + n_F^{k'} \mu_F + L^k r$$

$$= n_D^{k'} (\mu_D - P_D r) + n_F^{k'} (\mu_F - P_F r) + W^k r. \quad (5)$$

The variance of end-of-period wealth is given by

$$Var(\tilde{W}^k) = n_D^{k'} V_D n_D^k + 2 n_D^{k'} V_{DF} n_F^k + n_F^{k'} V_F n_F^k. \quad (6)$$

Therefore,

$$CEQ^k = n_D^{k'} (\mu_D - P_D r) + n_F^{k'} (\mu_F - P_F r) + W^k r$$

$$-\frac{A^k}{2}[n_D^{k\prime}V_D n_D^k + 2n_D^{k\prime}V_{DF}n_F^k + n_F^{k\prime}V_F n_F^k]\,. \tag{7}$$

Maximization yields the following first-order conditions

$$\frac{\partial CEQ^k}{\partial n_D^k} = (\mu_D - P_D r) - A^k[V_D n_D^k + V_{DF} n_F^k] = 0 \tag{8}$$

and

$$\frac{\partial CEQ^k}{\partial n_F^k} = (\mu_F - P_F r) - A^k[V_{DF}^\prime n_D^k + V_F n_F^k] = 0\,. \tag{9}$$

Rewriting equations (8) and (9) with respect to the demand vectors n_K^k yields

$$\begin{bmatrix} n_D^k \\ n_F^k \end{bmatrix} = \frac{1}{A^k}\begin{bmatrix} V_D & V_{DF} \\ V_{DF}^\prime & V_F \end{bmatrix}^{-1}\begin{bmatrix} \mu_D - P_D r \\ \mu_F - P_F r \end{bmatrix}. \tag{10}$$

By defining the above inverse matrix as

$$\Omega = \begin{bmatrix} V_D & V_{DF} \\ V_{DF}^\prime & V_F \end{bmatrix}^{-1} = \begin{bmatrix} \Gamma_D & \Gamma_{DF} \\ \Gamma_{DF}^\prime & \Gamma_F \end{bmatrix}, \tag{11}$$

we can rewrite the aggregate demand functions as

$$\begin{bmatrix} n_D^k \\ n_F^k \end{bmatrix} = \frac{1}{A^k}\Omega\begin{bmatrix} \mu_D - P_D r \\ \mu_F - P_F r \end{bmatrix} \tag{12}$$

The market clearing conditions are required to arrive at

equilibrium asset prices. They are,

$$n_i^d + n_i^f = N_i \quad i \in D. \tag{13}$$

$$n_i^d \leq \delta N_i \text{ and } n_i^f = N_i - n_i^d \quad i \in F. \tag{14}$$

With a short sale restriction,

$$n_i^d \geq 0 \quad i \in F \tag{15}$$

Since the δ constraint is assumed to be binding, the foreign securities will be held long, in aggregate, by the domestic investors. Therefore, the short-sale restriction need not be considered.

The foreign asset price for the domestic investor equals the full integration price plus the premium offered by the domestic investor due to the restriction. In this case the demand exceeds the unconstrained equilibrium supply. That is to say,

$$P_F^d = P_F^* + \pi \quad for \quad \pi > 0. \tag{16}$$

Conversely, the foreign asset price for the foreign investor equals the full integration price minus the discount demanded by the foreign investor. Here, the unconstrained equilibrium demand is less than the unconstrained equilibrium supply.

Plugging these into the aggregate demand functions in (12)

and solving for the price vectors results in

$$\begin{bmatrix} P_D \\ P_F^* \end{bmatrix} = \frac{1}{r}\left\{\begin{bmatrix} \mu_D \\ \mu_F \end{bmatrix} - A^W \Omega^{-1} \begin{bmatrix} N_D \\ N_F \end{bmatrix} + \frac{A^W}{A^D}\begin{bmatrix} 0 \\ \pi \end{bmatrix} - \frac{A^W}{A^F}\begin{bmatrix} 0 \\ \lambda \end{bmatrix}\right\} \quad (17)$$

where world risk tolerance is given by

$$\frac{1}{A^W} = \frac{1}{A^D} + \frac{1}{A^F}. \quad (18)$$

First, we need to find equilibrium asset prices with no restrictions. With no foreign ownership constraint (delta=1) the last two terms of equation (17) go to zero.
Therefore,

$$\pi = \frac{A^D}{A^F}\lambda. \quad (19)$$

By using the market clearing conditions in (13) and (14), we get the following two equations:

$$A^D \delta N_F = \{\Gamma_{DF}'[\mu_D - P_D r] + \Gamma_F[\mu_F - P_F^* r]\} - \Gamma_F \pi r. \quad (20)$$

$$A^F(1-\delta) N_F = \{\Gamma_{DF}'[\mu_D - P_D r] + \Gamma_F[\mu_F - P_F^* r]\} + \Gamma_F \lambda r. \quad (21)$$

Substituting (21) from (20) gives

$$[A^F - (A^D + A^F)\delta] N_F = \Gamma(\pi + \lambda) r. \quad (22)$$

Substituting (19) for π in (22) and rearranging provides

$$\lambda=\frac{1}{I}[A^{F}(1-\delta)-A^{N}]\Sigma \text{ where, } \Sigma=[V_{F}-V_{DF}^{\prime}V_{D}^{-1}V_{DF}]N_{F}. \tag{23}$$

Substituting (19) for λ in (22) and rearranging provides

$$\pi=\frac{1}{I}[A^{N}-A^{D}\delta]\Sigma. \tag{24}$$

Consequently, equilibrium asset foreign price (P_F^*) under no restriction (delta = 1) is given by

$$P_F^*=\frac{1}{I}\{\mu_D-A^{N}[V_DN_D+V_{DF}N_F]\}. \tag{25}$$

Foreign asset prices for each agent are then

$$P_F^d=P_F^*+\pi=\frac{1}{I}\{\mu_F-A^{N}[V_{DF}^{\prime}N_D+V_FN_F]+(A^{N}-A^{D}\delta)\Sigma\}. \tag{26}$$

and

$$P_F^f=P_F^*-\lambda=\frac{1}{I}\{\mu_F-A^{N}[V_{DF}^{\prime}N_D+V_FN_F]-(A^{F}(1-\delta)-A^{N})\Sigma\}. \tag{27}$$

2. Extension of Eun and Janakiramanan's model

In this section, I extend Eun and Janakiramanan's [1986] model and derive implications.

2.1. Extension on Premiums/Discounts

From (26) and (27), we can derive the domestic investor's premium on foreign assets as follows.

$$P_F^d - P_F^f = \pi + \lambda \tag{28}$$

$$= \frac{1}{r}[A^F(1-\delta) - A^D\delta]\Sigma. \tag{29}$$

From equation (2), we find that whether closed-end country funds are selling at a premium or a discount is determined by :

1. If $A^D > (1/\delta - 1)\ A^F$, the fund is selling at a discount. (30)
2. If $A^D = (1/\delta - 1)\ A^F$, the fund is selling at NAV. (31)
3. If $A^D < (1/\delta - 1)\ A^F$, the fund is selling at a premium. (32)

Where A^k is Absolute Risk Aversion of agent k. ($k \in D, F$)

For example, let A^D and A^F take on values in an arbitrary range from 0 to 2, and investigate the pricing of CECFs for two distinct values of δ in (29). The following examples use $\delta = .1$ (Figure I-1A) and $\delta = .5$ (Figure I-1B). In these cases, if the coordinate (A^F, A^D) falls in the shaded area, the fund sells at a premium. If (A^F, A^D) falls on the line, it sells neither a discount nor a premium. If (A^F, A^D) falls below the line, it sells at a discount. A discount is allowed by not restricting the binding condition to $0<\delta<A^W/A^D$. If we assume δ is still binding in the range between A^W/A^D and 1, then a discount is allowed.

We know that $(1/\delta - 1)$ is the slope of the line and it decreases as δ increases. This means that as δ increases the shaded area becomes smaller. This can be interpreted as meaning that the probability that a CECF sells at discount (premium) becomes higher as δ increases (decreases). From the figures, we can see that as delta changes (loosening of restrictions), at the same risk aversion coordinates the chance of the foreign asset selling at a premium is lower at higher levels of delta, δ. Let M^D and M^F represent the wealth of investors in each market and $\overline{1/A_i^D}$ and $\overline{1/A_i^F}$ represent the mean per unit absolute risk aversion of the investors. Then

$$\frac{1}{A^D} = M^D * \left(\overline{\frac{1}{A_i^D}}\right) \qquad (33)$$

and

$$\frac{1}{A^F}=M^F*(\overline{\frac{1}{A_i^F}}) \qquad (34)$$

Plugging these into equation (30) yields the following result:

$$\delta > \frac{1}{\frac{A^D}{A^F}+1}=\frac{1}{\frac{M^F\times(\overline{\frac{1}{A_i^F}})}{M^D\times(\overline{\frac{1}{A_i^D}})}+1} \qquad (35)$$

Assuming equal average risk aversion for foreign and domestic investors, then for the fund to sell at a discount,

$$\overline{\frac{1}{A_i^F}}=\overline{\frac{1}{A_i^D}}, \qquad (36)$$

and

$$\delta>\frac{1}{M+1}, \qquad (37)$$

where M is the size of the foreign market relative to the domestic market. Conversely, for the fund to sell at a premium,

$$\delta<\frac{1}{M+1}. \qquad (38)$$

This means that as the ratio M of the size of the foreign market to that of the domestic market grows, the threshold delta which determines whether a fund sells at a premium or a discount decreases.

2.2. Extension on the volatility of CECF share price and NAV

If the premium/discount was a constant fraction of NAV, investors would not care about the volatility of the premium/discount. However, fluctuations in the premium/discount appear to be mean reverting (Sharpe and Sosin (1975)). Others document significant positive abnormal returns from assuming long positions on funds with large discounts. Does this hold true for CECFs? If so, what are the driving forces and are there any differences in volatilities between premium funds and discount funds? Unlike domestic CEFs, there are several CECFs which sell at high premiums.

Another interesting motivation for a study of the volatility of CECF prices and NAV is based on the noise trader effect. Lee, Schleifer and Thaler [1990] assume that individual investors are irrational noise traders and institutional investors are rational. If this is true, the institutional ownership of CECFs selling at a premium should be lower than funds selling at a discount. Assuming that the volatility of NAV reflects the fundamental volatility, we can conjecture that the variance ratio ($Var(P^d_F)/Var(P^f_F)$) of funds selling at a premium should be higher than funds selling at a discount.

The theoretical motivation for a study of price volatility is based on equations (3) and (6) in this paper. We can see that the variance of wealth is a function of price volatility and that CEQ is a function of the variance of wealth. Therefore, the variance of the CECF price affects the utility of investors. EJ's model looks only at the demand side assuming that the supply (endowment) is exogenous. However, we can impose randomness on the supply as suggested by Lucas [1978]. Let, N_D and N_F be the supply vectors such that $N_D \sim N(\mu_D, \Sigma_D)$ and $N_F \sim N(\mu_F, \Sigma_F)$. This will allow us to test the relative volatility of CECF prices and NAVs with respect to changes in delta.
With stochastic supply, the prices in EJ's model become :

$$P_F^d = P_F^* + \pi = \frac{1}{r}\{\mu_F - A^N[V_{DF}'N_D + V_F N_F] + (A^N - A^D\delta)\,[V_F - V_{DF}'V_D^{-1}V_{DF}]\,N_F\} \quad (39)$$

and

$$P_F^f = P_F^* - \lambda = \frac{1}{r}\{\mu_F - A^N[V_{DF}'N_D + V_F N_F] - (A^F(1-\delta) - A^N)\,[V_F - V_{DF}'V_D^{-1}V_{DF}]\,N_F\} \quad (40)$$

Rearranging these prices with respect to N_D and N_F yields

$$P_F^d = \frac{1}{r}\{\mu_F - A^N V_{DF}'N_D - [A^N V_{DF}'V_D^{-1}V_{DF} + A^D\delta\,[V_F - V_{DF}'V_D^{-1}V_{DF}]\,]\,N_F\}\,. \quad (41)$$

and

$$P_F^f = \frac{1}{r}\{\mu_F - A^N V_{DF}' N_D - [A^F(1-\delta)(V_F - V_{DF}' V_D^{-1} V_{DF}) + A^N V_{DF}' V_D^{-1} V_{DF}] N_F\}. \quad (42)$$

For notational convenience, let

$$M_1 = A^N V_{DF}', \quad (43)$$

$$M_2 = A^N V_{DF}' V_D^{-1} V_{DF} + A^D \delta [V_F - V_{DF}' V_D^{-1} V_{DF}], \quad (44)$$

and

$$M_3 = A^N V_{DF}' V_D^{-1} V_{DF} + A^F(1-\delta)[V_F - V_{DF}' V_D^{-1} V_{DF}]. \quad (45)$$

Now we can obtain a closed-form solution for the variance of CECF prices P_F^d and NAV P_F^f.

$$Var(P_F^d) = Var(\frac{1}{r}\{-A^N V_{DF}' N_D - [A^N V_{DF}' V_D^{-1} V_{DF} + A^D \delta [V_F - V_{DF}' V_D^{-1} V_{DF}]] N_F\})$$

$$= \frac{1}{r^2}[M_1 \Sigma_D M_1' + M_2 \Sigma_F M_2' + 2 M_1 \Sigma_{DF} M_2']. \quad (46)$$

$$Var(P_F^f) = Var(\frac{1}{r}\{-A^N V_{DF}' N_D - [A^F(1-\delta)(V_F - V_{DF}' V_D^{-1} V_{DF}) + A^N V_{DF}' V_D^{-1} V_{DF}] N_F\})$$

$$= \frac{1}{r^2}[M_1 \Sigma_D M_1' + M_3 \Sigma_F M_3' + 2 M_1 \Sigma_{DF} M_3']. \quad (47)$$

Changes in delta result in changes in CECF price variance and NAV variance according to this extension of EJ's model. In appendix I-A, we show that there are two cases which yield different results.

Let $\pi \geq 0$ and $\lambda \geq 0$.

Case I : If $A^D \geq A^F$ and $Cov(P_F^*, \pi) > 0$ (i.e. $Cov(N^D, N^F) < 0$), then $Var(P_F^d)/Var(P_F^f)$ is greater than 1, and an increase in delta should result in a decrease in the variance ratio $((Var(P_F^d)/Var(P_F^f))$ by decreasing the volatility of P_F^d and increasing that of P_F^f.

Case II: If $A^D < A^F$ and $Cov(P_F^*, \pi) < 0$ (i.e. $Cov(N^D, N^F) > 0$), then $Var(P_F^d)/Var(P_F^f)$ is less than 1, and an increase in delta should result in a increase in the variance ratio $((Var(P_F^d)/Var(P_F^f))$ by increasing the volatility of P_F^d and decreasing that of P_F^f.

If we let $\pi < 0$ and $\lambda < 0$, then variance ratios are reversed in each case, that is, $Var(P_F^d)/Var(P_F^f)$ is less than 1 in case I and $Var(P_F^d)/Var(P_F^f)$ is greater than 1 in case II. Also, $\frac{\partial[Var(P_F^d) - Var(P_F^f)]}{\partial\delta}$ is positive in case I and negative in case II.

Appendix I-A Volatility of CECF share price and NAV and how the volatility difference changes with change in δ

From (26) and (27), $P_F^d = P_F^* + \pi$ and $P_F^f = P_F^* - \lambda$

$$Var(P_F^d) = Var(P_F^*) + 2Cov(P_F^*, \pi) + Var(\pi). \qquad (A-1)$$

$$Var(P_F^f) = Var(P_F^*) - 2Cov(P_F^*, \lambda) + var(\lambda). \qquad (A-2)$$

when

$$\pi = \frac{A^D}{A^F}\lambda \qquad and \qquad \lambda = \frac{A^F}{A^D}\pi$$

$$Var(P_F^f) = Var(P_F^*) - 2Cov(P_F^*, \frac{A^F}{A^D}\pi) + (\frac{A^F}{A^D})^2 Var(\pi).$$

$$= Var(P_F^*) - 2\frac{A^F}{A^D}Cov(P_F^*, \pi) + (\frac{A^F}{A^D})^2 Var(\pi). \qquad (A-3)$$

Therefore,

$Var(P_F^d) - Var(P_F^f)$

$= 2(1 + A^F/A^D)*Cov(P_F^*, \pi) + (1 - (A^F/A^D)^2)*Var(\pi)$

$= (1 + A^F/A^D)\{2Cov(P_F^*, \pi) + (1 - (A^F/A^D))*Var(\pi)\}$

(A-4)

The relative size of $Var(P_F^d)$ and $Var(P_F^f)$ is determined by the following conditions.

Let $\pi \geq 0$ and $\lambda \geq 0$.

Case I : If $A^D \geq A^F$ and $Cov(P_F^*, \pi) > 0$ (i.e. $Cov(N^D, N^F) < 0$[4]),

then $Var(P_F^d) \geq Var(P_F^f)$

Case II: If $A^D < A^F$ and $Cov(P_F^*, \pi) < 0$ (i.e. $Cov(N^D, N^F) > 0$), then

$Var(P_F^d) < Var(P_F^f)$

If we let $\pi < 0$ and $\lambda < 0$, then the above relationship is reversed.

Sign of change in $[Var(P_F^d) - Var(P_F^f)]$ with respect to change in δ is also determined by these conditions.

Let $\pi \geq 0$ and $\lambda \geq 0$.

Case I : $A^D \geq A^F$ and $Cov(P_F^*, \pi) > 0$ (i.e. $Cov(N^D, N^F) < 0$)

$$Var(P_F^d) - Var(P_F^f) = (1/r^2)[2(1 + A^F/A^D)\ Cov\{(V_{DF}'N_D + V_F N_F)(-A^W),\ (A^W - A^D\delta)[V_F - V_{DF}'V_D^{-1}V_{DF}]N_F\} + (1-(A^F/A^D)^2) * Var((A^W - A^D\delta)[V_F - V_{DF}'V_D^{-1}V_{DF}]N_F)]$$

$$= (1/r^2)[2(1 + A^F/A^D)\ Cov\{(V_{DF}'N_D + V_F N_F)(-A^W),\ A^W[V_F - V_{DF}'V_D^{-1}V_{DF}]N_F\} + 2(1 + A^F/A^D)$$

---

[4] $Cov(P_F^*, \pi) = Cov\{(V_{DF}'N_D + V_F N_F)(-A^W),\ (A^W - A^D\delta)\ [V_F - V_{DF}V_D^{-1}V_{DF}]N_F\}$
For this to be positive, $[V'_{DF}Cov(N_D, N_F) + V_F Var(N_F)]$ should be negative. Then $Cov(N_D, N_F) < -V'_{DF}{}^{-1}V_F Var(N_F) < 0$.

$$Cov\{(V_{DF}'N_D + V_FN_F)A^W, A^D\delta[V_F-V_{DF}'V_D^{-1}V_{DF}]N_F\} + (1-(A^F/A^D)^2)*(A^W - A^D\delta)^2[V_F-V_{DF}'V_D^{-1}V_{DF}] Var(N_F)[V_F-V_{DF}'V_D^{-1}V_{DF}]']$$

(A-5)

$$\frac{\partial[Var(P_F^d) - Var(P_F^f)]}{\partial\delta}$$

$$= (1/r^2)[2(1 + A^F/A^D)A^D Cov\{(V_{DF}'N_D + V_FN_F)A^W, [V_F-V_{DF}'V_D^{-1}V_{DF}]N_F\} - 2A^D(1-(A^F/A^D)^2)(A^W-A^D\delta)* [V_F-V_{DF}'V_D^{-1}V_{DF}]Var(N_F)[V_F-V_{DF}'V_D^{-1}V_{DF}]']$$

$$= (1/r^2)[2(1 + A^F/A^D)A^D [Cov\{(V_{DF}'N_D+ V_FN_F)A^W, [V_F-V_{DF}'V_D^{-1}V_{DF}]N_F\} - (1-(A^F/A^D))(A^W - A^D\delta)* [V_F-V_{DF}'V_D^{-1}V_{DF}]Var(N_F)[V_F-V_{DF}'V_D^{-1}V_{DF}]']]<0$$

(A-6)

where, $(1 + A^F/A^D)A^D$ is positive, $Cov\{(V_{DF}'N_D + V_FN_F)A^W, [V_F-V_{DF}V_D^{-1}V_{DF}]N_F\}$ is negative and $(1-(A^F/A^D))$ is positive. $(A^W - A^D\delta)$ is positive since binding δ has the range of $0<\delta<(A^W/A^D)$. Finally, $[V_F-V_{DF}'V_D^{-1}V_{DF}]Var(N_F)[V_F-V_{DF}'V_D^{-1}V_{DF}]'$ is positive. Therefore, if $A^D \geq A^F$ and $Cov(P_F^*, \pi)>0$ (i.e. $Cov(N^D, N^F)<0$), then

$$\frac{\partial[Var(P_F^d) - Var(P_F^f)]}{\partial\delta} <0.$$

Case II: $A^D<A^F$ and $Cov(P_F^*, \pi)<0$ (i.e. $Cov(N^D, N^F)>0$)

$$\frac{\partial[Var(P_F^d) - Var(P_F^f)]}{\partial\delta} >0.$$

Let $\pi<0$ and $\lambda<0$. Then, by the same analysis as above

Case I : $A^D \geq A^F$ and $Cov(P_F^* , \pi)>0$ (i.e. $Cov(N^D, N^F)<0$)

$$\frac{\partial[Var(P_F^d) - Var(P_F^f)]}{\partial\delta} >0.$$

Case II: $A^D<A^F$ and $Cov(P_F^* , \pi)<0$ (i.e. $Cov(N^D, N^F)>0$)

$$\frac{\partial[Var(P_F^d) - Var(P_F^f)]}{\partial\delta} <0.$$

Figure I-1A

The coordinates of absolute risk aversion measures A^F(foreign) and A^D(domestic) which make foreign assets sell at a premium (δ = 0.1)

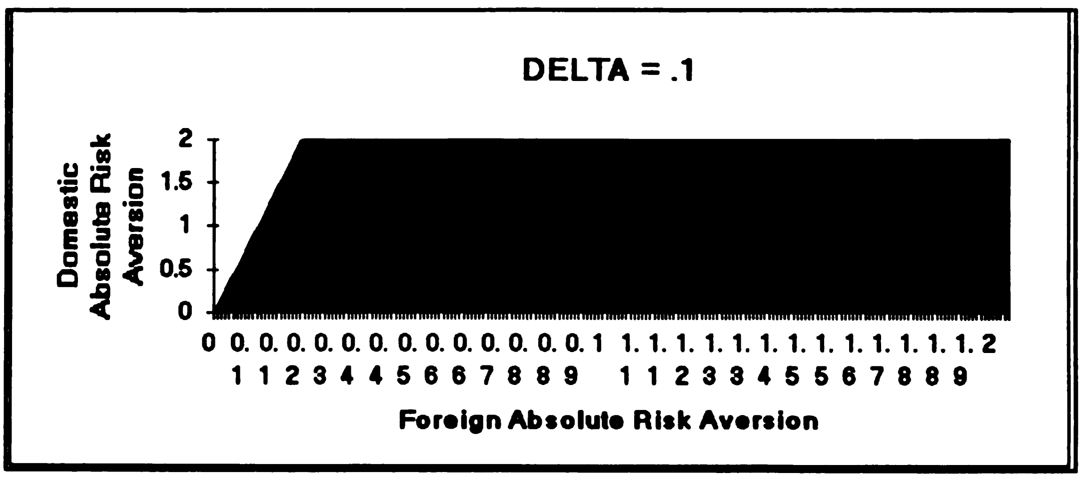
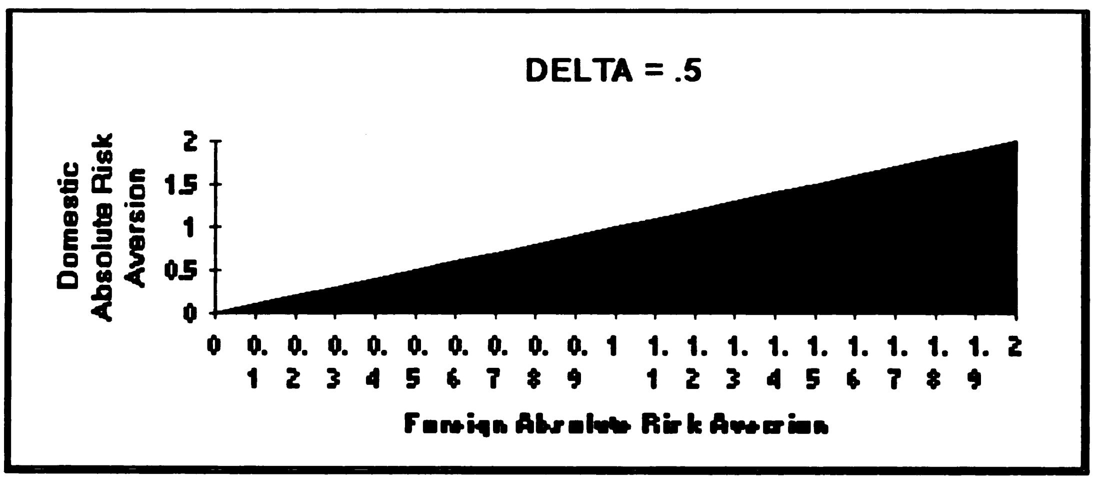


Figure I-1B

<u>The coordinates of absolute risk aversion measures A^F(foreign) and A^D(domestic) which make foreign assets sell at a premium (δ = 0.5)</u>



ESSAY II. Lucas-type model (A consumption-based asset pricing model)

1. Introduction.

Few investors are more susceptible to turbulent times than the owners of closed-end funds (CECFs). They often react in panic to news headlines. This anxiety comes from the fact that the predominant holders of closed-end country funds are small non-institutional investors who normally are less informed about foreign assets than the local people. The sentiments of these investors drive CECF share prices and this makes CECF share prices P_{CECF} more volatile than that of the underlying net asset values. Currency fluctuations and political risk could be sources which make fund share volatility higher than net asset value volatility. As an example, Figure II-1 presents the ratio Var(Price)/Var(NAV) for the Korea Fund over the period 1985-1991 using monthly observations. The Korea Fund's share volatility is much higher than its NAV volatility.

While I was working on the Eun and Janakiramanan extension, I became interested in the theoretical variance of CECF and its NAV. However, in the Eun & Janakiramanan's model, variances couldn't be obtained without adding randomness, since there is no random variable in price functions. In particular, how can the volatility of fund share price and its net asset value be obtained in a theoretical framework, when there is an investment restriction like that in Eun and Janakiramanan [1986]? I decided to impose the investment constraint in a Lucas-type [1974] consumption-based general equilibrium asset pricing model.

2. Theoretical reasoning.

Eun and Janakiramanan's [1986] asset pricing model basically follows the CAPM approach along with two agents and a restriction

on foreign ownership (a 'delta' constraint). As such, it is a one-period pricing model with constant parameters. Under these circumstances, we can not find the variances of both net asset value and fund share value. A different approach is required to obtain the variance of net asset value and fund share price.

Lucas's [1974] stochastic equilibrium asset pricing model is the basic framework for this study. This model assumes a one-good, pure exchange economy with identical consumers. An asset is a claim to all or part of the output of one of these units. The Lucas model basically assumes that the endowment is stochastic over the period following a Markov process defined by its transition function. In this study, due to an assumption of time-additive preference, a constant discount rate is assumed. By using the utility maximization rule, the asset price can be endogenously determined as a function of y (endowment).

I introduce this one-period asset pricing model to include a random variable into the pricing function. In so doing, I obtain not only the price but also the volatility of the price.

Suppose that consumption is smooth and endowment (y) is stochastic over time. As long as the endowment is generous (endowment is greater than consumption), people will postpone consumption into the future by increasing their asset holdings. This will increase asset prices.

On the other hand, if the endowment is poor (endowment is less than consumption), people will not be able to invest in assets for future consumption. Thus, the asset price will not be much affected. From this, we can infer the fact that the volatility of the fund share price should be higher than that of the net asset value if and only if the ownership constraints are binding.

The model applied in this study is based on Lucas's [1974] asset pricing model. Michener [1982] (Appendix 1) used a log utility function which is unbounded and myopic. This model is a good example of the Lucas-type derivation of asset price and its volatility. However, the closed-form solution of the asset price does not include either z (beginning-of-the period number of shares) or x (end-of-the period number of shares). This is due to the characteristics of the log utility function which makes it impossible to impose a restriction on the price function. Therefore, the log utility function can not be used for a volatility test of this kind.

The other utility function tried was the power utility function which also failed to get the appropriate price function. I include derivations based on the log and power utility functions as Appendx II-B and II-C, respectively.

Finally, I used the negative exponential utility function, which resulted in the price function with x (number of shares at the end-of-the period) and y (production or endowment) variables in it. This makes it possible to compare the variances of fund share price and the net asset value under the imposition of the restriction. As is shown in the main text, the price function is not simple enough for a direct comparison. Therefore, we resort to numerical analysis to investigate the differences.

3. Model

Following Lucas [1978], assume a pure exchange economy with two agents f (foreign) and d (domestic) possessing identical time-additive preferences of the form :

$$U(C_t^k) = -\frac{1}{\eta}\exp(-\eta C_t^k) \qquad (1)$$

where C_t^k denotes investor k's consumption at time t and eta is a constant. Agents f and d can be interpreted as representing a large number of identical consumers in a foreign and in a domestic country, respectively. Their exponential utility function exhibits constant absolute risk aversion :

$$ARA = \frac{\partial'' U}{\partial' U} = -\eta \qquad (2)$$

and decreasing relative risk aversion :

$$RRA = -\eta C_t^k \qquad (3)$$

Each agent maximizes his expected utility across all future periods where exponential utility is given by

$$E[\sum_{t=0}^{\infty} \beta^t U(C_t^k)] = E[-(\frac{1}{\eta}) \sum_{t=0}^{\infty} \beta^t \exp(-\eta C_t^k)] \qquad (4)$$

and ß is a subjective discount factor such that $0<\beta<1$. There is a single infinitely-divisible asset produced and consumed in the economy. Production is generated independently each period according to a Markov process:

$$Y_t \sim N(\mu, \sigma^2). \tag{5}$$

In this economy, each period will be identical with respect to all variables except output Y_t. Since the Markov production process Y is strong-form stationary, all information necessary for summarizing the present and future state of the economy is contained in the current output realization Y_t. For this reason, we'll drop the t subscript when it is not necessary for clarity and for the stream of outputs from the stochastic production process y. The production outputs y are represented by the distribution function G(y) or, more simply, G.

Ownership of production y is determined in a competitive stock market between agents f and d. For convenience, assume that ownership in the productive process is represented by a single infinitely-divisible equity share. Let

P_D^k: *Domestic asset price for investor k*

P_F^k: *Foreign asset price for investor k*

X_D^k: *Agent k's end-of-period number of domestic shares*

x_F^k: *Agent k's end-of-period number of foreign shares*

Z_D^k: *Agent k's beginning-of-period number of domestic shares*

Z_F^k: *Agent k's beginning-of-period number of foreign shares*

Agent f holds beginning-of-period proportions Z_D^f, Z_F^f and agent d holds beginning-of-period proportions Z_D^d, Z_F^d of this equity share which entitle them to $Y(Z_D^f + Z_F^f)$ and $Y(Z_D^d + Z_F^d)$ output units, respectively. Shares are traded ex-dividend in a competitive auction at the beginning of each period. Let X_D^k and X_F^k denote end-of period share holdings after the next competitive auction. Allowing the asset price to differ across agents $k \in (d, f)$, perhaps due to restrictions on share holdings Z_D^k and Z_F^k, results in prices P_D^k and P_F^k.

In this economy, all shares are held by one of the agents, so that

$$Z_D^d + Z_D^f = Z_F^d + Z_F^f = 1. \qquad (6)$$

Each agent's beginning-of-period resources include a claim $(Z_D^k + Z_F^k)$ on production Y (a random variable) as well as beginning-of-period equity value $[Z_D^k P_D^k + Z_F^k P_F^k]$.
These resources are either consumed (C^k) or used to purchase end-of-period equity in an amount $[X_D^k P_D^k + X_F^k P_F^k]$.
Consequently, each agent faces a constraint

$$C^k + P_D^k X_D^k + P_F^k X_F^k \leq Y(Z_D^k + Z_F^k) + P_D^k Z_D^k + P_F^k Z_F^k \qquad (7)$$

Now, the equilibrium condition is

$$x_F^d+x_F^f=x_D^d+x_D^f=1. \quad (8)$$

Suppose there is a binding 'delta constraint' (δ) on domestic ownership of the foreign asset,

$$X_F^d=\delta \text{ and } X_F^f=1-\delta. \quad (9)$$

and a binding 'gamma constraint' (γ) on foreign ownership of the domestic asset.

$$X_D^f=\gamma \text{ and } X_D^d=1-\gamma. \quad (10)$$

A stationarity condition is imposed on asset ownership to simplify the problem:

$$X_D^k=Z_D^k \text{ and } X_F^k=Z_F^k, \quad (11)$$

$$k \in (d, f).$$

Let y' denote next period's production represented by the distribution function of G.

Now we define the indirect utility function for agent k.

$$U(y, z_D^k, z_F^k) = \max[-(\frac{1}{\eta})\exp(-\eta C^k) + \beta\int U(y', x_D^k, x_F^k)\, dG(y')]$$

$$= \max[-(\frac{1}{\eta})\exp(-\eta\{y(z_D^k+z_F^k)+P_D^k(y)(z_D^k-x_D^k)+P_F^k(y)(z_F^k-x_F^k)\})$$

$$+\beta E\{U(y', x_D^k, x_F^k)\}] \qquad (12)$$

where ⁿ(eta) is the absolute risk aversion for both agents. Following Lucas [1974], Appendix II-A derives the closed-form solution for the volatilities of P_F^k (k ∊ d, f) assuming exponential utility as follows:

For k=f,this means that the variance of net asset value is given by

$$Var(P_F^f) = \left(\frac{\beta}{1-\beta}\right)^2 (\mu - \eta\sigma^2(x_D^f + x_F^f))^2 \times$$

$$\exp(2\eta^2\sigma^2(x_D^f + x_F^f)^2)\,[\exp(\eta^2\sigma^2(x_D^f + x_F^f)^2) - 1]\,. \qquad (13)$$

For k=d,this means that the variance of the foreign fund share price is given by

$$Var(P_F^d) = \left(\frac{\beta}{1-\beta}\right)^2 (\mu - \eta\sigma^2(x_D^d + x_F^d))^2 \times$$

$$\exp(2\eta^2\sigma^2(x_D^d + x_F^d)^2)\,[\exp(\eta^2\sigma^2(x_D^d + x_F^d)^2) - 1]\,. \qquad (14)$$

4. Implications and Analysis

When the delta constraint on domestic ownership of the foreign asset is binding, domestic investors' unconstrained equilibrium quantity demanded of the foreign asset is greater than the constraint delta. Similarly, there is a gamma constraint on foreign ownership of the domestic asset. Even though the domestic market is open for foreign investors, if the foreign government restricts capital outflow, there is a gamma constraint. Using the binding conditions in (9) and (10) would yield prices

$$P_F^d = \frac{\beta(\mu-\eta\sigma^2(1+(\delta-\gamma)))\exp(\eta(1+(\delta-\gamma))\{y-\mu\}+\eta^2\sigma^2(1+(\delta-\gamma))^2/2)}{1-\beta}$$

and (15)

$$P_F^f = \frac{\beta(\mu-\eta\sigma^2(1-(\delta-\gamma)))\exp(\eta(1-(\delta-\gamma))\{y-\mu\}+\eta^2\sigma^2(1-(\delta-\gamma))^2/2)}{1-\beta}$$

(16)

The closed-end country fund share price premium over net asset value is then

Premium = $P_F^d - P_F^f$ =

$$\frac{\beta}{1-\beta}[(\mu-\eta\sigma^2(1+T))\exp(\eta(1+T)\{y-\mu\}+\eta^2\sigma^2(1+T)^2/2)$$

$$-(\mu-\eta\sigma^2(1-T))\exp(\eta(1-T)\{y-\mu\}+\eta^2\sigma^2(1-T)^2/2)] \quad (17)$$

where T is the difference between δ and γ. The domestic investor's ownership claim on the foreign asset is (1+T) while that of the foreign investor is (1-T). When the ownership restrictions are binding,

$$Var(P_F^f) = \left(\frac{\beta}{1-\beta}\right)^2 (\mu - \eta\sigma^2(1-T))^2 \times$$

$$\exp(2\eta^2\sigma^2(1-T)^2)\,[\exp(\eta^2\sigma^2(1-T)^2)-1] \qquad (18)$$

and

$$Var(P_F^d) = \left(\frac{\beta}{1-\beta}\right)^2 (\mu - \eta\sigma^2(1+T))^2 \times$$

$$\exp(2\eta^2\sigma^2(1+T)^2)\,[\exp(\eta^2\sigma^2(1+T)^2)-1] \qquad (19)$$

When $T = \delta - \gamma > 0$, under smooth consumption domestic investors have more y to invest in the foreign asset than foreign investors do.

The higher the y, the higher the asset price. Under an assumption of smooth consumption, as y increases the portion of y to invest in the foreign asset increases, which increases asset price P_F^d more than P_F^f. If y is small, both investors may not be able to invest in the foreign asset. Therefore, the price will not be much affected. This implies that the variance of P_F^d is greater than the variance of P_F^f. It is difficult to show analytically the relative size of $var(P_F^d)$ over $var(P_F^f)$. However, in some special cases, we can prove it. For instance, if σ^2 is very small, then σ^4 approaches 0. In that case, the variance ratio reduces to

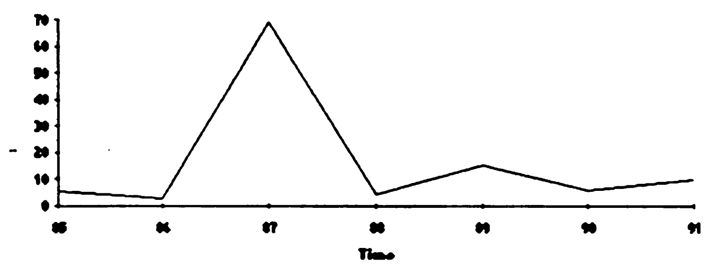
$$\frac{Var(P_F^d)}{Var(P_F^f)} = \frac{(1+T)^2}{(1-T)^2}. \tag{20}$$

This is greater than 1 as long as T is positive.

The limitation of this model lies in the assumption of a single asset. Lucas's model assumes a single asset which is shared by the domestic and foreign investor. Therefore, there is no diversification possibility in this economy. In EJ's model, investors pay a premium for diversification. In Lucas's model, endowment y determines the level of the foreign asset premium. The higher the claim on y, the higher the asset price and hence the premium. Single-asset models such as this are unable to capture the diversification effect such as in Eun and Janakiramanan [1986].

Figure II-1 Variance ratio (variance of Korea fund price over variance of Korea fund NAV)

This figure shows the actual annual variance ratio {var(fund share price)/var(net asset value)} changes based on monthly observations. Variance ratio is always far greater than 1, which means that the variance of fund share is greater than the variance of net asset value. In contrast to what the theoretical model predicts, the variance ratio does not show monotonic increases as investment restrictions are loosened. Therefore, other factors should also be considered.



APPENDIX II-A **Exponential Utility**

This appendix derives equations (13) and (14) using a negative exponential utility function. Define the indirect utility function for agent k as:

$$U(y,z_D^k,z_F^k)=\max[-(\frac{1}{\eta})\exp(-\eta C^k)+\beta\int U(y',x_D^k,x_F^k)\,dG(y')]$$

$$=\max[-(\frac{1}{\eta})\exp(-\eta\{y(z_D^k+z_F^k)+P_D^k(z_D^k-x_D^k)+P_F^k(z_F^k-x_F^k)\})$$

$$+\beta E\{U(y',x_D^k,x_F^k)\}] \qquad (A\text{-}1)$$

where η is the absolute risk aversion for both agents and E is an expectation operator. Imposing the stationary condition that all shares are held by investors throughout the period ($z_D^k = x_D^k$ and $z_F^k = x_F^k$) results in the indirect utility function[5]

$$U(y,x_D^k,x_F^k)=-(\frac{1}{\eta})\exp(-\eta y(x_D^k+x_F^k))+h(x_D^k,x_F^k) \qquad (A\text{-}2)$$

Substituting (A-2) into (A-1) yields,

$$U(y,z_D^k,z_F^k)$$

$$=\max[-(\frac{1}{\eta})\exp(-\eta y\{z_D^k+z_F^k\}+P_D^k(z_D^k-x_D^k)+P_F^k(z_F^k-x_F^k)\})$$
$$+\beta\{-(\frac{1}{\eta})\exp(-\eta\mu(x_D^k+x_F^k)+\eta^2\sigma^2(x_D^k+x_F^k)^2/2)+h(x_D^k,x_F^k)\}] \qquad (A\text{-}3)$$

---

[5]The existence and uniqueness of the indirect utility function have been proved by Lucas [1978].

Using the stationary condition $z_D^k = x_D^k, z_F^k = x_F^k$, let

$$B(x_D^k, x_F^k) = -\left(\frac{1}{\eta}\right)\exp\left(-\eta\mu(x_D^k+x_F^k) + \eta^2\sigma^2(x_D^k+x_F^k)^2/2\right), \tag{A-4}$$

$$A(x_D^k, x_F^k) = B(x_D^k, x_F^k) + h(x_D^k+x_F^k). \tag{A-5}$$

Then

$$U(y, x_D^k, x_F^k) = -\left(\frac{1}{\eta}\right)\exp\left(-\eta y(x_D^k+x_F^k)\right) + \beta A(x_D^k, x_F^k)$$

$$= -\left(\frac{1}{\eta}\right)\exp\left(-\eta y(x_D^k+x_F^k)\right) + h(x_D^k, x_F^k). \tag{A-6}$$

Then from the above relationship,

$$\beta\left[B(x_D^k, x_F^k) + h(x_D^k, x_F^k)\right] = h(x_D^k, x_F^k). \tag{A-7}$$

Solving for $h(x_D^k, x_F^k)$ yields

$$h(x_D^k, x_F^k) = \frac{\beta B(x_D^k, x_F^k)}{1-\beta}. \tag{A-8}$$

Therefore,

$$A(x_D^k, x_F^k) = \frac{B(x_D^k, x_F^k)}{1-\beta}$$

$$= \frac{-\exp\left(-\eta\mu(x_D^k+x_F^k) + \eta^2\sigma^2(x_D^k+x_F^k)^2/2\right)}{\eta(1-\beta)}. \tag{A-9}$$

The first order condition for (A-3) with respect to x_F^k is

$$-P_F^k \exp(-\eta y(x_D^k+x_F^k)) + \beta A'(x_D^k, x_F^k) = 0 \qquad (A\text{-}10)$$

where

$$A'(x_D^k, x_F^k) = \frac{-[-\eta\mu+\eta^2\sigma^2(x_D^k+x_F^k)]\exp(-\eta\mu(x_D^k+x_F^k)+\eta^2\sigma^2(x_D^k+x_F^k)^2/2)}{\eta(1-\beta)} \qquad (A\text{-}11)$$

Plugging equation (A-11) into (A-10) and rearranging yields

$$P_F^k \exp(-\eta y(x_D^k+x_F^k))$$

$$=\beta\frac{(\eta\mu-\eta^2\sigma^2(x_D^k+x_F^k))\exp(-\eta\mu(x_D^k+x_F^k)+\eta^2\sigma^2(x_D^k+x_F^k)^2/2)}{\eta(1-\beta)}. \qquad (A\text{-}12)$$

Therefore, the equilibrium price of the foreign asset to agent k is

$$P_F^k = \frac{\beta(\mu-\eta\sigma^2(x_D^k+x_F^k))\exp(\eta(x_D^k+x_F^k)\{y-\mu\}+\eta^2\sigma^2(x_D^k+x_F^k)^2/2)}{1-\beta}$$

$$=C(x_D^k, x_F^k)\exp[\eta(x_D^k+x_F^k)y]. \qquad (A\text{-}13)$$

This implies that the asset price for agent k is a function of x_D^k , x_F^k and y, where

$$C(x_D^k,x_F^k)=\frac{\beta(\mu-\eta\sigma^2(x_D^k+x_F^k))\exp(-\eta(x_D^k+x_F^k)\mu+\eta^2\sigma^2(x_D^k+x_F^k)^2/2)}{1-\beta}.$$

(A-14)

Since $C(x_D^k,x_F^k)$ is a constant term,

$$Var(P^k(y))=(C(x_D^k,x_F^k))^2\times Var(\exp[\eta(x_D^k+x_F^k)y]). \qquad (A-15)$$

The stochastic component of equation (A-15) is

$$Var(\exp[\eta(x_D^k+x_F^k)y])$$

$$=E(\exp[2\eta(x_D^k+x_F^k)y])-\{E(\exp[\eta(x_D^k+x_F^k)y])\}^2 \qquad (A-16)$$

Now, the second term of equation (A-16) is

$$E(\exp[\eta(x_D^k+x_F^k)y])=\frac{1}{\sqrt{2\pi}\sigma}\int_{-\infty}^{\infty}\exp(\eta(x_D^k+x_F^k)y)\exp(\frac{-[y-\mu]^2}{2\sigma^2})\,dy$$

(A-17)

We can expand the term in the integral of equation (A-17) as follows:

$$\exp(\eta(x_D^k+x_F^k)y)\exp(\frac{-[y-\mu]^2}{2\sigma^2})$$

$$=\exp[-\frac{1}{2\sigma^2}\{y^2-2(\mu+\sigma^2\eta(x_D^k+x_F^k))y+\mu^2\}]$$

$$=\exp[\mu\eta(x_D^k+x_F^k)+\frac{\sigma^2\eta^2(x_D^k+x_F^k)^2}{2}]\exp[-\frac{1}{2\sigma^2}(y-(\mu+\sigma^2\eta(x_D^k+x_F^k)))^2]$$

(A-18)

Therefore,

$$E[\exp(\eta(x_D^k+x_F^k)y)] =$$

$$\frac{\exp[\mu\eta(x_D^k+x_F^k)+\frac{\sigma^2\eta^2(x_D^k+x_F^k)^2}{2}]}{\sqrt{2\pi}\sigma}\int_{-\infty}^{\infty}\exp-\frac{1}{2\sigma^2}[y-(\mu+\sigma^2\eta(x_D^k+x_F^k)]^2dy. \quad \text{(A-19)}$$

Now, $y \sim N(\mu+\sigma^2\eta(x_D^k+x_F^k), \sigma^2)$.

since

$$f(y)=\frac{1}{\sqrt{2\pi}\sigma}\exp[-\frac{1}{2\sigma^2}(y-(\mu+\sigma^2\eta(x_D^k+x_F^k)))^2] \quad \text{(A-20)}$$

and

$$\int_{-\infty}^{\infty} f(y)\,dy=1, \quad \text{(A-21)}$$

then plugging (A-20) into (A-21) yields

$$\int_{-\infty}^{\infty}\exp[-\frac{1}{2\sigma^2}(y-(\mu+\sigma^2\eta(x_D^k+x_F^k)))^2]\,dy=\sqrt{2\pi}\sigma \quad \text{(A-22)}$$

$$\therefore,\ E(\exp[\eta(x_D^k+x_F^k)y])=\exp[\eta(x_D^k+x_F^k)(\mu+\frac{\sigma^2\eta(x_D^k+x_F^k)}{2})]. \qquad (A\text{-}23)$$

By using the same method we obtain,

$$E(\exp[2\eta(x_D^k+x_F^k)y])=\exp[2\eta(x_D^k+x_F^k)(\mu+\sigma^2\eta(x_D^k+x_F^k))] \qquad (A\text{-}24)$$

$$\therefore,\ Var(\exp[\eta(x_D^k+x_F^k)y])=$$

$$\exp[2\eta(x_D^k+x_F^k)(\mu+\sigma^2\eta(x_D^k+x_F^k))]-\exp[2\eta(x_D^k+x_F^k)(\mu+\frac{\sigma^2\eta(x_D^k+x_F^k)}{2})]$$

(A-25)

As $Var(P_F^k)=C(x_D^k,x_F^k)^2Var(\exp[\eta(x_D^k+x_F^k)y])$,

$$Var(P_F^k)$$

$$=[\frac{\beta(\mu-\eta\sigma^2(x_D^k+x_F^k))\exp(-\eta(x_D^k+x_F^k)\mu+\eta^2\sigma^2(x_D^k+x_F^k)^2/2)}{1-\beta}]^2$$

$$\times\ \exp(2\eta(x_D^k+x_F^k)\mu+\eta^2(x_D^k+x_F^k)^2\sigma^2)(\exp(\eta^2(x_D^k+x_F^k)^2\sigma^2)-1)$$

$$=(\frac{\beta}{1-\beta})^2(\mu-\eta\sigma^2(x_D^k+x_F^k))^2\times$$

$$\exp(2\eta^2\sigma^2(x_D^k+x_F^k)^2)\,[\exp(\eta^2\sigma^2(x_D^k+x_F^k)^2)-1] \qquad (A\text{-}26)$$

These simplify as equations (13) and (14):

$$Var(P_F^f)=(\frac{\beta}{1-\beta})^2(\mu-\eta\sigma^2(x_D^f+x_F^f))^2\times$$

$$\exp(2\eta^2\sigma^2(x_D^f+x_F^f)^2)\,[\exp(\eta^2\sigma^2(x_D^f+x_F^f)^2)-1]\,. \qquad (13)$$

$$Var(P_F^d)=(\frac{\beta}{1-\beta})^2(\mu-\eta\sigma^2(x_D^d+x_F^d))^2\times$$

$$\exp(2\eta^2\sigma^2(x_D^d+x_F^d)^2)\,[\exp(\eta^2\sigma^2(x_D^d+x_F^d)^2)-1]\,. \qquad (14)$$

APPENDIX II-B **Log Utility**

Michener [1982] derived a closed-form solution of an asset price in a pure exchange economy based on a log utility function. Assume a Lucas' [1974] economy and utility function

$$\sum_{t=0}^{\infty} \beta^t \log C_t \quad where \quad 0<\beta<1 \qquad (B\text{-}1)$$

where ß : discount rate

C_t : consumption at time t.

As in Lucas, there is only one asset in this world. Michener uses an example of shares in a fruit tree which produces its nonstorable consumption good y, following the Markov process:

$$\ln y' = \alpha \ln y + \epsilon_t \quad where \; 0 \le \alpha < 1, \; \epsilon_t \sim N(0,\sigma^2). \qquad (B\text{-}2)$$

As there is no storage or investment, c=y*z in equilibrium and the budget constraint is

$$Wealth = yz + P(y)z = c + P(y)x \qquad (B\text{-}3)$$

where z is beginning-of-the period number of shares and x is end-of-period number of shares.

Let the value function be

$$V(y,z) = \max_{(c,x)} [U(c) + \beta \int_{\Omega} V(y',x)\, dF(y'|y)]. \qquad (B\text{-}4)$$

Conjecturing

$$P(y)=a_1y \text{ and } V(y,z)=k_0'+k_1'\log\text{ (Wealth)}+k_2'\log y \qquad (B\text{-}5)$$

yields

$$V(y,z)=k_0'+k_1'\log[yz+P(y)z]+k_2'\log y$$

$$=k_0+k_1\log z+k_2 \log y. \qquad (B\text{-}6)$$

Provided that V(y,z) has the conjectured form,

$$k_0+k_1\log z+k_2\log y=\max_x\{\log[yz+a_1y(z-x)]$$

$$+\beta\int_\Omega(k_0+k_1\log x+k_2\log y')\,dF(y'|y)\}$$

$$=\max_x\{\log[yz+a_1y(z-x)]+\beta E(k_0+k_1\log x+k_2\log y')\}$$

$$=\max_x\{\log[yz+a_1y(z-x)]$$

$$+\beta(k_0+k_1\log x+k_2\alpha\log y)\}. \qquad (B\text{-}7)$$

The first order condition with respect to x is

$$\frac{\partial V}{\partial x}=\frac{-a_1y}{yz+a_1y(z-x)}+\frac{\beta k_1}{x}=0 \qquad (B\text{-}8)$$

Under the stationary condition (z=x), this gives the relationship

$$-a_1+\beta k_1=0 \qquad (B\text{-}9)$$

and

$$k_0+k_1\log x+k_2\log y=\log y+\log x+\beta\,(k_0+k_1\log x+k_2\alpha\log y)\,. \qquad (B\text{-}10)$$

From this, we can get

$$P(y)=a_1y=\beta k_1y=\frac{\beta}{1-\beta}y. \qquad (B\text{-}11)$$

since

$$k_0=0,\,k_1=\frac{1}{1-\beta},\,k_2=\frac{1}{1-\beta\alpha} \qquad (B\text{-}12)$$

Note that x is not a factor affecting P(y). Therefore, under the log utility function, a delta constraint can not be imposed in this economy.

APPENDIX II-C <u>Power Utility</u>

In this appendix, I derive a closed-form price solution for asset y using a power utility function in Lucas'[1974] economy. If x (end-of-period number of shares) is in the price function we can impose an ownership restriction since, when the ownership restriction is binding, $x=\delta$. If we don't have x in the price function, we can not impose a delta constraint on the end-of-period number of shares and the power utility function will not help us impose an ownership restriction in this economy.

Let, $Y = e^y$ where y is the stochastic endowment.

$$lnY\sim N(\mu,\sigma^2),\ E(Y^r)=Ee^{ry}=e^{r\mu+\frac{1}{2}r^2\sigma^2}=A. \qquad (C\text{-}1)$$

People maximize the following utility function :

$$U(Y,z^k)=\max\{-(1/r)[(Yz^k+P^k(Y)(z^k-x^k)]^r+\beta E[U(Y',x^k)]\} \qquad (C\text{-}2)$$

Subject to

$$C+P^k(Y)x^k<Yz^k+P^k(Y)z^k. \qquad (C\text{-}3)$$

Conjecture

$$U(Y,z^k)=-(1/r)(Yz^k)^r+\beta f(z^k). \qquad (C\text{-}4)$$

Substituting (C-4) into (C-2) yields,

$$-(1/r)(Yz^k)^r+\beta f(z^k)$$

$$=\max\{-(1/r)[(Yz^k+P^k(Y)(z^k-x^k)]^r+\beta E[-(1/r)(Yx^k)^r+\beta f(x^k)]\}$$

$$=\max\{-(1/r)[(Yz^k+P^k(Y)(z^k-x^k)]^r+\beta E[-(1/r)A(x^k)^r+\beta f(x^k)]\}.$$

By using $x^k = z^k$(stationary condition), we obtain

$$\beta(-1/r)A(z^k)^r+\beta^2 f(z^k)=\beta f(z^k). \qquad (C\text{-}6)$$

Rearranging (C-6) yields

$$f(z^k)=\frac{1}{1-\beta}(-1/r)A(z^k)^r. \qquad (C\text{-}7)$$

Now the utility function (C-5) can be rewritten as

$$U(Y,z^k)=\max\{-(1/r)(Yz^k+P^k(Y)(z^k-x^k)]^r$$

$$+\frac{\beta}{1-\beta}(-1/r)A(z^k)^r\}. \qquad (C\text{-}8)$$

Therefore, from (C-1),

$$U(Y,z^k)=-(1/r)(Yz^k+P^k(Y)(z^k-x^k)]^r+\frac{\beta}{1-\beta}[-(1/r)(e^{r\mu+\frac{1}{2}r^2\sigma^2})(z^k)$$

(C-9)

Taking the derivative with respect to x^k yields

$$\frac{\partial \max}{\partial x^k} = P^k(Y)\,[\,(Yz^k + P^k(Y)\,(z^k - x^k))\,]^{r-1} + \frac{\beta}{1-\beta}\,[-(1/r)\,(e^{r\mu+\frac{1}{2}r^2\sigma^2})\,(x^k)^{r-}$$

(C-10)

Solving for $P^k(Y)$ yields

$$P^k(Y) = (\frac{\beta}{1-\beta})\,(1/r)\,[e^{r\mu+\frac{1}{2}r^2\sigma^2}]\,Y^{1-r}. \qquad (C\text{-}11)$$

Therefore, imposition of a delta restriction is not possible since the x variable does not appear in (C-11).

ESSAY III. An Empirical Investigation into the Determination of Closed-End Country Fund Premiums/Discounts and Volatilities

Introduction.

The key assumption of Eun and Janakiramanan's[1986] international asset pricing model with a constraint on foreign investment is that investors have homogeneous expectations regarding asset returns and variances. The ownership restriction then affects foreign and domestic prices through a diversification effect. In contrast, Lee et al's [1990] investor sentiment hypothesis is based on an assumption of heterogeneous expectations. This essay is an empirical investigation into which of these effects is predominant in Closed-End Country Fund (CECF) premiums, discounts and premium/discount volatilities.

1. CECF premiums/discounts and ownership restrictions

1.1 Long-run evidence : The case of the Korea Fund

There was a time period during which the only available investment tool in the Korean stock market for non-Korean investors was the Korea fund (NYSE symbol 'KF'). During this time, the Korea Fund represented a proxy for Eun and

Janakiramanan's foreign equity ownership constraint (δ) in the Korean market. This section documents and interprets the Korea Fund's premium over net asset value which has existed since its inception in 1984.

The Korea Fund provided the following information :

a. The daily per share market price of the Korea fund and its underlying net asset value between 1984-1991.

b. Korea fund shares outstanding during the period on a daily basis.

c. Korean stock market index during the period on a daily basis.

From this data, the following two indices were constructed :

a. The total Korean stock market value on a daily basis. This index is based on the market value as of 1/1/80 when we put the market value at that time as 100 (2,609,400,000,000 Korean won).

b. The ratio of the NAV of the Korea Fund over the total Korean stock market value. This ratio is used as a proxy for the proportion of non-Korean ownership of Korean stocks allowed by the Korean government. This was an appropriate proxy during the period when the Korea fund was the only available investment instrument. The ratio increased throughout the 1980's as the Korean government allowed progressively more non-Korean investment in Korean equities. This ratio is our proxy for Eun and Janakiramanan's (EJ) delta constraint δ.

Figure III-1A plots the Korea Fund premium-to-NAV alongside the ratio of Korea Fund NAV to the Korean Stock Exchange market value. According to EJ, premiums should be an inverse function of delta. As we can see from figure III-1, movement in the Korea Fund premium relative to changes in the delta restriction shows that EJ's model is not sufficient to explain the observed behavior of CECF premiums. The premium rose and then fell during these period even though the delta constraint on foreign ownership of Korean stocks was increasingly less restrictive throughout this period.

The following regression was run using daily observations over the period (1984.9-1987.3) when the Korea fund was the only fund available for non-Korean investors. (i.e. before other Korean funds emerged, such as the Korea Europe fund, Korea Asia Fund, Korea Investment Fund, and so forth). (See Table III-1)

$PREMIUM = A + B*\Delta\delta + C*NASDAQ$

where $\Delta\delta$ (Change in the ratio of the NAV of the Korea Fund over the total Korean stock market value) is a proxy for the change in foreign ownership constraint and NASDAQ (NASDAQ index return) is a proxy for investor sentiment.

$H_0 : B = 0$

$H_A : B < 0$

The regression results in Table III-1 show that coefficient of δ is significantly positive.[6] This is inconsistent with EJ's model. Increase in delta should have resulted in a decrease in the premium according to their model. However, the opposite happened.

1.2 Short-run evidence

Bonser-Neal et al [1990] (BBNW) find that changes in fund premiums are related to announcements of changes in investment restrictions. In particular, they test whether announcements of liberalization of foreign or domestic restrictions are associated with declines in premiums and announcements of tightening of restrictions with rises in the premiums. Ceterus paribus, constraining the foreign ownership restriction will raise the price/net asset value ratio by approximately the amount the marginal domestic investor is going to pay to avoid the restriction. BBNW's

[6]Figure III-1B illustrates that residuals are relatively randomly distributed.

conclusion is that government regulation can be effective in segmenting markets.

BBNW use the following dummy variable regression model:

$$\pi_{jt}=\delta_{0j}+\delta_{1j}D_{1jt}+\delta_{2j}D_{2jt}+\delta_{3j}D_{3jt}+\epsilon_{jt}, \quad j=1,2,3,4,5.$$

where

π_{jt} : change in the jth fund's premium in week t.

D_{1jt} = 1(-1) if t is between two and seven weeks before the announcement of a loosening (tightening) of the jth country's investment restrictions.

D_{2jt} = 1(-1) if t is between one week before and one week after the announcement of a loosening (tightening) of the jth country's investment restrictions.

D_{3jt} = 1(-1) if t is between two and seven weeks after the announcement of a loosening (tightening) of the jth country's investment restrictions.

δ_{1j} : The average weekly effect before the announcement of regulatory changes on the jth fund's premiums/discounts.
δ_{2j} : The average weekly change in the premium or discount during the three-week period surrounding the announcement.
δ_{3j} : The average weekly effect after the announcement of regulatory changes on the jth fund's premiums/discounts.

The regression coefficients measure the average weekly effects of announced changes in investment restrictions on closed-end country fund premiums/discounts.

After adjusting for dividends and missing data, BBNW ran the dummy variable regression above. Their results show that δ_{1j} and δ_{2j} are significantly negative at the 1% level when an event-weighted test was performed.[7] The negative signs on these coefficients mean that, on average, the premium (discount) decreased (increased) over the 5-week period before the announcements and over the 3-week period around the announcements. However, among the five CECFs tested, Japan Fund and Taiwan Fund yielded insignificant results.

Following Bergström et al [working paper], we differentiate between capital inflow and outflow restrictions. By adding a capital outflow constraint to EJ's model, Bergström et. al. derive closed-form solutions for P^d_F and P^f_F. An outflow constraint and an inflow or δ constraint operate in opposite directions. With a capital outflow constraint (such as Bergström's switch currency constraint), the discount demanded by the domestic investors for holding domestic assets is lower, since foreign assets are not so attractive with a binding capital outflow constraint. Therefore, unlike the BBNW model, dummy

[7]Figure III-2 shows that residuals for BBNW regression are randomly distributed.

variables are -1 if the announcement involves tightening of an inflow restriction or loosening of an outflow restriction, and 1 if loosening of an inflow restriction or tightening of an outflow restriction. Results are reported in Table III-2. No coefficients are significant at a 5% significance level.[8] The results imply that the announcement effect of a change in an investment ownership restriction cannot by itself explain the changes in CECF premiums surrounding these events.

1.3. Critique of BBNW study

There are several points that concern us regarding the Bonser-Neal et al [1990] study. These include the following.

a. Theoretical basis:

Following EJ's theoretical framework, Bergström et al [working paper] show that with in-and-outflow constraints foreign investors pay a premium for domestic assets and domestic investors pay a premium for foreign assets. They used restricted shares which are available for foreign(i.e. home country) investors only, and unrestricted shares which

[8]We also test with the events related to changes in capital inflow restrictions only. With BBNW data, only δ_{1j} is significantly negative at 5% significance level. With updated data, no coefficients are significant at 5% significance level.

are available for both foreign and domestic investors. BBNW did not differentiate between inflow and outflow constraints. They treated them the same and only looked at whether the restrictions were tightened or loosened.

b. Number of events:

BBNW used only 23 events. Only two of these are announcements of tightening in an investment restriction. In the empirical analysis which follows, we were able to add 8 more events. Hopefully, this will lead to a more robust test of the relation between changes in CECF premiums and changes in investment restrictions.

1.4 Controlling for investor sentiment

In EJ's model, the price of fund shares and NAVs are a function of the absolute risk aversion of the foreign and the domestic agents and the delta constraint.

$$P_F^d - P_F^f = f(A^D, A^F, \delta)$$

Lee's study suggests that differential sentiment of U.S. investors relative to their foreign counterparts affects the closed-end country fund premiums. While EJ's model restricts the 'sentiment' to risk aversion, LST use the sentiment to indicate either higher/lower expected returns or lower/higher risk aversion between domestic and foreign investors.

Assuming that $\Delta\delta$ (announcement of changes in investment restrictions) is linearly related to the Δpremium, changes in investor sentiment can be 'backed out' with 2SLS:

1. $\Delta Premium = a + b\Delta S + e$
2. $e = \alpha + \beta\Delta\delta + u$

where ΔS is a proxy for investor sentiment changes. Just as Lee et. al. used changes in value weighted discounts on closed-end funds (CEFs) as a proxy for investor sentiment changes, we can form and use a CECF premium index as a proxy for investor sentiment regarding foreign investment. This is equivalent to controlling the relation between the Δpremium and $\Delta\delta$ for changes in investor sentiment with a multiple regression.

The following hypothesis is tested here.

H_0 : Change in δ is independent of change in the CECF premium.

H_A : Loosening δ decreases the premium and tightening δ increases the premium.

As a proxy for change in investor sentiment, ΔS, across all

CECFs, we construct an index of all CECF premium changes and use the difference e = Δpremium (world-adjusted) = Δpremium in jth fund - ΔAverage premium across all other funds in the second stage regression. This assumes a=0 and b=1 in the first stage regression.

Δpremium (world-adjusted) = Δpremium in jth fund -

$$[\frac{1}{N-1}\sum_{i=1}^{N} \Delta premium_i]$$

The relation between Δpremium and Δδ (announcement of changes in investment restrictions) after controlling for changes across all CECF's is then

Δpremium = $\alpha-\beta\Delta\delta$.

where Δpremium is the change in the jth CECF premium minus the average premium change in other funds over the period.

This regression equation controls for U.S. investor sentiment regarding foreign investment and hence looks at the pure announcement effect of an investment restriction change. BBNW's study is based on 23 events. When we looked up the announcement dates in the WSJ index, we found eight additional announcement dates which are clustered for several particular funds. Considering the fact that differential risk aversion and investor sentiment can affect premiums/discounts, we think an update of the data may yield more conclusive results than BBNW's study. We ran the test with their original data and with our updated data. If this test yields an insignificant result, the announcement effect of investment restriction changes may not be a significant factor in CECF premium/discount changes. Results are reported in Table III-3. After controlling for investor sentiment, the announcements do not seem to affect CECF premium changes.

According to LST, stocks and Closed-End Funds (CEFs) with low institutional ownership are more sensitive to changes in investor sentiment than CEFs with high institutional ownership. In other words, CEFs and small stock prices in which institutional ownership is usually low tend to move together with changes in the sentiments of individual investors. If the ownership structure of CECFs resembles that of CEFs and small stocks, changes in U.S. investor sentiment regarding foreign investment should affect CECF prices. Foreign investor sentiment change should directly affect only the NAV. Therefore, the ΔCECF premium reflects change in differential investor sentiment. One item to note is that the underlying assets of CECFs are usually the largest stocks in foreign countries with high institutional ownership, while the fund shares are largely owned by small U.S. investors.

Two hypotheses are tested. First,

H_0 : U.S. small stock market returns are independent of ΔCECF premiums

H_A : ΔCECF premiums widen (narrow) when U.S. small stock market returns are high (low) and vice versa.

NASDAQ index returns were regressed on the CECF premium change index (WPINX). Table III-4 reports that they are significantly positively correlated at 1% level. This tells us that small investor sentiment, which is represented by the NASDAQ index return, is an important factor affecting CECF premiums/discounts. NASDAQ returns mostly affect CECF share prices, not the NAV. In other words, domestic investor sentiment affects CECF premiums/discounts by influencing the Fund share prices.

The following hypothesis can also be tested :

H_0 : Foreign market returns are independent of CECF premiums

H_A : CECF premiums narrow (widen) when foreign market returns are high (low) and vice versa.

In Table III-5, the Korean stock market index return at time t-1 is regressed on the change in the Korea Fund premium at time t. They are strongly positively correlated. This means that the premium is larger when the foreign market is performing well. We view this as consistent with the investor sentiment hypothesis. Small investors (major shareholders of CECFs) seem to respond very sensitively to country-specific news. In other words, they overreact and thus increase premium volatilities. Due to the limitation of our data[9], we confine the test only to the Korea Fund. However, tests of other funds are also done by using NAV return as the proxy for foreign market return. Net assets are usually the blue chip stocks in the foreign markets. If the investor sentiment hypothesis holds, the foreign market return should have explanatory power for changes in CECF premiums/discounts. The results (Table III-6) show that some funds' changes in premiums at week t are positively affected by foreign market returns at week t-1. Changes in premiums at week t are negatively related to NAV returns at week t. Therefore, investors seem to respond to some foreign market returns, but U.S. market returns seem to be a more significant factor affecting CECF premiums than the foreign market return.

2. Volatility ratio : CECFs selling at a premium have higher VRs(variance ratios) than those selling at a discount.

[9]We do not have other foreign stock market returns data.

There is a difference between the variance of CECF prices and the variance of their NAVs. In Essay I, we derive the theoretical implication of the volatility ratio ($Var(P^d_F)/Var(P^f_F)$). The ratio is expected to decrease if cov(ND, NF) is negative as ownership constraint is loosened. In most cases, the ownership constraint is loosened as time passes. Therefore, the variance ratios are expected to decrease as time goes on. However, the variance ratios are not monotonically decreasing as the theoretical model predicts.

According to our test results, CECFs selling at premiums usually have higher variances than those selling at discounts (see Table III-7 and III-8). We view this as consistent with Lee's [1990] investor sentiment hypothesis. If institutional investors are rational and small investors are irrational noise traders, the lower the institutional ownership, the higher the noise trader effect on CECF share price volatility. Discounts of CECFs are eliminated as CECFs are open-ended as were Japan fund and France fund.[10] This makes funds selling at discounts attractive to institutional investors since we can expect open-ending at some time in the future. Also, the fact that discounts narrow in a bullish market and widen in a bearish market

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[10]Brickley and Schallheim [1985] find that CEF discounts are real since when they go open-ending share prices increase sharply converge to NAV.

offers rational investors a winning strategy[11].

Premiums on CECFs can be explained by the investor sentiment hypothesis as follows. Unlike domestic CEFs, the underlying assets of CECFs can not be easily duplicated especially for funds with investment restrictions. And individual investors usually can not invest directly in foreign countries mainly due to lack of information. Therefore, CECFs are favored and these could be possible explanations for the existence of CECF premiums. However, institutional investors who can buy the same underlying assets at a lower cost than the CECF share price, do not have to pay a premium for CECFs. In that sense, the institutional ownership of CECFs selling at a premium should be lower than for those funds selling at a discount.

If this is true, assuming that volatility of NAV reflects fundamental volatility, we can conjecture that the variance ratio ($Var(P^d_T)/Var(P^f_T)$) of funds selling at a premium should be higher than the variance ratio of funds selling at a discount. To support this hypothesis, we gathered annual institutional ownership data on CECFs from the Spectrum database. Average annual institutional ownership data for premium funds and discount funds are described in Appendix III-B. Consistent with our expectation, premium funds seem to have lower institutional

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[11]Richards et al [1980] used a filter rule to generate excess returns for CEFs across bull and bear markets.

ownership than discount funds.[12]

One important finding of this research is that CECFs selling at a premium tend to have higher variance ratios. This finding was statistically significant at 1% based on both a Pearson correlation test and a Logit analysis. (Table III-8 and III-9)

3. The relation between premiums/discounts and premium/discount Volatilities

Figure III-5 shows that premium funds' volatility ratio is greater than discount funds' volatility ratio. This means that investors react more sensitively on premium funds than on discount funds. Tables III-8 and III-9 show that funds with higher premiums usually have higher share price/NAV volatilities as well.[13] Share price/NAV volatilities are especially high when premiums are at their highest, but the relation holds at lower premiums and discounts as well.[14] Investor sentiment is presumably

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[12]Regression results (Table III-9) show that there is a negative correlation between CECF premium and institutional ownership.

[13]The relation between fund premiums and the variance of the premium (rather than the share price-to-net asset value ratio) is also positive and significant using either regression or logit analysis

[14]The relationship between Var(CECF share price return)/Var(NAV return) and premiums/discounts is also tested. However, it is not significant at 5% significance level.

responsible for both the premiums (and discounts) and the share price/NAV volatilities.

Summary and Conclusion

These essays investigate factors affecting CECF premiums/discounts and CECF share price/NAV volatilities. CECFs are international assets. Therefore, we studied international asset pricing models with investment barriers which may explain the difference between CECF share price and NAV. Among others, EJ's investment ownership constraints seem to affect premiums paid over foreign asset's NAV. Essay I extends EJ's CAPM-based model to extract the theoretical implication on foreign asset's premiums/discounts and on the volatility ratio. Essay II, based on Lucas's general asset pricing framework, derives closed-form solutions for foreign asset prices and variances when there are ownership constraints. BBNW adopt EJ's theoretical implications in their study of CECF premiums/discounts. However, it is difficult for us to believe that announcements of investment restriction changes alone can explain the CECF premium/discount movement because there are many other factors affecting CECF premiums/discounts such as U.S. investor sentiment or foreign market returns, etc. Essay III, empirically investigates these factors affecting CECF premiums/discounts and premium/discount volatilities.

BBNW's study has at least two shortcomings. First, they did not differentiate between capital inflow and outflow constraints. Second, they used only 23 events. This study shows that the investment ownership constraint is not sufficient to explain changes in CECF premiums/discounts after differentiating capital inflow and outflow restrictions and updating the sample. Results are similar after controlling for the world CECF premium index. There are two other problems associated with using CECFs in a BBNW-type study. First, premiums and discounts tend to move with U.S. investor sentiment and with a foreign market index. A strong correlation was found between a World CECF premium index and the NASDAQ index. Almost all individual fund premium changes are strongly positively correlated both with each other and with the NASDAQ index. (Table III-10 and III-11) On the other hand, the Korea Fund's premium is affected by Korean stock market returns. This means that investors are responding to country-specific news. Out of the 14 funds tested, only 5 funds' NAVs are related to CECF premiums. This could be due to the use of weekly rather than daily data. Also, NAV returns may not be a good proxy for some foreign market returns. But if the proxy is reasonable, foreign market returns may have less of an influence on CECF premiums than U.S. investor sentiment. For a more powerful test, correlations between foreign market returns and CECF premiums/discounts should be considered.

Second, Bailey and Lim [1992] showed that CECF returns move with U.S. market returns, while foreign stock market returns do not move with the U.S. market returns. This was also documented in Lee, Kim and Bodurtha's [working paper] recent study. Lee et. al. conclude that CECF premiums/discounts are affected by U.S. investor sentiments. For this reason, CECFs may not be the best choice for diversification purposes. It would be better to test the impact of ownership restrictions with the restricted foreign stocks available for domestic investors in the foreign stock market. For instance, Korea Mobile Telecom is now selling at more than a 100% premium for non-Korean investors while the Korea Fund is selling close to NAV. It may be fruitful to use individual foreign stocks other than CECFs in tests of factors affecting CECF premiums/discounts.

Finally, we find that the variance ratio (VAR of Share price over VAR of NAV) of CECFs is usually greater than 1. This means that CECF share prices are more volatile than NAVs. Funds selling at large premiums tend to have much higher variance ratios than discount funds. I interpret this as meaning that investors react more sensitively toward premium funds. These results could be due to differential investor sentiments on premium funds and on discount funds since premium funds, on average, have a lower percentage of institutional ownership.

Appendix III-A

Events and data update

France:

7/23/86 - The French Parliament amends the government's denationalization bill by raising the limit on foreign participation in state-owned companies at the time of sale from 15% to 20% (IMF, 1986; and WSJ, 8/1/86, p. 21): Direct investment, loosening, capital inflows.

9/30/86 - The Government plans to announce a move that will allow residents to hold foreign currency bank accounts (WSJ, 10/1/86, p. 37): Foreign exchange accounts, loosening, capital outflows.

Japan:

8/24/81 - Banking sources say that Japanese banking authorities are planning to raise the ceiling on yen-denominated loans outside Japan (WSJ, 8/25/81, p. 34): Commercial banks' international transactions, loosening, capital outflows.

5/17/82 - Japan's Finance Ministry relaxes rules covering yen loans to foreign borrowers (WSJ, 5/18/82, p. 35):

Commercial banks' international transactions, loosening, capital outflows.

1/30/83 - Japan's Finance Ministry announces that it plans to lift the ban on domestic sales of foreign zero-coupon bonds (WSJ, 1/31/83, p. 34): Portfolio investment, loosening, capital outflows.

9/22/83 - The Japanese Finance Ministry says that it is considering easing restrictions on investments in Japanese real estate and stocks by foreigners (WSJ, 9/23/83, p. 34): Direct and portfolio investment, loosening, capital inflows.

4/17/84 - Beryl Sprinkel, under secretary of the U.S. Treasury for monetary affairs, announces an agreement with Japan which gives U.S. and other foreign banks greater access to Japanese financial markets (WSJ, 4/18/84, p. 35): Commercial banks' international transactions, loosening, capital outflows and inflows.

3/28/85 - The Finance Ministry announces that it will increase the number of foreign companies allowed to issue yen-denominated bonds in Japan. In addition, the Ministry announces that it will permit medium to long-term Euroyen loans to foreign companies. Previously, such loans were restricted to maturities of less than one year (WSJ, 3/29/85, p. 32): Portfolio investment, loosening, capital outflows.

6/23/85 - A Ministry of Finance official announces that Japan will open trust banking business and pension funds to 9 foreign banks. Foreigners had anticipated only 8 banks (WSJ, 6/24/85, p. 22): Commercial banks' international transactions, loosening, capital outflows.

10/27/85 - At least 7 U.S. and other non-Japanese brokerage firms have decided to apply for membership on the Tokyo Stock Exchange. This implies that foreign members can make their own trades and avoid paying 27% of their commissions to Japanese members and may facilitate the sale of Japanese stocks abroad (WSJ, 10/28/85, p. 27): Portfolio investment, loosening, capital inflows.

South Korea

12/28/84 - The Ministry of Finance announces that foreign investment will be permitted in 19 additional industries (IMF, 1984): Direct investment, loosening, capital inflows.

6/6/85 - The Finance Ministry announces plans to allow foreign investment in 230 more business areas by 1988 (WSJ, 6/7/85, p. 7): Direct investment, loosening, capital inflows.

10/15/85 - The Finance Ministry announces that it will open an additional 102 business areas to foreign investment (FT, 10/15/85, p. 5; and WSJ, 10/17/85, p. 32): Direct investment, loosening, capital inflows.

12/2/87 - The South Korean government announces that it will allow foreigners to exchange Korean convertible bonds for stock (WSJ, 12/3/87, p. 48): Portfolio investment, loosening, capital inflows.

3/28/88 - South Korean officials said that the government is likely to allow Korean securities, insurance, and investment trust companies to buy foreign stocks (WSJ, 3/29/88, p. 27): Portfolio investment, loosening, capital outflows.

Mexico:

8/13/82 - The Government closes the foreign exchange markets and imposes restrictions on money in foreign currency accounts (WSJ, 8/17/82. p. 33): Foreign exchange accounts, tightening, capital outflows.

6/19/83 - The Government announces that it is relaxing rules governing foreign investment (WSJ, 6/20/83, p. 31): Direct investment, loosening, capital inflows.

2/17/84 - The Government announces a list of priority sectors where majority foreign ownership would be authorized (IMF, 1984): Direct investment, loosening, capital inflows.

1/18/85 - The Government announces that it is rejecting IBM's application to build a 100% IBM-owned microcomputer factory. The IBM project has been "viewed by many foreign investors as a test of Mexico's stated policy of welcoming more 100% foreign-owned projects" (WSJ, 1/21/85, p. 27): Direct investment, tightening, capital inflows.

7/23/85 - The Government reverses its position and accepts a proposal to allow IBM to build its factory (WSJ, 7/24/85, p. 10): Direct investment, loosening, capital inflows.

11/6/85 - The Government places new restrictions on Mexican bank accounts held by foreign bank offices. Most "bankers interpreted the new measures as a means of slowing capital flight" (WSJ, 11/7/85, p. 34): Commercial banks' international transactions, tightening, capital outflows.

Taiwan:

6/14/87 - The Review committees to Taiwan's Parliament approve the lifting of controls on outward foreign exchange movements (FT, 6/15/87, p. 5): Foreign exchange accounts, loosening, capital outflows.

5/5/88 - A Government official announces that Taiwan's cabinet has approved a proposal to allow foreigners to invest in local securities houses. The cabinet also approved plans to increase foreign direct investment in Taiwan (WSJ, 5/6/88, p. 16): Portfolio and direct investment, loosening, capital inflows.

Events update

The limit on foreign equity holding in India will be raised to 51% from 40%, as part of the month-old government's push to open up the nation's economy. New Delhi also said it would remove bureaucratic obstacles to industrial growth. (S)Jl 25/91 - A, 5:4

Mexico is loosening its regulations on foreign investment, opening up its economy to 100% foreign ownership of many enterprises with assets of as much as $100 million; the new regulations are a bid to attract foreign capital at a time when bank credit is dwindling. 5/16/89-A11:3

The Mexican government is promoting new investment instruments that allow foreigners to buy into publicly traded Mexican companies through a trust administered by the state development bank. The procedure grants investors all the privileges of shareholders except voting rights; table. (L)Mr 26/90 - C, 12:1

South Korea is allowing foreign investment of up to 100% in three manufacturing sectors and 99% in advertising agencies. (S)Ja 2/90 - A, 8:2

Seoul plans by the end of 1991 to restrict to about $1 billion annually South Korean firms' total sale of securities on foreign markets. (S)s 25/91 - A, 6:1

Taiwan is about to open its door a little wider to global financial markets by allowing the first local sales of foreign securities. (M)D 17/90 - B, 6C:3

The Taiwan government approved regulations opening Taiwan's stock exchange to direct investment by foreigners, and fund managers may be able to apply in Jan. 1991, (M)D 28/90 -A, 27:5

Taiwan's SEC has proposed easing restrictions on foreign capital in the stock market and other investments. The plan would permit foreign institutions' capital gains to be taken out of the country after three months, instead of a year.

(S)Ag 28/91 - A,5:4

out of the country after three months, instead of a year.

(S)Ag 28/91 - A,5:4

Appendix III-B

Average annual premiums/discounts and institutional ownership of CECFs (1/1/89-12/31/91)

Premium is the annual average of weekly ln(Fund share price/NAV) and the source of institutional ownership data is Spectrum database. Beginning-of-the year institutional ownership was used.

		YEAR		
FUND		89	90	91
Brazil	premium	-0.381	0.1228	0.1103
	inst. ownership	34%	27%	20%
Germany	premium	0.4594	0.049	0.1775
	inst. ownership	3.6%	4%	1%
Swiss	premium	0.1475	-0.103	-0.055
	inst. ownership	7.3%	7%	4%
India	premium		-0.258	-0.05
	inst. ownership		32%	33%
Italy	premium	0.1114	-0.152	-0.217
	inst. ownership	13.3	16	13
Korea	premium	0.6169	0.1096	0.226
	inst. ownership	11.7%	10%	14%

		YEAR		
FUND		89	90	91
Malaysia	premium	0.308	-0.197	-0.162
	inst. ownership	17.2%	13%	9%
Mexico	premium	-0.151	-0.216	-0.127
	inst. ownership	12.8%	18%	28%
Spain	premium	0.8318	0.0313	0.0341
	inst. ownership	1.5%	1%	0%
Taiwan	premium	0.2252	0.2524	0.1147
	inst. ownership	2.2%	2%	1%
UK	premium	-0.082	-0.181	-0.143
	inst. ownership	7%	0%	2%
Average institutional ownership of premium funds		8.1%	8.8%	7.2%
Average institutional ownership of discount funds		18%	14.3%	14.83%

*As we can see from the lower part of the Appendix III-B, the average institutional ownership of a premium fund is lower than that of a discount fund.

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Figure III-1A

Korea Fund premium (1984.9-1991.12)

The changes in Korea fund premium between 1984.9-1991.12 are shown in this figure. The premium is measured as the logarithm of the ratio of the fund's price to its net asset value. If premium is 1, that means KF is selling at 100% premium.

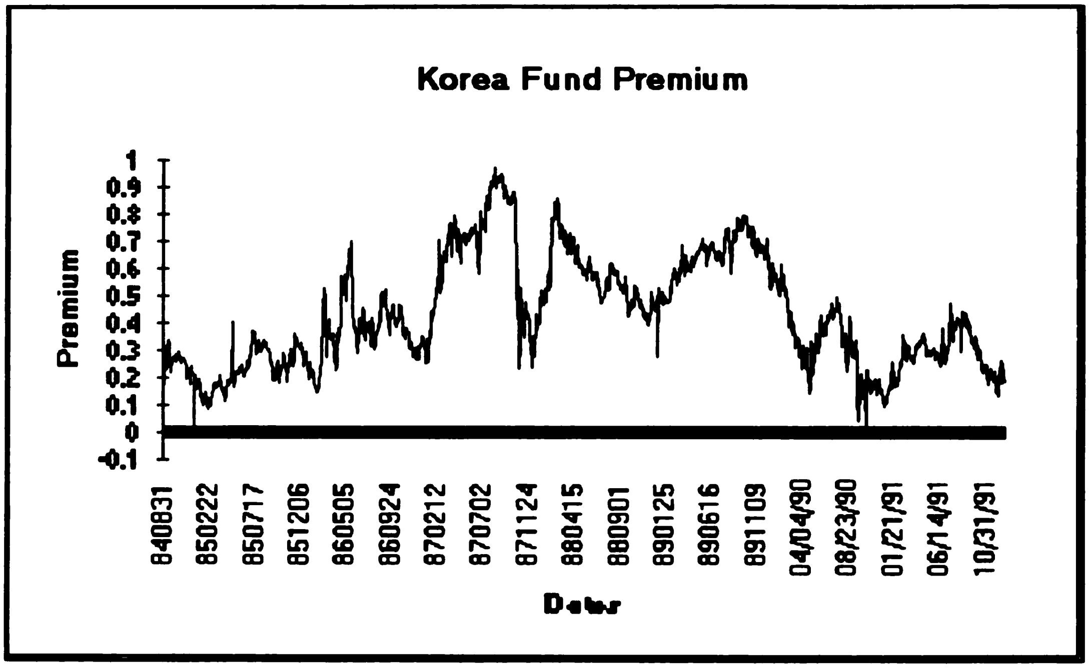


Figure III-1B

The relationship between regression standardized residual and regression standardized predicted value : The case of KF

PREMIUM = A + B*$\Delta\delta$ + C*NASDAQ

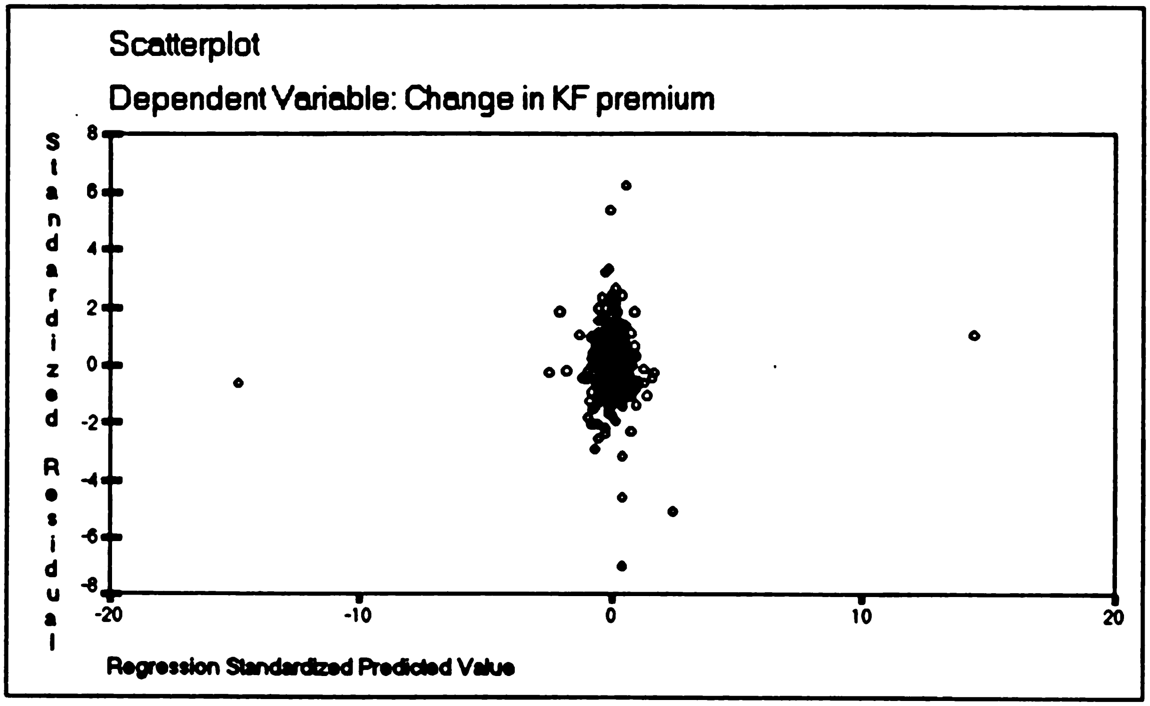


Figure III-2

Scatterplot for residuals and predicted values based on BBNW regression

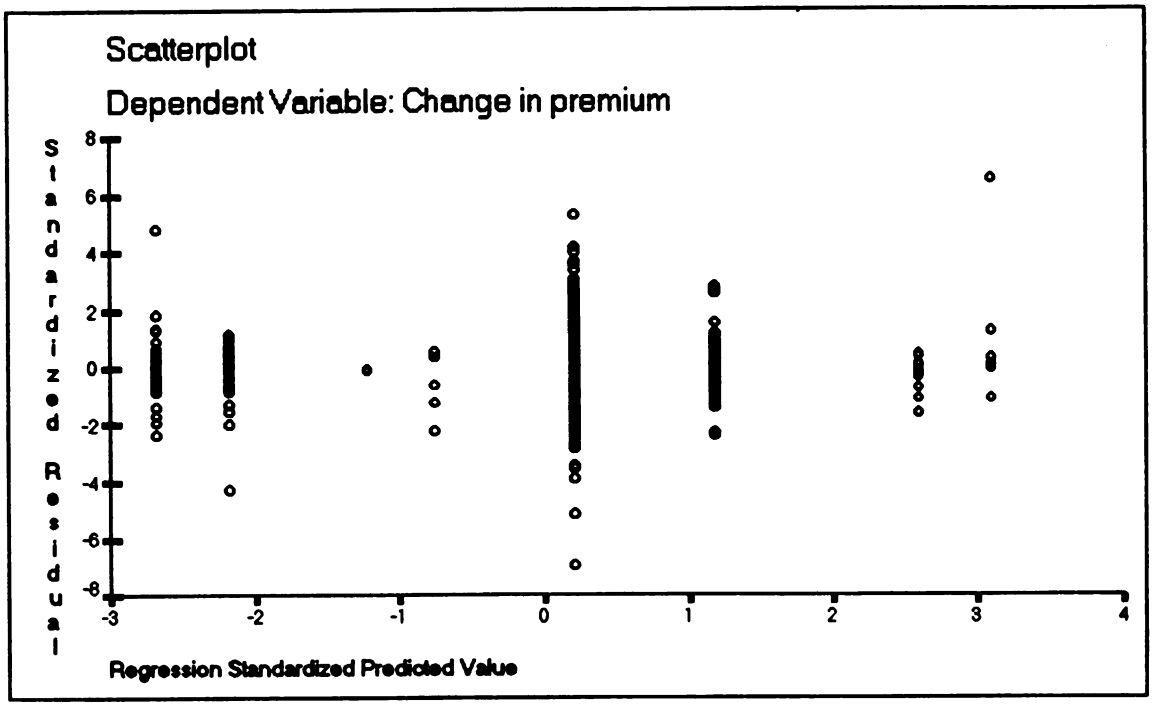
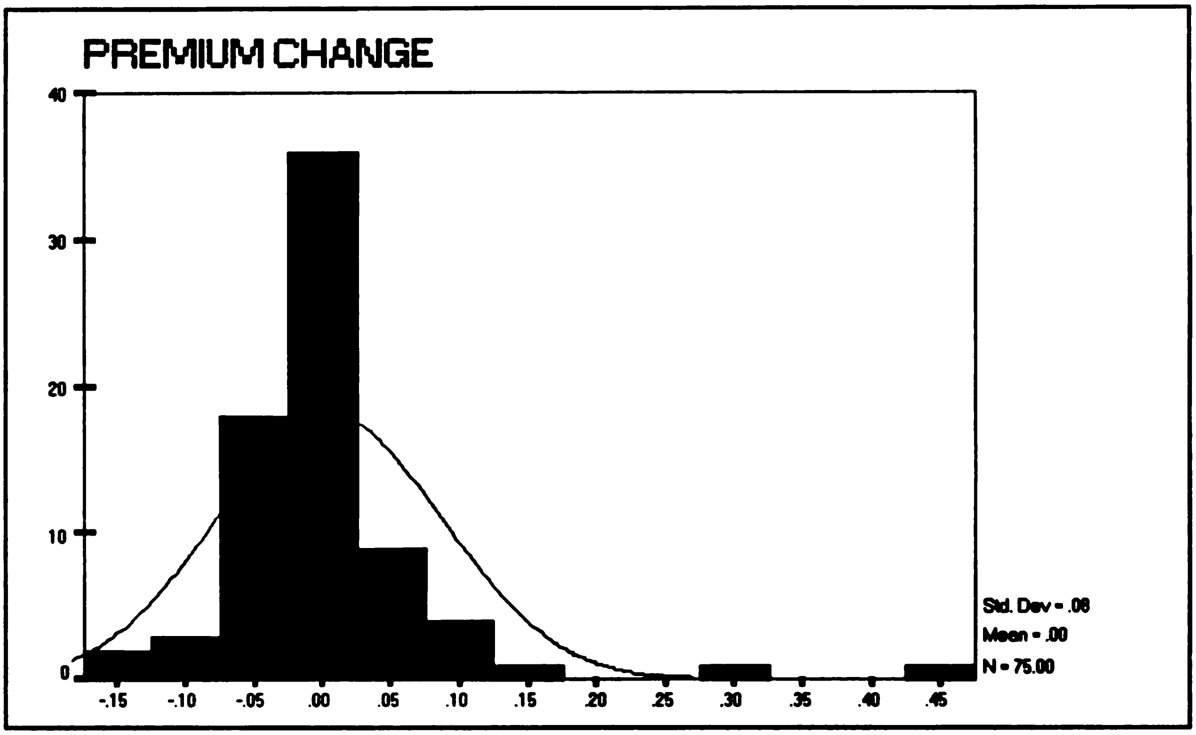


Figure III-3

Premium change during the 3-day event period

(25 events with no missing observations * 3 days per event = 75 observations)



*Normality test was rejected at 1% level as follows.

	Statistic	df	Significance
K-S (Lilliefors)	.2029	75	.0000

The distribution is skewed to the right and clustered around Mean.

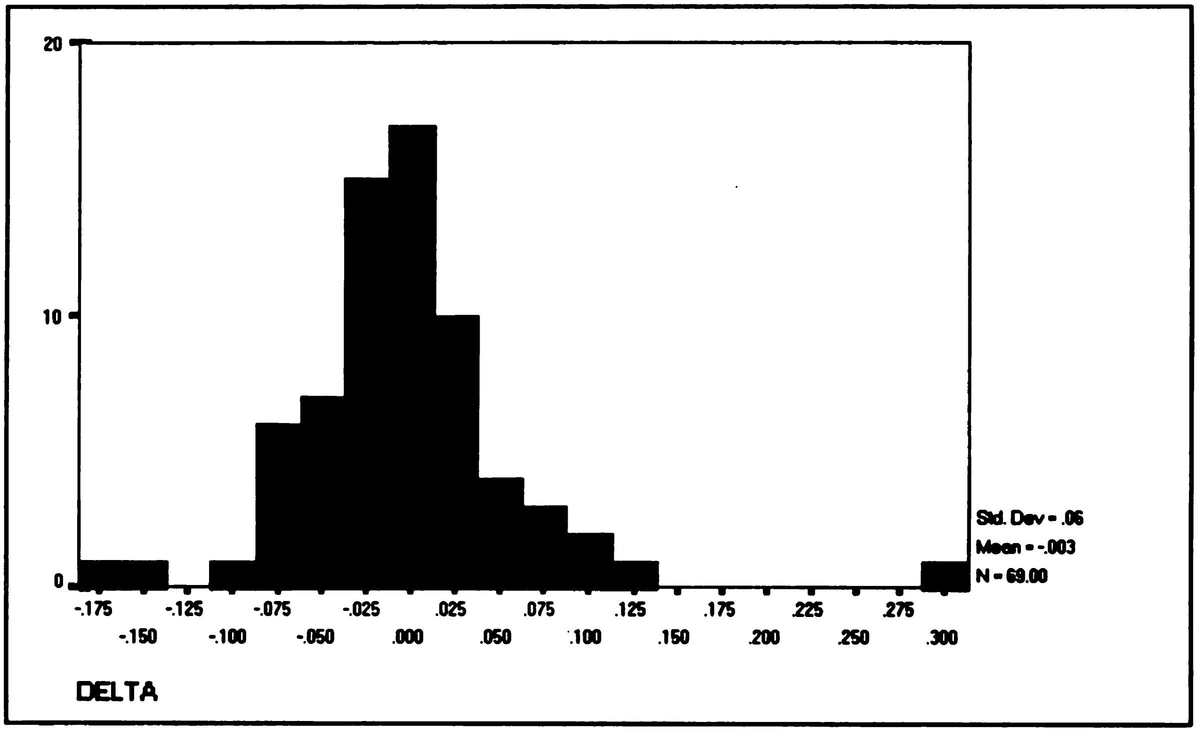
Mean	.005	Std Dev	.082
Kurtosis	13.265	S.E. Kurt	.548
Skewness	2.703	S.E. Skew	.277

Figure III-4

Premium changes around loosening restrictions

(23 events * 3 days per event = 69 observations)

According to BBNW, with the announcement of loosening restrictions, the distribution of premiums are supposed to be skewed to the left (the mean is close to 0, -0.0034). However, it is skewed to the right.



*Normality test was rejected at 1% level as follows.

	Statistic	df	Significance
K-S (Lilliefors)	.1561	69	.0003

The distribution is skewed to the right and clustered around Mean.

Mean	-0.0034	Std Err	.0077
Skewness	1.3364	S E Skew	.2887
Kurtosis	7.0582	S E Kurt	.5701

Figure III-5

Premium changes around tightening restrictions

(2 events * 3 days per event = 6 observations)

This figure shows CECF premium changes around the announcement of tightening investment restrictions. However, Two events (six observations) would seem to be insufficient for conclusive results.

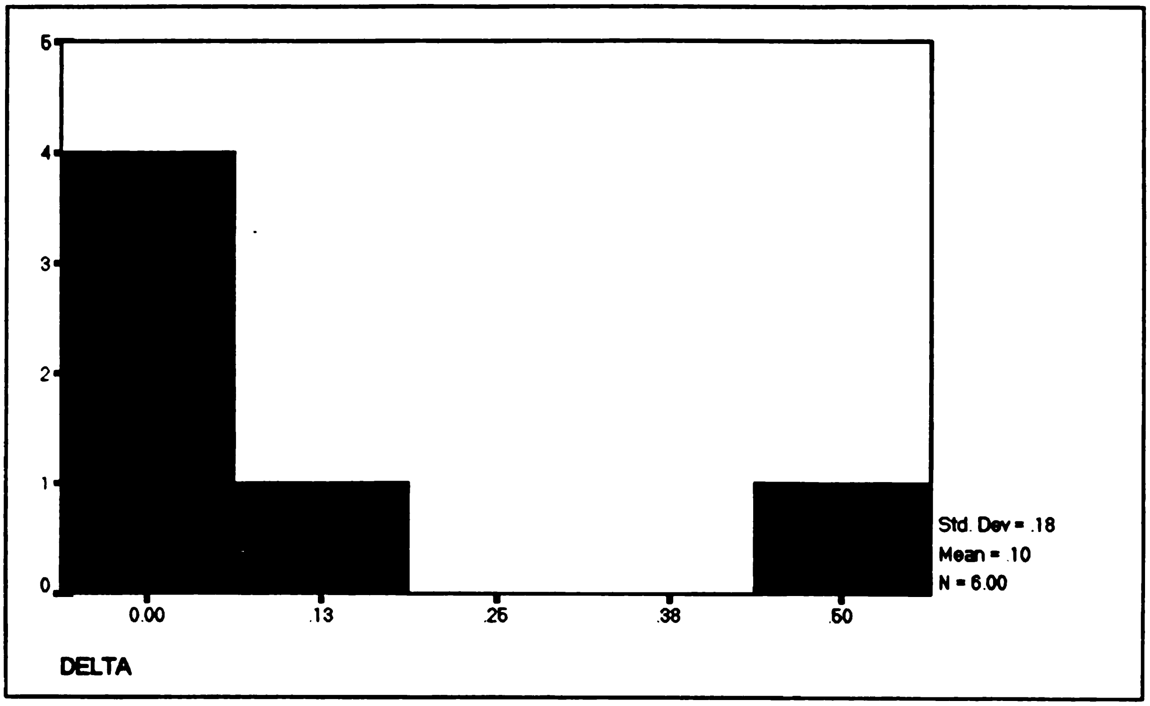


Figure III-6

CECF premiums/discounts and variance ratios

* This chart shows the difference in the annual variance ratio {variance (fund share price)/var(net asset value)} between premium funds and discount funds. The reference line indicates 0% premium. Therefore, points above the line show variance ratios of premium funds and points below the line show variance ratios of discount funds. Premium funds have higher variance ratios and discount funds have lower variance ratios.

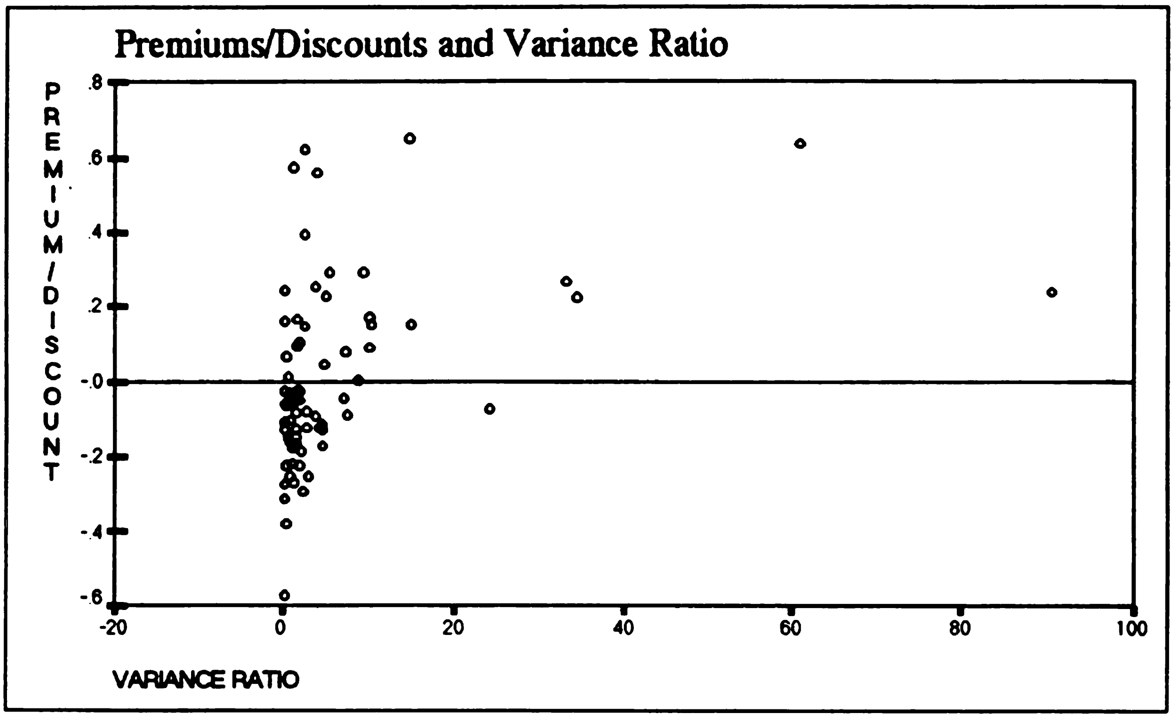


Table III-1

Korea Fund's premium and ownership constraints

(1984.9-1987.3)

Regression was run during the period when the Korea Fund was the only investment instrument available for foreign investors in the Korean stock market.

Change in KF premium = a + b*delta + c*NASDAQ +e

Delta: Changes in the proxy for ownership constraint
NASDAQ: Daily NASDAQ index return

Variable	Coefficient	SE(Coefficient)	T	Sig T
Delta	16.696691	2.125615	7.855	.0000
NASDAQ	1.002232	.318173	3.150	.0017
(Constant)	4.73801E-04	.001378	.344	.7311

Table III-2

Dummy variable regressions after differentiating capital inflow and outflow restrictions

Dummy variable regressions for each fund with the BBNW data (original data) and with the updated data are presented below.

where

j : Initial of each fund.

π_{jt} : Change in the jth fund's premium in week t.

D_{1jt} = -1 if t is between two and seven weeks before the announcement of tightening an inflow restriction or loosening an outflow restriction, and 1 if loosening an inflow restriction or tightening an outflow restriction of the jth country.

D_{2jt} = -1 if t is between one week before and one week after the announcement of tightening an inflow restriction or loosening an outflow restriction, and 1 if loosening an inflow restriction or tightening an outflow restriction of the jth country.

D_{3jt} = -1 if t is between two and seven weeks after the announcement of tightening an inflow restriction or loosening an outflow restriction, and 1 if loosening an inflow restriction or tightening an outflow restriction of the jth country.

δ_{1j} : The average weekly effect before the announcement of regulatory changes on the jth fund's premiums/discounts.

δ_{2j} : The average weekly change in the premium or discount during the three-week period surrounding the announcement.

δ_{3j} : The average weekly effect after the announcement of regulatory changes on the jth fund's premiums/discounts.

Regression with the original data

Name	France	Japan	Korea	Mexico	Taiwan	Overall
# of events	2	7	5	6	2	22
# of obs	132	292	208	314	80	1026
constant	7.9E-4	6.6E-4	.002	-.001	-.011	-2.01E-4
Std. error	.004	.002	.005	.005	.012	.002
T-stat	.2	.368	.48	-.216	-.97	-.104
δ_{1j}	.001	-3.71	-.13	-.026	-.003	-.01
Std. error	.022	.0052	.014	.019	.039	.007
T-stat	.055	-.007	-.9	-1.377	-.079	-1.33
δ_{2j}	-.041	.002	-.015	.048	-.037	5.4E-4
Std. error	.021	.007	.017	.024	.051	.009
T-stat	-.189	.268	-.88	1.97	-.73	.061
δ_{3j}	.009	-.003	.019	.005	-.038	8.24E-4
Std. error	.0183	.005	.014	.022	.036	.007
T-stat	.49	-.59	1.31	.235	-1.05	.12

Regression with the updated data

Name	France	Japan	Korea	Mexico	Taiwan	India	Overall
# of events	2	8	7	8	5	1	31
# of obs	132	292	379	486	223	172	1664
constant	7.9E-4	6.6E-4	5.4E-4	7.8E-4	-.006	-.0014	-3.3E-4
Std. error	.004	.002	.003	.004	.0067	.0051	.0017
T-stat	.2	.368	.17	.185	-.85	-.271	-.194
δ_{1i}	.001	-3.71	-.14	-.022	.0116	-.02	-.0085
Std. error	.022	.0052	.0107	.0165	.025	.038	.0064
T-stat	.055	-.007	-1.306	-1.343	.459	-.476	-1.318
δ_{2i}	-.041	.002	-.013	.031	-.0108	.0424	.0015
Std. error	.021	.007	.0132	.021	.0304	.038	.008
T-stat	-.189	.268	-.971	1.478	-.355	1.119	.182
δ_{3i}	.009	-.003	.007	-.005	-.0222	-.0159	-.0033
Std. error	.0183	.005	.0109	.018	.026	.0295	.0065
T-stat	.49	-.59	.631	-.303	-.857	-.54	-.513

*The results show that after differentiating inflow and outflow constraints, there is no direct relationship between the changes in premium and the announcement of restriction changes.

Table III-3

Regression of dummy variables over World-adjusted premium change

jth fund Premium-ΔWorld CECF index without jth fund

$= a + b_1D_1 + b_2D_2 + b_3D_3 + e$

D_1 = -1 if t is between two and seven weeks before the announcement of tightening an inflow restriction or loosening an outflow restriction, and 1 if loosening an inflow restriction or tightening an outflow restriction of the jth country.

D_2 = -1 if t is between one week before and one week after the announcement of tightening an inflow restriction or loosening an outflow restriction, and 1 if loosening an inflow restriction or tightening an outflow restriction of the jth country.

D_3 = -1 if t is between two and seven weeks after the announcement of tightening an inflow restriction or loosening an outflow restriction, and 1 if loosening an inflow restriction or tightening an outflow restriction of the jth country.

b_1 : The average weekly effect before the announcement of regulatory changes on the event-weighted premiums/discounts.
b_2 : The average weekly change in the event-weighted premium or discount during the three-week period surrounding the announcement.
b_3 : The average weekly effect after the announcement of regulatory changes on the event-weighted premiums/discounts.

Test with BBNW data

Variable	Coefficient	SE(Coef)	T	Sig T
b_1	-.035983	.028432	-1.266	.2059
b_2	-.008485	.035972	-.236	.8136
b_3	.018737	.028587	.655	.5123
(Constant)	-.014319	.008252	-1.735	.0830

Test with updated data

Variable	Coefficient	SE(Coef)	T	Sig T
b_1	-.038668	.031542	-1.226	.2204
b_2	.022157	.039450	.562	.5744
b_3	-.001582	.031657	-.050	.9602
(Constant)	-.002084	.008495	-.245	.8062

Table III-4

Regression of NASDAQ index return over World CECF Premium Change index

ΔWPINX = a + b * NASDAQ index return + e

DEPENDENT VARIABLE : World CECF Premium change Index

Variable	Coefficient	SE(Coef)	T	Sig T
NASDAQ INDEX	.468490	.058612	7.993	.0000
(Constant)	-.001792	.001080	-1.659	.0976

* Change in World CECF premium index is significantly positively correlated with NASDAQ index return at 1% dependence level. This is consistent with Lee's hypothesis in that small investor sentiment commonly affects both.

Table III-5

Korea fund's premium and Korean stock exchange index
(Daily observations)

Prem = a + b*KMR

Prem: Changes in KF premium at time t
KMR: Korean stock market return at time t-1

Variable	Coefficient	SE(Coeff)	T	Sig T
KMR	.034846	.006598	5.281	.0000
(Constant)	-3.21879E-04	8.5139E-04	-.378	.7054

Result shows that Korean stock market return affects changes in KF premium. 1607 daily observations are used from 9/84 through 12/91.

Table III-6

Change in premiums/discounts and NAV return (a proxy for foreign market return)

(Weekly observations)

$\Delta PREMIUM_t = A + B*NAV\ return_{t-1} + e_t$

Fund Name	B(Coeff)	S.E.(Coeff)	T-stat(signif)
BRAZIL	.005	.077	.064(.9489)
FRANCE	.3679	.149	2.463(.0147)
GERMANY	.4007	.109	3.68(.0003)
HELVETIA(SWISS)	.3409	.116	2.95(.0035)
INDIA	.1135	.103	1.1(.273)
ITALY	.576	.133	4.33(.000)
JAPAN	.0513	.058	.887(.376)
KOREA	.0255	.068	.377(.706)
MALAYSIA	.178	.088	2.033(.043)
MEXICO	.0154	.065	.235(.814)
SPAIN	.242	.177	1.37(.1725)
TAIWAN	.0229	.108	.212(.832)
THAI	.0096	.099	.098(.922)
UK	.00115	.0048	.242(.809)

$\Delta PREMIUM_t = A + B*NAV\ return_t + e_t$

Fund Name	B(Coeff)	S.E.(Coeff)	T-stat(signifi)
BRAZIL	-.49	.067	-7.34(.000)
FRANCE	-.36	.15	-2.39(.018)
GERMANY	-.803	.1	-7.94(.000)
HELVETIA(SWISS)	-.212	.117	-1.81(.0713)
INDIA	-.37	.099	-3.74(.000)
ITALY	-.603	.133	-4.53(.000)
JAPAN	-.165	.058	-2.89(.004)
KOREA	-.206	.067	-3.09(.002)
MALAYSIA	-.202	.087	-2.31(.022)
MEXICO	-.338	.064	-5.32(.000)
SPAIN	-.544	.174	-3.13(.002)
TAIWAN	-.731	.095	-7.71(.000)
THAI	-.399	.095	-4.2(.000)
UK	.002	.005	.433(.667)

Table III-7

Relationship between premium and institutional ownership

Average annual premium/discount = a + b * Inst. Ownership

Variable	Coefficient	SE(coeff)	T	Sig T
Inst. ownership	-.009317	.004300	-2.167	.0383
(Constant)	.151850	.065675	2.312	.0278

The result is significant at 5% level. There should be some other reasons but there seems to be some institutional preferences on discount funds than premium funds.

Table III-8

Correlation test between premium and variance ratio

Correlation between average annual premium/discount and ratio of annual CECF share price variance over NAV variance is tested in this table. They are strongly positively correlated at 1% significance level.

Approximate Statistic	Value	T-value	Significance
Pearson's R	.44366	4.25862	.00006

*14 country specific country funds are used for the test between 1981-1991. They are Brazil, France, Germany, Swiss, India, Italy, Japan, Korea, Malaysia, Mexico, Spain, Taiwan, Thailand, and UK fund.

Table III-9

Logit analysis

Logit analysis was done to test whether variance ratios are really different between premium funds and discount funds. The result is significant at 1% level that premium funds seem to have higher variance ratios than discount funds. This is consistent with the hypothesis that the ownership structure could possibly affect the variance ratios of CECFs.

Dependent Variable : 1 if premium fund, 0 if discount fund
Independent variable : Annual variance of CECF SP over that of NAV

Iterations Taken	7		
Usable Observations	76	Degrees of Freedom	74
Cases Correct	57		
Log Likelihood	-41.561662		
Average Likelihood	0.5787620		

Variable	Coefficient	Std Error	T-Stat	Signif
1. Constant	-1.362	0.364	-3.745	0.00018
2. Variance ratio	0.197	0.076	2.594	0.00947

*14 country funds are used for the test over the period 1981-1991. They are Brazil, France, Germany, Swiss, India, Italy, Japan, Korea, Malaysia, Mexico, Spain, Taiwan, Thai, and UK fund.

Table III-10

Correlation Table based on monthly premium/discount

Variable	Cases	Mean	Std Dev
BRAZIL	40	-.1928	.2901
FRANCE	42	-.1760	.0936
GERMANY	65	.0226	.1505
HELVETIA	53	-.0700	.0784
INDIA_GR	37	-.0836	.1912
ITALY	68	-.1364	.1390
JAPAN	67	-.1022	.0972
KOREA	87	.4247	.1994
MALAYSIA	56	-.0316	.1768
MEXICO	107	-.1480	.2866
SPAIN	42	.1460	.2728
TAIWAN	53	.2325	.2972
THAI	47	.1931	.1542
UK	51	-.1778	.0519

Correlations:	BRAZIL	FRANCE	GERMANY	HELVETIA	INDIA_GR	ITALY
BRAZIL	1.0000					
FRANCE	-.4674	1.0000				
GERMANY	.1194	.1293	1.0000			
HELVETIA	.2860	.3320	.7725**	1.0000		
INDIA_GR	.0135	.5561	.6245**	.6019**	1.0000	
ITALY	.0120	.4909**	.6642**	.6342**	.5317**	1.0000
JAPAN	.	.7170*	.3204	.	.	.7719**
KOREA	-.8005**	.4848**	-.0927	-.0344	.2953	.1386
MALAYSIA	.0536	.0381	.7200**	.7243**	.7878**	.5914**
MEXICO	.3581	.7042**	.5060**	.4345**	.5615**	.3365*
SPAIN	-.1422	.5691*	.7581**	.7416**	.7299**	.7412**
TAIWAN	.2913	-.2075	-.0436	.2900	.0749	-.0813
THAI	-.4680*	.2526	.3796*	.3910*	.3207	.2762
UK	.2242	.2267	.6435**	.6388**	.7367**	.5660**

Correlations:	JAPAN	KOREA	MALAYSIA	MEXICO	SPAIN	TAIWAN
BRAZIL						
FRANCE						
GERMANY						
HELVETIA						
INDIA_GR						
ITALY						
JAPAN	1.0000					
KOREA	-.2445	1.0000				
MALAYSIA	.6242	.2160	1.0000			
MEXICO	.4109*	-.1273	.3211*	1.0000		
SPAIN	.	.2648	.7301**	.3709*	1.0000	
TAIWAN	-.6905	.4184*	.2620	-.2112	-.0678	1.0000
THAI	.	.5770**	.3379	.0461	.5644**	.3997*
UK	.	-.1576	.6469**	.3261*	.5979**	-.1678

Correlations:	THAI	UK
THAI	1.0000	
UK	-.0818	1.0000

*2-tailed Signif: * - .01 ** - .001*

" . " is printed if a coefficient cannot be computed

*This table shows that changes in many funds' premiums/discounts are significantly positively correlated with each other. No particularly strong regional correlations are detected.

Table III-11

Correlation table based on weekly changes in premiums/discounts of CECFs

This table shows that changes in CECF premiums are strongly correlated with each other and with NASDAQ index returns. Except for a few number of Funds, most funds' premium changes are strongly positively correlated with NASDAQ index return. Small investor sentiment which affects NASDAQ index return also seems to affect CECF premium changes. Table values represent pairwise Spearman correlation coefficients. The number of observations is in parentheses. P-values are also reported.

Variable definition

CLEM : change in Clemente global fund premium

FAUS : change in First Australia fund premium

FIBE : change in First Iberian fund premium

MAL : change in Malaysia fund premium

NASD : NASDAQ index return

OVER : change in Overseas securities fund premium

SCAN : change in Scandanavian fund premium

SCUD : change in Scudder New Asia fund premium

TEMP : change in Templeton emerging market fund premium

WORLD : change in Worldwide V fund premium

WPI : change in world CECF premiums

	ASA	ASIA	BRAZIL	CLEM	FAUS	FIBE
ASA	1.0000 (389) P= .					
ASIA	-.1806 (80) P= .109	1.0000 (254) P= .				
BRAZIL	-.0761 (34) P= .669	.1260 (194) P= .080	1.0000 (204) P= .			
CLEM	.2583 (74) P= .026	-.0057 (71) P= .962	.0371 (35) P= .833	1.0000 (76) P= .		
FAUS	-.1770 (144) P= .034	.4790 (80) P= .000	.0644 (35) P= .713	-.0544 (73) P= .648	1.0000 (149) P= .	
FIBE	.2753 (33) P= .121	.0214 (31) P= .909	-.1798 (32) P= .325	.2035 (34) P= .248	.2977 (34) P= .087	1.0000 (34) P= .
FRANCE	.3471 (129) P= .000	.0616 (124) P= .497	.0457 (79) P= .689	.2308 (76) P= .045	-.0447 (127) P= .618	.1670 (34) P= .345
GERMANY	.0907 (123) P= .319	.3648 (249) P= .000	.1255 (201) P= .076	.0429 (74) P= .716	.1593 (121) P= .081	.4043 (32) P= .022
INDIA	.0710 (17) P= .787	.1300 (179) P= .083	.0425 (175) P= .577	-.3574 (17) P= .159	-.5235 (17) P= .031	-.3113 (15) P= .259
ITALY	.1400 (141) P= .098	.1343 (246) P= .035	.0707 (196) P= .325	.1775 (75) P= .128	.2099 (137) P= .014	.2304 (33) P= .197
JAPAN	.0524 (311) P= .357	.0641 (12) P= .843		.5668 (5) P= .319	-.0215 (75) P= .855	
KOREA	.0569 (210) P= .412	.1831 (247) P= .004	-.0506 (200) P= .477	.3083 (73) P= .008	.1154 (145) P= .167	-.0103 (33) P= .955

	ASA	ASIA	BRAZIL	CLEM	FAUS	FIBE
MAL	.1497	.2604	.0480	.2322	.1908	-.0761
	(83)	(250)	(203)	(76)	(82)	(34)
	P= .177	P= .000	P= .497	P= .044	P= .086	P= .669
MEXICO	.0365	-.0406	.0153	.2857	-.0387	-.1630
	(334)	(249)	(199)	(76)	(149)	(34)
	P= .506	P= .524	P= .830	P= .012	P= .639	P= .357
NASD	.1768	.1974	.0714	.3961	.1760	.2043
	(389)	(229)	(179)	(76)	(149)	(34)
	P= .000	P= .003	P= .342	P= .000	P= .032	P= .246
OVER	.0382					
	(217)					
	P= .576					
SCAN	.3550	-.0579	.0569	.1676	-.0530	.2438
	(127)	(81)	(35)	(75)	(124)	(34)
	P= .000	P= .608	P= .746	P= .151	P= .559	P= .165
SCUD	.0011	.0931	.1730	-.0379	.2791	.3809
	(76)	(237)	(196)	(74)	(75)	(34)
	P= .992	P= .153	P= .015	P= .749	P= .015	P= .026
SPAIN	.1978	.1436	.0523	-.0038	.0594	.1383
	(25)	(193)	(189)	(25)	(25)	(22)
	P= .343	P= .046	P= .474	P= .986	P= .778	P= .539
SWISS	.1981	.2830	.1135	.1916	.1545	.3423
	(68)	(235)	(202)	(67)	(67)	(34)
	P= .105	P= .000	P= .108	P= .120	P= .212	P= .048
TAIWAN	.1466	.0994	.1435	.0634	.0368	-.0073
	(88)	(228)	(186)	(69)	(86)	(31)
	P= .173	P= .134	P= .051	P= .605	P= .736	P= .969
TEMP	.2687	-.0099	.0080	.2046	-.0729	.4550
	(92)	(252)	(203)	(75)	(91)	(34)
	P= .010	P= .876	P= .909	P= .078	P= .492	P= .007
THAI	.0703	.2843	.0546	.0363	.1217	.0902
	(45)	(213)	(202)	(45)	(45)	(34)
	P= .646	P= .000	P= .441	P= .813	P= .426	P= .612
UK	-.2031	.2513	-.0499	.0633	.3747	.3682
	(70)	(233)	(199)	(69)	(69)	(32)
	P= .092	P= .000	P= .484	P= .605	P= .002	P= .038

	ASA	ASIA	BRAZIL	CLEM	FAUS	FIBE
US	-.0223 (157) P= .782					
WORLD	-.1335 (114) P= .157	.3545 (82) P= .001	.0299 (35) P= .864	-.0036 (76) P= .975	.3164 (111) P= .001	.1876 (34) P= .288
WPI	.4152 (389) P= .000	.4691 (254) P= .000	.3604 (204) P= .000	.3759 (76) P= .001	.3655 (149) P= .000	.4982 (34) P= .003

	FRANCE	GERMANY	INDIA	ITALY	JAPAN	KOREA
FRANCE	1.0000 (180) P= .					
GERMANY	.0506 (172) P= .510	1.0000 (303) P= .				
INDIA	.1341 (59) P= .311	-.0604 (183) P= .416	1.0000 (186) P= .			
ITALY	.2164 (177) P= .004	.0029 (295) P= .961	.1663 (181) P= .025	1.0000 (317) P= .		
JAPAN	.2166 (57) P= .106	.0452 (53) P= .748		.3307 (69) P= .006	1.0000 (319) P= .	
KOREA	.2597 (175) P= .001	.1322 (296) P= .023	.1531 (182) P= .039	.0917 (310) P= .107	.0762 (142) P= .367	1.0000 (393) P= .
MAL	.0614 (132) P= .484	.2542 (258) P= .000	.2029 (186) P= .005	.0296 (256) P= .637	.1886 (10) P= .602	.1913 (257) P= .002
MEXICO	.0723 (180) P= .335	.0957 (298) P= .099	.0886 (182) P= .234	.0369 (313) P= .515	.0295 (264) P= .634	.0693 (370) P= .183

	FRANCE	GERMANY	INDIA	ITALY	JAPAN	KOREA
NASD	.4740 (180) P= .000	.0710 (279) P= .237	.3369 (162) P= .000	.2140 (292) P= .000	.1692 (319) P= .002	.3175 (368) P= .000
OVER					-.2378 (219) P= .000	-.0245 (48) P= .869
SCAN	.2274 (129) P= .010	.1145 (124) P= .205	.0694 (17) P= .791	.2040 (129) P= .020	.2356 (55) P= .083	.1104 (126) P= .218
SCUD	.1769 (120) P= .053	.1251 (244) P= .051	.1043 (178) P= .166	.4016 (241) P= .000	-.1802 (5) P= .772	.1173 (245) P= .067
SPAIN	.0435 (71) P= .719	.3830 (198) P= .000	.0333 (184) P= .653	.0904 (195) P= .209		.2096 (200) P= .003
SWISS	.1678 (115) P= .073	.2519 (242) P= .000	.0474 (184) P= .523	.0750 (239) P= .248		.1760 (240) P= .006
TAIWAN	.2267 (133) P= .009	.0165 (247) P= .797	.0704 (166) P= .367	.0349 (244) P= .588	-.2546 (22) P= .253	.3482 (244) P= .000
TEMP	.0999 (140) P= .240	.0682 (267) P= .267	.0933 (185) P= .207	.0807 (264) P= .191	-.0602 (19) P= .807	.1248 (265) P= .042
THAI	.0404 (93) P= .701	.2960 (218) P= .000	-.1090 (184) P= .141	-.0408 (215) P= .552		.0932 (218) P= .170
UK	.2465 (116) P= .008	.1610 (240) P= .013	.2062 (179) P= .006	.0977 (237) P= .134		.2667 (238) P= .000
US					-.0015 (156) P= .985	
WORLD	.1630 (117) P= .079	.0884 (115) P= .348	-.2082 (17) P= .423	.0290 (116) P= .757	.2468 (42) P= .115	.0817 (113) P= .390
WPI	.4382 (180) P= .000	.4806 (303) P= .000	.3309 (186) P= .000	.4055 (317) P= .000	.2518 (319) P= .000	.4936 (393) P= .000

	MAL	MEXICO	NASD	OVER	SCAN	SCUD
ASA	.1497 (83) P= .177	.0365 (334) P= .506	.1768 (389) P= .000	.0382 (217) P= .576	.3550 (127) P= .000	.0011 (76) P= .992
ASIA	.2604 (250) P= .000	-.0406 (249) P= .524	.1974 (229) P= .003		-.0579 (81) P= .608	.0931 (237) P= .153
BRAZIL	.0480 (203) P= .497	.0153 (199) P= .830	.0714 (179) P= .342		.0569 (35) P= .746	.1730 (196) P= .015
CLEM	.2322 (76) P= .044	.2857 (76) P= .012	.3961 (76) P= .000		.1676 (75) P= .151	-.0379 (74) P= .749
FAUS	.1908 (82) P= .086	-.0387 (149) P= .639	.1760 (149) P= .032		-.0530 (124) P= .559	.2791 (75) P= .015
FIBE	-.0761 (34) P= .669	-.1630 (34) P= .357	.2043 (34) P= .246		.2438 (34) P= .165	.3809 (34) P= .026
MAL	1.0000 (263) P= .					
MEXICO	.1981 (259) P= .001	1.0000 (516) P= .				
NASD	.2412 (238) P= .000	.1372 (495) P= .002	1.0000 (553) P= .			
OVER		-.1107 (170) P= .151	-.1055 (221) P= .118	1.0000 (221) P= .		
SCAN	.2766 (84) P= .011	-.0708 (130) P= .423	.2035 (130) P= .020		1.0000 (130) P= .	
SCUD	.1096 (248) P= .085	.1233 (244) P= .054	.2269 (224) P= .001		.1460 (77) P= .205	1.0000 (248) P= .

	MAL	MEXICO	NASD	OVER	SCAN	SCUD
SPAIN	.2040 (202) P= .004	-.0033 (198) P= .963	.1924 (177) P= .010		-.0917 (25) P= .663	-.0437 (195) P= .544
SWISS	.0797 (246) P= .213	.0024 (242) P= .971	.1818 (222) P= .007		.0899 (70) P= .459	.1083 (236) P= .097
TAIWAN	.2337 (237) P= .000	.1762 (247) P= .005	.3122 (228) P= .000		.1308 (89) P= .222	.0863 (225) P= .197
TEMP	.0856 (261) P= .168	.3051 (267) P= .000	.1864 (247) P= .003		.3868 (92) P= .000	.1213 (246) P= .057
THAI	.4555 (222) P= .000	.0678 (219) P= .318	-.0727 (199) P= .307		.0450 (46) P= .766	.0758 (214) P= .269
UK	.1354 (244) P= .035	-.0117 (240) P= .856	.3371 (220) P= .000		-.1307 (71) P= .277	.1416 (235) P= .030
US		.0363 (123) P= .691	-.0203 (157) P= .801	-.0478 (153) P= .557		
WORLD	.0638 (85) P= .562	-.0155 (117) P= .868	.1393 (117) P= .134		-.2740 (114) P= .003	.3701 (78) P= .001
WPI	.5420 (263) P= .000	.5530 (516) P= .000	.3223 (553) P= .000	.3607 (221) P= .000	.3357 (130) P= .000	.4465 (248) P= .000

	SPAIN	SWISS	TAIWAN	TEMP	THAI	UK
SPAIN	1.0000 (202) P= .					
SWISS	.2233 (200) P= .001	1.0000 (247) P= .				

	SPAIN	SWISS	TAIWAN	TEMP	THAI	UK
TAIWAN	.0978 (182) P= .189	.0480 (223) P= .476	1.0000 (251) P= .			
TEMP	.0008 (201) P= .991	.0896 (246) P= .161	.1306 (244) P= .042	1.0000 (272) P= .		
THAI	.2054 (200) P= .004	.2134 (221) P= .001	.0534 (201) P= .452	-.0034 (222) P= .960	1.0000 (223) P= .	
UK	.2181 (195) P= .002	.3307 (239) P= .000	.2020 (220) P= .003	.0043 (244) P= .947	.0572 (215) P= .404	1.0000 (245) P= .
WORLD	-.4183 (25) P= .037	.1340 (70) P= .269	-.0839 (90) P= .432	-.2181 (94) P= .035	.1451 (46) P= .336	.4587 (72) P= .000
WPI	.4407 (202) P= .000	.4045 (247) P= .000	.4773 (251) P= .000	.3337 (272) P= .000	.4190 (223) P= .000	.3993 (245) P= .000

	US	WORLD	WPI
US	1.0000 (157) P= .		
WORLD		1.0000 (117) P= .	
WPI	.1911 (157) P= .017	.2408 (117) P= .009	1.0000 (578) P= .

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed