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# A DYNAMIC MODEL OF STOCK MARKET INTEGRATION BETWEEN EMERGING AND DEVELOPED MARKETS

by

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Abstract

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The purpose of this thesis is to analyze the time varying integration versus segmentation question for a number of emerging stock markets including Argentina, Brazil, Chile, Mexico, and Turkey vis-à-vis a global developed stock markets, and discuss the various issues regarding the volatility, and the predictability of the emerging stock market portfolio returns using both global and domestic information variables. I also analyzed the effect of time varying integration of the stock markets on return and risk of the investment of emerging markets. In this model expected returns, risks(variances and covariances), price of the risks, and integration measure are time varying. The variances in the model are calculated monthly by using ARCH(Auto Regressive Conditional Heteroskedasticity). Integration measure is formulated as logistic function of the local information variables, and takes the values between zero and one. I find the evidence supporting the hypothesis that all five countries in my sample are becoming more integrated with developed stock markets. As emerging stock markets become more integrated, their stock returns would response to same information variables as developed stock markets do.

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# I. INTRODUCTION

As world equity markets become more globalized, increasing inflow of investment into international markets will continue. According to some recent studies[1], world economies have become increasingly integrated, and the correlation among the major equity markets have been rising. The most two important reasons behind the growth in international equity investing are reducing market risk and increasing returns.

According to Modern Portfolio Theory, the risk of the investment is defined as unpredictability or variability of returns. Total risk consists of unsystematic or firm specific risk, and systematic or market risk. Firm-specific risk can be eliminated or reduced by proper diversification, but market risk can not be. When we talk about international investment, if equity market movement of an individual country is independent of the other countries' equity market movements, a fund manager can reduce the market risk of the portfolio by diversifying its exposure to a number of different equity markets around the world. However, due to rising correlations among international equity markets the effectiveness of diversification of portfolio via global investing has been reduced. This is when emerging markets started gaining importance.

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[1] Agtmael, Antoine, and Park, 1993, World's Emerging Stock Markets, Princeton University Press.

A decade ago hardly any attention was paid to emerging markets[2] by international investors. Nowadays many emerging markets are no longer undiscovered; and some of the emerging equity markets still have low correlation with the developed countries' equity markets.[3] Because of this low correlation between the emerging and developed equity markets, the diversification of a global portfolio by including the emerging markets will benefit the effectiveness of risk reduction and higher returns.

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[2] The phrase "emerging stock market" has different meanings. On the one hand, it implies that a market has begun a process of change, growing in size and sophistication, in contrast to markets that are small and give little appearance of change. On the other hand, it could refer to any market in a developing economy, with the implication that all have the potential for development. International Finance Corporation of World Bank follows the second definition: just as most low and middle income economies are considered "developing" regardless of their particular stage of development, all stock markets in developing countries are considered "emerging". IFC generally follows the criteria of the world bank in classifying economies as low income, middle income or high income, primarily on the basis of gross national product(GNP) per capita. The world bank uses the following categories:
i) Low income economies are those with a GNP per capita of $610 or less in 1990
ii) Middle income economies are those with a GNP per capita of more than $610 but less than $7,620 in 1990.
iii) High income economies are those with a GNP per capita of $7,620 or more in 1990.

[3] See Harvey(1991), Campbell and Hamao(1992), Solnik(1974), Harvey(1993b, 1993c), Divecha, Drach and Stefek(1992).

Since the beginning of 1980's,

i) more and more institutional investors have been interested in investment opportunities in the emerging markets.

ii) ties between emerging and developed countries have been increasing with the growing interdependence of the world economies.

The degree that one equity is integrated or segmented with other markets play crucial role in increasing returns and lowering the risk of portfolio, hence level of integration between capital markets should be studied. As far as integration or segmentation is concerned there are three possible classification between two countries' stock markets; they might be completely integrated, completely segmented or some level of integration between these two(partially integrated or partially segmented). However, in reality the market movement of each country is neither completely integrated nor completely segmented; there are always some degree of integration and segmentation which is less than complete. In order to talk about complete integration there should be free access by foreign investors to emerging markets, as well as free access by emerging investors to foreign markets. Complete integration is defined as a market condition where investors earn the same risk adjusted expected return on similar financial instruments in different national markets. With complete integration the only priced risk should be the systematic risk relative to the world market. At the other extreme, complete segmentation implies that only national factors. e.g. the domestic systematic risk should enter the pricing of assets.

I will let the degree of market integration to change over time. If the markets are completely segmented the value of integration parameter will be zero; if the markets are completely integrated the value of integration parameter will be one and finally if the markets are partially integrated or segmented the value of integration will be between zero and one.

Segmentation can be the result of many barriers to international investment. Restrictions may differ from country to country. Some emerging markets are 100% inevitable where some others apply strong restrictions to free access to their equity markets by foreign investors. Potential barriers might be: transaction taxes, availability and accuracy of information and accounting. foreign exchange regulations. the number of listed securities[4], political risk, restrictions on foreign ownership. availability of transportation and communication means. impediments based on traditional practices such as reluctance to deal with foreigners, difficulty of obtaining information about foreign stocks, and differences in quality of financial reporting due to differences in accounting disclosure requirements.

My contribution is defining the time-varying integration measure as a logistic function of the local information variables. In order to develop my model

[4]This might be considered as indirect restriction. If a country's market has a few listed securities foreign investment will be reduced due to lack of options of choosing different stocks for the purpose of diversification.

for time varying market integration I will use the international version of the Capital Asset Pricing Model(ICAPM).[5]

## II. BACKGROUNDS AND CURRENT THEORY

### Capital Asset Pricing Model

The capital asset pricing theory presented in Sharpe (1964), Lintner(1965), and Mossin(1966) states that in equilibrium the ex-ante return on asset i. $E(R_i)$ is related to the ex-ante expected return of the market $E(R_m)$, by the following equation

$$(1)\ E(R_i) = E(R_0) + B_i\left[E(R_m) - E(R_0)\right]$$

where $E(R_0)$ is the expected return of asset or portfolio uncorrelated with the market, and $B_i$ is defined as $\frac{Cov(R_i, R_m)}{Var(R_m)}$, the well known measure of systematic or non-diversifable risk, $E(R_i)$ is the ex-ante return on asset i, $E(R_m)$ is the ex-ante-return of the market.

Capital asset pricing model above has important limitations, because it considers only national investments. International version of CAPM(ICAPM) is presented by Solnik(1974), Wheatley(1988), Errunza and Losq(1985), Eun and

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[5] In ICAPM the risk of an individual security or country is measured by its contribution or covariance with the world market portfolio. CAPM also implies that the risk of the market portfolio is measured by the variance of its returns, so that the risk premium for the market portfolio increases with the variance of its returns.

Janakiraman(1986). According to ICAPM, if $\Omega_{t-1}$ is the information set that the investors use to determine the prices, the following equation can be written:

$$(2)\quad E\left[r_{it} \mid \Omega_{t-1}\right] = B_i E\left[r_{wt} \mid \Omega_{t-1}\right]$$

where $r_{it} = R_{it} - R_{ft}$ is the excess return on country i, $r_{wt} = R_{wt} - R_{ft}$ is the excess return on the world market portfolio, $R_{it}$ is the return on country i realized at time t, $R_{wt}$ is the return on world market portfolio of risky assets, $R_{ft}$ is the riskless rate of interest(observable at time t-1, T bill rate). $B_i$ is the conditional covariance between the return on country i and the world market portfolio divided by the conditional variance of the world market portfolio return.

$$(3)\quad B_i = \frac{\operatorname{cov}(r_{it}, r_{wt})}{\operatorname{var}(r_{wt})}$$

This formulation implies that expected country returns are proportional to the expected world market portfolio returns[6], and the beta is the coefficient of proportionality. Conditional expectations are linear on information variables. Conditional sensitivity, which is the covariance between the country portfolio return and world market portfolio return, is defined as country risk. The risk of an individual country is measured by its contribution to the world market portfolio risk(covariance between the country portfolio return and world market portfolio

[6] In this paper when I mention about the world market portfolio, I mean the developed market portfolio which includes the countries listed below: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States.

return) The international version of the CAPM predicts that countries with higher covariance(higher risk) will command higher expected returns. The reward per unit of risk called the world price of covariance risk. The differences in the countries' conditional covariance should explain the differences in national portfolio returns.

**Equity Markets Integration**

Sharpe(1964), Lintner(1965), and Mossin(1966), by only considering national investments assume markets are completely segmented. Harvey(1991), and Solnik(1983) used the notion that risk can be defined as sensitivity to the changes in world market returns, this notion is contingent on the assumption of complete market integration, therefore they assumed markets are completely integrated. Markets are completely integrated if assets with the same risk have identical expected returns irrespective of the market in which they are sold. As the amount of segmentation increases, risk takes on new definition as a security's sensitivity to local market variables. If markets are segmented from the rest of the world, its covariance with a common world market return may have little or no ability to explain its expected return.

In Harvey (1991), he uses the definition of the beta in equation (3), to write equation (2) as follows:

$$(4)\quad \mathrm{E}\left[r_{it}\middle|\Omega_{t-1}\right]=\frac{Cov\left[r_{it},r_{wt}\middle|\Omega_{t-1}\right]}{Var\left[r_{wt}\middle|\Omega_{t-1}\right]}\mathrm{E}\left[r_{wt}\middle|\Omega_{t-1}\right]$$

or

$$(5)\quad \mathrm{E}\left[r_{it}\middle|\Omega_{t-1}\right] = \frac{\mathrm{E}\left[r_{wt}\middle|\Omega_{t-1}\right]}{Var\left[r_{wt}\middle|\Omega_{t-1}\right]} Cov\left[r_{it}, r_{rwt}\middle|\Omega_{t-1}\right]$$

equation (5) implies conditional asset pricing restriction. This conditional version of capital asset pricing model restricts the conditionally expected return on a country to be proportional to it's covariance with the market portfolio. He defines the proportionality factor as the world price of covariance risk which is the expected return that the investor receives for taking on a unit of covariance risk.

$$(6)\quad \lambda_{w} = \frac{\mathrm{E}\left[r_{wt}\middle|\Omega_{t-1}\right]}{Var\left[r_{wt}\middle|\Omega_{t-1}\right]}$$

In above equation $\lambda_w$ is the world price of covariance risk, which is the ratio of conditionally expected return on the market portfolio to the conditional variance of the market portfolio.

He measures the conditional risk for 17 countries. His tests provide evidence on the conditional mean variance efficiency of the benchmark portfolio. His results show that countries' risk exposures(world price of the covariance risk) help to explain differences in performance of the portfolio. He also presented that these risk exposures change through time and that the world price of covariance risk is not constant.

Bekaert and Harvey(1994) found the time varying world market integration by using "regime switching model". Their contribution is to propose a methodology that allows for the degree of market integration to change overtime.. Their measure of conditional capital market integration arises from a conditional regime-switching model, allows them to describe expected returns in countries that are segmented from world capital markets in one part of the sample and became integrated later in the sample. Their results suggest that a number of emerging markets exhibit time varying integration. Some markets appear to be more integrated then one might expect based on prior knowledge of investment restrictions. Other markets appear segmented even though foreigners have relatively free access to their capital markets.

## III. MODEL

In this model I will assume time varying betas, expected returns and risks(variances and covariance). Variances are calculated by using the ARCH(Auto Regressive Conditional Heteroskedasticity) model. The covariance on the other hand, are simply the multiplication of the residuals obtained from the regressions of emerging market stock returns and world market stock returns on the information variables. Using these variance and covariance we calculate monthly betas and expected returns. Conditionally expected returns in any country is affected by their covariance with a world market portfolio return and by the variance of the local market portfolio return.

In completely integrated markets, covariance is the only risk should be priced. That is, in integrated capital markets, investors will diversify local country variance by holding stocks from many countries. As a result, increase in the country variance(which might be caused by local factors) do not necessarily increases expected returns. In completely segmented markets, the variance is the only measure of the risk.

Integration measure I use, is a time varying weight which is applied to these two moments, variance and covariance. The model allows for time varying prices of variance risk which depends on country-specific information and a world price of covariance risk which depends on global information.

The model is conditional in the sense that predetermined information is allowed to effect the expected returns, covariance, variances, world price of the covariance risk, local price of the variance risk, and the integration measure.

The local market portfolio returns are linear functions of the local information variables, which is formulated as follows:

(7) $r_{it} = Z_{t-1}\delta_i + e_{it}$

$e_{it}$ is the investors forecast error for the return of country i. $Z_{t-1}$ are (1xk) vector of information variables that are available to the investor, since all the information variables are not available to the investors, $Z \subset \Omega$, Z is just the subset of the true information set. $Z_{t-1}$ = {Retu, Prer, Diyi } where retu is the monthly returns of the stocks, prer is the price earning ratio, diyi is the dividend yield for each country. In most studies[7], local equity returns, local exchange rate changes, local dividend yields, local price earning ratios, the ratio of the market capitalization to gross domestic product, and the local short term interest rate changes are used as local variables; these variables tend to capture the changes in the equity prices. $\delta_i$ (kx1) set of time invariant weights that the investor uses to derive the conditional expected returns. In this model $\delta_i$ is (4x1) vector of coefficients. Under the assumptions that error terms are normally distributed with the mean of zero, then the expectation of returns will be following

(8) $E_{t-1}\left[r_{it} \middle| Z_{t-1}\right] = Z_{t-1}\delta_i$

The error terms are the differences between actual and expected returns which can be written as:

(9) $e_{it} = r_{it} - Z_{t-1}\delta_i$

World market portfolio returns are also linear functions of the information variables, but global information variables, which can be formulated as follows:

(10) $r_{wt} = Z_{t-1}\delta_{w'} + e_{wt}$

$e_{wt}$ is the investors forecast error for the return of world market portfolio. $Z_{t-1}$ are(1xk) information variables that are available to investor, $\delta_{w'}$ is (kx1) time invariant coefficients and $r_{wt}$ is the excess return of the world market portfolio. $\delta_{w'}$ (kx1) set of time invariant weights that the investor uses to derive the conditional expected returns. In our model $\delta_w$ is (4x1) vector of coefficients. $Z_{t-1}$ are (1xk) vector of information variables that are available to the

[7] Gibbons and Ferson(1985), Fama and French(1988), Harvey(1994), John Campbell(1986, 1991), Campbell and Hamao(1992), Donald B. Keim and Robert F. Stambaugh(1986), Chan, Karolyi, and Stulz(1992).

investor. $Z_{t-1}$ = { Spp, Term, Moody} Spp is the dividend yield of the Standard and Poor stock market index. term is the 10 year U.S. T bond rate minus 3 month U.S. T bill rate, and the moody is the Moody's Baa minus Aaa bond yield. Again in most studies [8], return of the world index, dummy variable for the month of the January, Junk bond spread(difference between yields on Moody's Baa and Aaa rated bonds). Short maturity term structure are included as global information variables.

Assuming normally distributed error terms with mean zero; expectation of world market portfolio would be :

(11) $E_{t-1}\left[r_{wt}|Z_{t-1}\right] = Z_{t-1}\delta_w$

Error terms can be calculated as in equation (12) to be used in measurement of covariance.

(12) $e_{wt} = r_{wt} - Z_{t-1}\delta_w$

We can write conditional covariance and variances as follows:

(13) $Cov\left[r_{it}, r_{wt}|Z_{t-1}\right] = E\left[e_{it}e_{wt}|Z_{t-1}\right]$

(14) $Var\left[r_{it}|Z_{t-1}\right] = E\left[e_{it}e_{it}|Z_{t-1}\right] = E\left[e_{it}^2|Z_{t-1}\right]$

(15) $Var\left[r_{wt}|Z_{t-1}\right] = E\left[e_{wt}e_{wt}|Z_{t-1}\right] = E\left[e_{wt}^2|Z_{t-1}\right]$

[8] Chan, Karolyi, and Stulz(1992) , Bekaert and Harvey(1993), Harvey(1991,1992, 1994)

As it is mentioned before markets can be either completely integrated, or completely segmented. If the markets are completely integrated, the return of the local market portfolio can be explained by following equation

(16) $$E_{t-1}\left[r_{it} \middle| Z_{t-1}\right] = \lambda_{w',t-1} Cov_{t-1}\left[r_{it}, r_{wt} \middle| Z_{t-1}\right]$$

where $r_{it}$ is the return on a portfolio of country i equity from time t-1 to time t, in excess of a risk free return, $r_{wt}$ is the excess return on the world market portfolio, $Z_{t-1}$ is the information set available to the investors, $\lambda_{w',t-1}$ is the world price of covariance risk, measured by using equation (6).

Equation (16) suggests that for the completely integrated markets the expected returns are determined by multiplying covariance and the world price of risk.

If the markets are completely segmented, the return of the local market portfolio can be explained by following equation:

(17) $$E_{t-1}\left[r_{it} \middle| Z_{t-1}\right] = \lambda_{i',t-1} Var_{t-1}\left[r_{it} \middle| Z_{t-1}\right]$$

where $r_{it}$ is the return of portfolio of country i from t-1 to t, $\lambda_i$ is the local price of variance risk.

In order to test both models I use new definitions for the world price of covariance risk( $\lambda_{w'}$ ) and local price of variance risk( $\lambda_i$ ) see Beakert and Harvey(1994).

(18) $$\lambda_{w't-1} = \exp\left(Z_{w't-1}\delta_w\right)$$

$\delta_{w'}$ is the coefficients from the regression of the world market portfolio returns on the explanatory variables. $Z_{w't-1}$

(19) $\lambda_{i',t-1} = \exp(Z_{i't-1}\delta_i)$

$\delta_i$ is the coefficients from the regression of country returns on the lagged explanatory variables, $Z_{i't-1}$.

**Deriving model of time varying integration**

An asset pricing model that allows for time varying integration should let both conditional covariance with the world market return and variance with the local market return to effect conditional mean.

The models in (16) and (17) can be combined as following, see Beakert and Harvey(1994):

(20)

$$r_{it} = \phi_{i't-1}\lambda_{w',t-1}Cov_{t-1}[r_{it}r_{wt}|Z_{wi't-1}] + (1-\phi_{i't-1})\lambda_{i't-1}Var_{t-1}[r_{it}|Z_{i't-1}] + e_{it}$$

If we take the expectation of both sides in equation (20) we have the following equation;

(21)

$$E_{t-1}[r_{it}|Z_{i't-1}] = \phi_{i't-1}\lambda_{w'',t-1}Cov_{t-1}[r_{it}r_{wt}|Z_{wi't-1}] + (1-\phi_{i't-1})\lambda_{i't-1}Var_{t-1}[r_{it}|Z_{i't-1}]$$

where $\phi_{i't-1}$ is the time varying integration measure, $\lambda_w$ is the world price of the covariance risk, and $\lambda_i$ is the price of variance risk. Conditional covariance and variances are given in equations (13 ) to (15). All the components in equation (21) are time varying, expected returns of a country depends on both covariance with world market returns and variance of a country returns. When the markets are completely integrated it's covariance with a common world market return has strong ability to explain it's expected returns. If the markets are completely segmented, variance of local market return would explain the expected returns.

The integration measure( $\phi_{i't-1}$ ), takes values between 0 and 1 if $\phi_{i't-1}=1$, markets are completely integrated, only covariance with the world portfolio is priced and we can reject the null hypothesis that markets are segmented, equation (21) will reduce to

(22) $E_{t-1}\left[r_{it}|Z_{i't-1}\right] = \lambda_{w't-1}Cov_{t-1}\left[r_{it}r_{wt}|Z_{wi't-1}\right]$

if $\phi_{i't-1}=0$. markets are completely segmented, only variance is priced this is consisted with the segmented markets, and equation (21) will reduce to:

(23) $E_{t-1}\left[r_{it}|Z_{i't-1}\right] = \lambda_{i't-1}Var_{t-1}\left[r_{it}|Z_{i't-1}\right]$

Using equation (21) we can write the conditional first moments as:

(24) $Z_{i't-1}\delta_i = \phi_{i't-1}\exp(Z_{w't-1}\delta_w)E\left[e_{it}e_{wt}|Z_{wi't-1}\right] + (1-\phi_{i't-1})\exp(Z_{i't-1}\delta_i)E\left[e_{it}^2|Z_{i't-1}\right]$

or

(25) $Z_{i't-1}\delta_i = \phi_{i't-1}\exp\left(Z_{w't-1}\delta_w\right)e_{it}e_{wt} + \left(1-\phi_{i't-1}\right)\exp\left(Z_{i't-1}\delta_i\right)e_{it}^2$

if we take the difference between two sides in equation(25) and call it $h_t$ , we have the following:

(26)

$$h_{wi't} = Z_{i't-1}\delta_i - \phi_{i't-1}\exp(Z_{w't-1}\delta_w)e_{it}e_{wt} - (1-\phi_{i't-1})\exp(Z_{i't-1}\delta_i)e_{it}^2$$

The econometric model to test the asset pricing restrictions is formed by combining equations (9), (12) and (26). Asset pricing restriction is that error terms are unrelated to the past information variables. I am testing that if all the error terms are unrelated to the past information variables. If the error terms are unpredictable our model is specified correctly.

$$(27)\ \varepsilon_t = (e_{it}e_{wt}h_{wi't}) = \begin{pmatrix} (r_{it} - Z_{t-1}\delta_i) \\ (r_{wt} - Z_{t-1}\delta_w) \\ (Z_{i't-1}\delta_i - \phi_{i't-1}\exp(Z_{w't-1}\delta_{w'})e_{it}e_{wt} - (1-\phi_{i't-1})\exp(Z_{i't-1}\delta_i)e_{it}^2) \end{pmatrix}$$

The model implies that $E[\varepsilon_t | Z_{t-1}] = 0$. With one country, equation (27) provides a test of the models restriction that the conditionally expected excess return of a country portfolio is proportional to it's conditional covariance with the world return. In the frame work of equation (27), all of the conditional moments, the means, variances, and covariance are allowed to change over time. Where $e_{it}$ is a 1x n(number of countries, n=1) in this model vector of errors in the conditional means of the country returns. The model implies that $E[\varepsilon_t | Z_{t-1}]$=0

The time varying integration measure, and can be formed in the frame of regime switching model see Beakert and Harvey(1994). In the first regime markets are completely integrated and expected returns are given by equation (16). In the second regime, markets are completely segmented and expected returns are given by equation(17)

$S_{it}$ is the unobserved state variable

$S_{it}$ =1, if the markets are integrated,

$S_{it}$ = 2, if the markets are segmented.

the parameter $\phi_{i't-1}$ can be interpreted as the conditional probability of being in regime 1, or

$$(28) \quad \phi_{i't-1} = \Pr ob\left[S_{it} = 1 \middle| Z_{t-1}\right]$$

in regime 2,

$$(29) \quad \phi_{i't-1} = \Pr ob\left[S_{it} = 2 \middle| Z_{t-1}\right]$$

According to another version of the regime-switching model regime probabilities can be formulated as:

$$(30) \quad \phi_{i't-1} = \frac{\exp\left(Z_{i't-1}\delta_i\right)}{1+\exp\left(Z_{i't-1}\delta_i\right)}$$

In equation (30) the integration measure is a logistic function of the local information variables. In this logistic function, at one extreme if the term in the parenthesis is positive infinity the value for $\phi_{i't-1}$ would be 1, at the other extreme if the term in the parentheses is negative infinity the value for $\phi_{i't-1}$ would be 0. In reality since the markets are neither completely integrated nor completely segmented, one should not expect the value of the term in the parenthesis to be either positive or negative infinity. Where $\delta_i$ vector of coefficients, and $Z_{i't-1}$ is information variables which includes local equity return, local exchange rate changes, local dividend yields, and the ratio of the market capitalization to GDP.

Since all these variables might be influenced by a change in policies affecting market integration, same variables would strongly explain $\phi_{i't-1}$. Besides, our local variables are local portfolio returns, price earning ratios, and dividend yields which will effect the integration.

**Test of complete integration versus complete segmentation**

According to my model if the countries are completely integrated, the systematic risk relative to the local market(variance) should not have any explanatory power for the pricing of assets. On the other hand, if the markets are completely segmented, the systematic risk relative to the world market(covariance) should not have any explanatory power for the pricing of assets.

(31) $r_{it} = \gamma_0 + \gamma_1 Cov_{t-1}\left[r_{it} r_{wt} \middle| Z_{wi't-1}\right] + \gamma_2 Var_{t-1}\left[r_{it} \middle| Z_{i't-1}\right] + e_{it}$

where $r_{it}$ is the excess return on country i's portfolio at time t, $Cov$ and $Var$ are the conditional covariance and variances.

A proper test of the integration would focus on the added explanatory power of the systematic risk relative to the local market(variance). A test of integration versus segmentation will test $\gamma_2$ =0 in equation (31) against the alternative that it is positive, if we do not reject the null hypothesis, then markets are completely integrated. On the other hand the test of segmentation versus integration will test $\gamma_1$ =0 against the alternative that it is positive, if we do not reject the null hypothesis then the markets are completely segmented.

**ARCH Model**

According to definition of the conditional variances we can write the following; where $h_{it}$ is the vector of time varying variances.

(32) $E\left[e_{it}e_{it}|Z_{i't-1}\right] = Var\left[e_{it}^{2}|Z_{i't-1}\right] = h_{it}$

The conditional time varying variances are modeled as ARCH.

General setting for our model is:

(33) $r_t = Z_{t-1}B + e_t$

$e_t|I_{t-1} \quad N(0.h_t)$

(34) $h_t = \alpha_0 + \alpha_1 \sum_{q=1} e_{t-q}e_{t-q}$

(35) $LogL(B.h_t) = T^{-1} \sum_{t=1} \log f_t(B.h_t)$

Likelihood function can be maximized with respect to unknown parameters$\left(B,\alpha_0^1,\alpha_1^i\right)(i = 1,S)$. The quasi maximum likelihood estimators is defined as a parameter vector which solves the problem $\max_\theta LnL\left(B,\alpha_0^i,\alpha_1^i\right)$.

$QMLE$ of parameters is found by solving the first order conditions

$\theta^i = \left(B,\alpha_0^i,\alpha_1^i\right)$

## IV. DATA and PREDICTABILITY

### Data

There are two different classes of information variables; global and domestic factors. Global factors are the return on world market portfolio, dividend yield of Standard and Poor Stock Index, US term structure premia, and US default risk yield spread. The rates of return on world market portfolio were taken from the Financial Times Actuaries. These were calculated by weighted average of the country returns included in the portfolio; where the weights are the market capitalization of each country in the portfolio. Dividend yields of Standard and Poor Stock Index were collected from the Standard and Poor Current Statistics. US term structure premia was taken from Dow Jones and was calculated as the difference between ten-year US bond yield and the yield on three-month US Treasury bill. US default risk yield spread is calculated as the difference between Moody's Baa and Aaa bond yields. These variables capture the business cycle in the world market.

Domestic factors, on the other hand, are equity returns in US dollar, lagged price earning ratio, and local dividend yields. All of the domestic factors were donated from International Finance Corporation of the World Bank. Our sample for all the information includes monthly data for the period of January 1989 to December 1993.

Autocorrelations of the monthly returns are provided in Table 1. First order autocorrelations for the first, second, third, and fourth lags of Argentina, Brazil, Chile Mexico, and Turkey stock returns are different from zero. I also used the Durbin's h test for the first order autocorrelations for various lags of returns, the test results are in table 2. According to Durbin' h test, null hypothesis of first order autocorrelation of Emerging Market stock portfolio returns for the first lag for Chile and Mexico; for the second, third, and fourth lags for all the five countries is rejected. This suggests that returns in these countries are predictable based on past information about the returns. the Dickey-Fuller test is performed for unit root in the return series; test results are in table 3. This test provides us to identify the specific trend if there is one.. As there are 57 observations in the regressions, the 95% of the distribution of likelihood ratio value is 5.13; therefore, we do not reject the null hypothesis for all the countries in our sample for both first and second order serial correlation. we can say that the hypothesis that the returns are characterized by random walk without possible drift is accepted.

The Heteroskedasticity tests of White and ARCH produces chi-square well above convential levels which are shown in table 4. According to both ARCH and White test results we reject the null hypothesis of homoskedastic error terms at 95 percent level of significance for all the five countries, error terms are heteroskedastic.

**Predictability**

I have 3 different sets of information variables:

i) Local information variables includes country returns, price earning ratios, and dividend yields.

ii)Global information variables includes dividend yields on Standard and Poor stock index. the difference between the Moody's Baa and Aaa bond yields. the difference between the 10 year U.S. bond yield and 3 month U.S. bill.

iii) Local + Global information variables includes all the variables in i and ii.

Beta coefficients and t statistics from the regressions of the Emerging Market stock portfolio returns on the local information variables are presented in table 5. For all the five countries lagged returns has a highest t statistics value. indicating that it has the most explanatory power among these information variables.

In table 6, R bar square values are presented from the regressions of the returns first on the lagged returns, second on the lagged returns and price earning ratios, and finally, on the lagged returns, price earning ratios and dividend yields. For all the countries addition of the price earning ratio did not contribute to R bar square value; addition of the dividend yields increased the R bar square value slightly for only Mexico and Brazil.

Table 7 presents coefficient of determination(R bar square) values from regression of returns on the local, global , and local + global variables. Adding the global variables into the regression does not contribute to R bar square value for all the countries, but when we regress the returns only on the global variables instead of local variables R bar square value decreases significantly; 15 percent for Argentina, 20 percent for Brazil, 5 percent for Chile, 10 percent for Mexico, and more than 50 percent for Turkey. These indicate that global variables alone explain some of the changes in the Emerging Countries stock returns.

Table 8 represents the test of null hypothesis that expected returns can not be predicted by using local. global , and local + global information variables. The multivariate tests of no predictability is rejected at a 5 percent level of significance.

## V. STATISTICAL TESTS and ESTIMATIONS

**Method of moments**

With method of moments CAPM restrictions in equation(27) are tested. The $\chi^2$ statistic provides a test of the model's restrictions. Besides $\chi^2$, $R^2$ is more intuitive statistic which is the adjusted coefficient of determination from a regression of the model errors. If the model fits well, the errors should be unrelated to the information variables, the $\chi^2$ and $R^2$ should be small. My results produce high chi square values for all five countries, therefore; we reject the null hypothesis that errors are unrelated to the information variables. This implies model misspecification. Also I regress the local error term on the local information variables, global error term on the global information variables, and the pricing error on the local and global information variables; $R^2$ values from these regressions are in table 9.

**Test of Constancy of Price of variance, Price of covariance and Integration**

I reject the null hypothesis of constant price of variance , price of covariance and integration measure for all the countries. I regress price of the variance, price of the covariance, and the integration measure on the local information variables, high $\chi^2$ values indicate that our information variables are able to explain the changes in the price of the variance, price of covariance, and the integration measure, therefore these are not constant. Results from these regressions produce highly significant $\chi^2$ values which are presented in table 10.

**Test of Integration versus Segmentation**

In order to test for segmentation I regress the country returns on both covariance and variance. If we do not reject the "null hypothesis of coefficient of covariance in the regression is zero" then we can conclude that variance has explanatory power, therefore country is segmented. In order to test for integration by using the same regression (regression of country returns on covariance and variance) we test the null hypothesis of coefficient of variance in the regression is zero. If we do not reject that the coefficient of variance is zero, then covariance can explain the changes in returns, therefore, the country is completely integrated.

Null hypothesis of complete integration is rejected for Argentina, Chile, Mexico, and Turkey; null hypothesis of complete segmentation is accepted for the same countries. Brazil seems completely integrated according to my tests.

**Estimations**

The results for all five countries are presented in figures from 1 to 5.

For Argentina the results suggest that the market became more integrated in our time period. Integration between Argentina and world market increased during the second half of the 1989. This was the year that President Menem took over the office. Menem's economic policies concerning economic liberalization; which includes privatization, free trade agreements and the reduced government intervention in business. All these efforts caused the dramatic turnaround in Argentina's economy since 1989. Trading activity in Buenas Aires Stock market jumped up 393.8% in 1991 giving Argentina the best shot in the IFC index in that year. Fiscal deficit fell from 21.8% of GDP in 1989 to 1.8% of GDP in 1990, and inflation fell sharply, with April 1993 inflation at 11.7%. For 1990 GDP declined about 2% compared to 4.6% in 1989. There is another high increase in the value of the integration; during the second half of the 1991, mainly due to approved bill by congress under which individuals and companies would pay 1 to 3 % tax on capital repatriated over the next 4 years. This increased capital flows from abroad into the stock market in the second half of the 1991.

Menem's affords to stem inflation, control currency risk, privatize businesses and encourage foreign investment brought funds from international investors till middle of the 1992 when Argentina' economy began to slow, at the same time my integration starts decreasing. After Brady Plan Agreement was concluded in April 1993 stock market condition increased, stock prices soared, average daily value traded increased significantly; according to my measure at the same time Argentina is becoming more integrated.

Integration between Brazil and developed countries' stock markets does not show a significant change over the period. The President Collor's plan which was introduced on March 15, 1990, designed to eliminate hyperinflation, froze most assets and virtually shut down Brazilian economy. Effect of the plan continued throughout the 1990 demand fell, economy was in recession where also my integration measure is low. Brazil starts becoming more integrated since the beginning of 1991 mainly due to easing regulations of foreign investment. Investors face 15% income tax on distributed earnings and cash dividends, but no tax on capital gains. Individual foreign investors can now direct their purchases through a fund or investment company. The period that foreign investment capital must remain in the country was reduced from 12 to 6 years and invested capital must remain a minimum of 2 years with that stock.

After resignation of president Collor in September 1992 . The new government focused on privatization, liberalization and an emergency fiscal adjustment. Economic improvements were by increased productivity in 1993. In 1993 my integration is also increasing significantly.

The integration of Chile starts from .70 in the beginning of the 1989 and increases continuously. According to my integration measure since the beginning of the 1992 Chile becomes almost completely integrated with the developed countries' stock markets. Foreign investment in Chile reached US $1.4 billion including ADRs at the end of the November of 1992. Net international reserves increased above US$9 billion in 1992. Turnover on the Santiago Stock Exchange increasing nearly 45% over $160 million monthly average in 1992, averaged $232 million per month in 1993. Part of the significant increase in trading activity and share prices during the year was attributed to strong foreign investor demand for ADRs.

In 1991 the regulations of foreign investment were eased. Passed legislation allowing private firms to invest in toll roads and port facilities concluded with free trade agreement with Mexico. After recent reforms foreign investment in 1991 amounted to $960 million. In December 1992 The Chamber of Deputies approved a bill that allows foreign investment repatriation after one year and lowers taxes on net profits. Favorable economic growth, corporate results controlled inflation, trade surplus all contributed the upward trend of the market; with this news Chile naturally won the attention of inter national investors and foreign investment in Chile reached $1.4 billion including ADR's in 1992. After 90% gain in 1991, total market capitalization had more than doubled by year earlier. At the end of 1992, it was 29.6 billion according to IFC.

Mexico shows almost same trend with Chile. My integration value starts from .60 in the beginning of the 1989 and increases since then and at the end of the 1993 it is almost 1 where it is assumed to be completely integrated with other markets. New regulations in 1993 brought the Mexican stock market more in line with the U.S. market were introduced; including stricter disclosure requirements, insider trading rules, and the introduction of market maker to improve liquidity. A large number of Mexican companies raised money in the international markets with great success in 1993. Restructuring of the Brady Plan reduced Mexico's external transfers. The state telephone monopoly was sold to private investors in December of 1991 making it the biggest privatization for Latin America. Due to mainly nearing competition of successful privatization, moderate but continuous growth, strong corporate earnings, and increased foreign investment stock market surged in 1991, during same period there is significant increase in my integration value. The depreciation of exchange rate at the end of May caused wawes of selling within the investment community. The rebound began in September of 1992 resulted from increased investors confidence in the government's commitment to sustain economic stability and bargain hunting due to attractive share prices. The Government sold 40 million L shares of Telmex in May 1992, of which 13.5 million ADS were sold in the U.S. and 9.5 million ADS were sold in international offerings. The privatization continued in 1992 and 1993 with 60 state holdings on the list in 1993. Mexico passed a law in December to further liberalize foreign investment. Under the new law, foreign direct investment can be made without prior government approval if the investment is less than $100 million in regions outside of Mexico city, Guadalajara or Monterrey. A new international section was created, where foreign debt instruments, equities, derivatives and funds will be traded. Many Mexican companies raised money in international markets in 1993.

Unlike Latin American countries Turkey becomes almost completely integrated during 1990, it becomes more segmented during 1991, the level of integration is very low in 1992 and 1993. Stock prices increased 300% in 1989. IFC price index showed negative results for 1990. IFC total return index showed increase of 22%. Many investors sold their shares as a result of the gulf crisis especially in the last three months of the year. The Turkish Investment Fund performed poorly in 1990. IFC price index dropped 53%. The total return index dropped 27% in 1991. In February market reached to its peak, poor economic news and political uncertainty caused a decline in share prices. Market rebounded sharply in last 2 months of the year.

Share prices decrease sharply where IFC Total Return index decreased 53% in 1992. The overall weakness of the market was because of high real returns on bank deposits, and treasury issues, high inflation, budget deficit and political uncertainty. A tax decree introducing preferential tax rates on investments in mutual funds and investments trusts having a 25% equity content helped produce a 4% gain in the IFC Global Total Return index in December. Turkey was the second best performing market in the world in 1993. Declines in the short term interest rates, expectations of lower inflation and announcements of strong year end corporate earnings moved share prices on the İSE(Istanbul Stock Exchange) sharply higher. For the year IFC Global index return increased 234.3% in dollar terms.

## VI. CONCLUSIONS

As one expects international equity markets including emerging markets are becoming more integrated. My results suggest that degree of integration for Argentina, Brazil, Chile, Mexico, and Turkey increased during 1989- 1993 time period as more foreign investors came into these markets and more investment funds are created by including, assets of these markets.

Factors that contribute to integration are free access by foreigners to domestic capital markets and free access by domestic investors to foreign capital markets. Potential barriers to integration come in the form of access, time lines of trading information, foreign exchange regulations, the availability and accuracy of accounting information, the number of securities listed on foreign developed exchanges, political risk and the institutional structures that protect the investors. The degree of restrictions vary from completely closed to foreign investors to 100% investable.

Performance of the stock market is influenced by many macro and micro factors, including state of the economy, political condition and risk, expectations, country's fiscal and monetary policies; and also some foreign factors if the market is integrated(not necessarily completely integrated). Therefore, integration between emerging and developed stock markets depends on the factors listed above. As we all expect if country's economic condition improves, stock market will increase there will be more demand by foreigners this will result increase in integration. In also bad times the opposite will happen. Therefore, it is possible to see that sometimes in the future emerging markets may become more segmented and may offer benefit from diversification. As emerging markets become more integrated their stock markets would response to same factors as developed markets, if this happens one can not benefit from diversification.

TABLE 1
Autocorrelations of Returns

| Variable Returns | p values[9] Lag 1 | Lag 2 | Lag 3 | Lag 4 |
|---|---|---|---|---|
| Argentina | 0.2791 | -0.0727 | -0.0798 | -0.0806 |
| Brazil | -0.148 | -0.046 | -0.05 | -0.053 |
| Chile | 0.122 | 0.255 | 0.256 | 0.255 |
| Mexico | -0.159 | 0.214 | 0.226 | 0.257 |
| Turkey | 0.089 | 0.219 | 0.167 | 0.147 |

[9] $\rho$ values are the estimates of first order serial autocorrelation and measured by using AR(1) model.

$\text{Retu}_t = \text{Retu}_{t-1} + e_t$ for the first lag,

$\text{Retu}_t = \text{Retu}_{t-2} + e_t$ for the second lag,

$\text{Retu}_t = \text{Retu}_{t-3} + e_t$ for the third lag,

$\text{Retu}_t = \text{Retu}_{t-4} + e_t$ for the fourth lag,

TABLE 2
Autocorrelations of Returns, Durbin h Test

| Variable | Durbin h Test[10] | | | |
|---|---|---|---|---|
| Return | Lag 1 | Lag 2 | Lag 3 | Lag 4 |
| Argentina | -0.277 | 4.425 | 5.993 | 7.335 |
| Brazil | 0.284 | 6.755 | 16.313 | 6.875 |
| Chile | 1.969 | 4.594 | 5.881 | 6.127 |
| Mexico | 2.087 | 4.997 | 5.972 | 6.319 |
| Turkey | 1.331 | 4.596 | 6.788 | 8.045 |

[10] The values for the Durbin h test are calculated by using the following formula $h = \rho\sqrt{N/1 - N(\alpha)}$ where N is the number of observations, and $\alpha$ is the variance of the coefficient of the lagged returns, and $\rho$ is the estimate of first order serial correlation.
Following criteria used for test results:
a) if h > 1.96 reject the null hypothesis that there is no positive first order autocorrelation,
b if h < 1.96 reject the null hypothesis that there is no negative first order autocorrelations,
c) if h lies between -1.96 and 1.96 do not reject the null hypothesis that there is no first order positive or negative autocorrelations.

TABLE 3
Unit Root Test of Returns

| | Dickey Fuller Test[11] | Augmented Dickey Fuller Test[12] |
|---|---|---|
| Argentina | 1.227 | 1.518 |
| Brazil | 1.951 | 3.371 |
| Chile | 2.36 | 3.085 |
| Mexico | 0.553 | 2.1 |
| Turkey | 1.63 | 2.19 |

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[11] I test the following model
$Retu_t = Retu_{t-1} + e_t$
Alternative to
$Retu_t = B_0 + B_1 \, Time + B_2 \, Retu_{t-1} + e_t$
I test the joint hypothesis of $B_0=0$, $B_1=0$, and $B_2=1$,

[12] Here I test the following model:
$Retu_t = (Retu_{t-1} - Retu_{t-2}) + e_t$
Alternative to
$Retu_t = B_0 + B_1 \, Time + B_2 \, Retu_{t-1} + B_3 \, (Retu_{t-1} - Retu_{t-2}) + e_t$
I test the joint hypothesis of $B_0=0$, $B_1=0$, and $B_2=1$,

Table 4
Test of Heteroskedasticity[13]

| | Arch Test | White Test |
|---|---|---|
| Argentina | 13.743[0.03334] | 15.84[0.0428] |
| Brazil | 14.186[0.0177] | 10.75[0.2158] |
| Chile | 20.628[0.0158] | 18.79[0.0160] |
| Mexico | 14.376[0.0172] | 18.75[0.0162] |
| Turkey | 7.517[0.5623] | 8.00[0.4329] |

[13] The following equation is estimated for the ARCH test:
$RESSQ_t = \beta_0 + \beta_1 RESSQ_{t-1} + e_t$ , where RESSQ is the square of the residuals are obtained from the regression estimated based on equation (4).
The following equation is estimated for the White test:
$RESSQ_t = \beta_0 + \beta_1 RETU_t + \beta_2 PRER_t + \beta_3 DIYI_t + \beta_4 RETUSQ_t + \beta_5 PRERSQ_t + \beta_6 DIYISQ_t + \beta_7 REPR_t + \beta_8 REDI_t + \beta_9 DIPR$
where RESSQ is the square of the residuals, RETU is the returns on Turkish stocks, PRER is the price earning ratios, DIYI is the dividend yields, RETUSQ is the square of the returns, PRERSQ is the square of the price earning ratios, DIYISQ is the square of the dividend yields, REPR is the product of the returns and price earning ratios, REDI is the product of the returns and dividend yields, DIPR is the product of the price earning ratios and DIPR is dividend yields.

TABLE 5
Regression of the Emerging Stock Market Returns on Domestic Information Variables[14]

| | $B_0$ | $B_1$ | $B_2$ | $B_3$ |
|---|---|---|---|---|
| Argentina | 110.4585 | 0.9459 | 0.401 | -14.613 |
| | (1.82) | (23.49) | (0.84) | (-1.30) |
| Brazil | 55.3375 | 0.7537 | 0.02 | 2.4815 |
| | (2.99) | (7.09) | (0.26) | (4.36) |
| Chile | 262.266 | 0.8648 | 22.0787 | -23.306 |
| | (0.92) | (10.14) | (0.82) | (-1.06) |
| Mexico | -283.471 | 1.0740) | 5.2349 | 79.6705 |
| | (-1.58) | (15.11) | (0.48) | (1.38) |
| Turkey | 152.1178 | 1.0037 | -13.661 | 15.6858 |
| | (0.3) | (10.92) | (-0.87) | (0.52) |

[14] Regressions are estimated using ordinary least squares. Results are based on monthly data starting from 1981:01- 1993:12(60 observations). The variables are defined as follows:
Retu = country returns,
Prer = price earning ratios,
Diyi = dividend yields.
Portfolio returns are calculated monthly by International Finance Corporation of The World Bank.
The following equation is estimated:
$\text{Retu}_t = \text{Constant} + \beta_0 \text{Retu}_{t-1} + \beta_1 \text{Prer}_{t-1} + \beta_2 \text{Diyi}_{t-1} + e_t$

TABLE 6
Coefficient of Determination
Domestic Variables[15]

| | Regression #1 $R^2$[16] | Regression #2 $R^2$ | Regression #3 $R^2$ |
|---|---|---|---|
| Argentina | 0.887 | 0.8862 | 0.886 |
| Brazil | 0.6996 | 0.6943 | 0.716 |
| Chile | 0.9734 | 0.9751 | 0.975 |
| Mexico | 0.9696 | 0.9697 | 0.9712 |
| Turkey | 0.9021 | 0.902 | 0.9003 |

[15] Regressions are estimated using ordinary least squares. Results are based on monthly data starting from 1981:01- 1993:12(60 observations). The variables are defined as follows:
Retu =lagged country returns,
Prer =lagged price earning ratios,
Diyi =lagged dividend yields.
Portfolio returns are calculated monthly by International Finance Corporation of The World Bank.
The following equations are estimated:
For regression#1: $\mathrm{Retu}_t = \mathrm{Constant} + \beta_0 \mathrm{Retu}_{t-1}$
For regression #2: $\mathrm{Retu}_t = \mathrm{Constant} + \beta_0 \mathrm{Retu}_{t-1} + \beta_1 \mathrm{Prer}_{t-1}$
For regression #3: $\mathrm{Retu}_t = \mathrm{Constant} + \beta_0 \mathrm{Retu}_{t-1} + \beta_1 \mathrm{Prer}_{t-1} + \beta_2 \mathrm{Diyi}_{t-1} + e_t$

[16] $R^2$, coefficient of determination where $R^2$ of 1 means perfect fit, whereas $R^2$ of 0 means no relationship between the dependent variable and the explanatory variables. Adjusted $R^2$ shows that after taking into account the degree of freedom.

TABLE 7
Coefficient of Determination, Domestic and Global Variables

| | Information Variables | | |
|---|---|---|---|
| | Local[17] | Global[18] | Local+Global[19] |
| Argentina | 0.886 | 0.73 | 0.8893 |
| Brazil | 0.716 | 0.5118 | 0.7244 |
| Chile | 0.975 | 0.9258 | 0.9765 |
| Mexico | 0.9712 | 0.8761 | 0.9727 |
| Turkey | 0.9003 | 0.3534 | 0.915 |

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[17] Regressions are estimated using ordinary least squares. Results are based on monthly data starting from 1981:01- 1993:12(60 observations). The variables are defined as follows:
Retu =lagged country returns, Prer =lagged price earning ratios, Diyi =lagged dividend yields.
The following equation is estimated:
$\text{Retu}_t = \text{Constant} + \beta_0 \text{Retu}_{t-1} + \beta_1 \text{Prer}_{t-1} + \beta_2 \text{Diyi}_{t-1} + e_t$

[18] Regressions are estimated using ordinary least squares. Results are based on monthly data starting from 1981:01- 1993:12(60 observations). The variables are defined as follows:
Spp =Dividend yield of standard and Poor Stock index, Term =U.S. term structure premia( the difference between 10 year U.S. bond yield and yield on 3 month U.S. T bill), Moody =U.S. default risk yield spread
( Moody's Baa minus Aaa bond yields)
The following equation is estimated:
$\text{Retu}_t = \text{Constant} + \beta_0 Spp_{t-1} + \beta_1 Term_{t-1} + \beta_2 \text{Moody}_{t-1} + e_t$

[19] Regressions are estimated using ordinary least squares. Results are based on monthly data starting from 1981:01- 1993:12(60 observations). The variables are defined as follows:
Retu = country returns, Prer = price earning ratios, Diyi = dividend yields, Spp =Dividend yield of standard and Poor Stock index, Term =U.S. term structure premia( the difference between 10 year U.S. bond yield and yield on 3 month U.S. T bill), Moody =U.S. default risk yield spread( Moody's Baa minus Aaa bond yields)
The following equation is estimated:
$\text{Retu}_t = \text{Constant} + \beta_0 \text{Retu}_{t-1} + \beta_1 \text{Prer}_{t-1} + \beta_2 \text{Diyi}_{t-1} + \text{B}_3 Spp_{t-1} + \text{B}_4 Term_{t-1} + \text{B}_5 Moody_{t-1} + e_t$

TABLE 8
Predictability of Returns

| Variable Returns | Information Variables Local * | Global** | Local+Global*** |
|---|---|---|---|
| Argentina | 52.6230[0.0][20] | 44.6293[0.0] | 53.1472[0.0] |
| Brazil | 43.1154[0.0] | 32.2029[0.0] | 44.4237[0.0] |
| Chile | 57.6067[0.0] | 55.7763[0.0] | 57.7588[0.0] |
| Mexico | 57.3936[0.0] | 52.9487[0.0] | 57.5562[0.0] |
| Turkey | 51.6219[0.0] | 22.4719[0.0] | 52.6942[0.0] |

[20] $\rho$ values are the probabilities that a $\chi^2$ variation exceeds the sample value of the statistics.

* The variables are used as follows:
Retu = country returns, Prer = price earning ratios, Diyi = dividend yields.
The following equation is estimated:

$$\mathrm{Retu}_t = \mathrm{Constant} + \beta_0 \mathrm{Retu}_{t-1} + \beta_1 \mathrm{Prer}_{t-1} + \beta_2 \mathrm{Diyi}_{t-1} + e_t$$

** The variables are used as follows:
Spp =Dividend yield of standard and Poor Stock index, Term =U.S. term structure premia( the difference between 10 year U.S. bond yield and yield on 3 month U.S. T bill), Moody =U.S. default risk yield spread( Moody's Baa minus Aaa bond yields)
The following equation is estimated:

$$\mathrm{Retu}_t = \mathrm{Constant} + \beta_0 Spp_{t-1} + \beta_1 Term_{t-1} + \beta_2 \mathrm{Moody}_{t-1} + e_t$$

*** The variables are used as follows:
Retu = country returns, Prer = price earning ratios, Diyi = dividend yields.
Spp =Dividend yield of standard and Poor Stock index, Term =U.S. term structure premia( the difference between 10 year U.S. bond yield and yield on 3 month U.S. T bill), Moody =U.S. default risk yield spread
( Moody's Baa minus Aaa bond yields)
The following equation is estimated:

$$\mathrm{Retu}_t = \mathrm{Constant} + \beta_0 \mathrm{Retu}_{t-1} + \beta_1 \mathrm{Prer}_{t-1} + \beta_2 \mathrm{Diyi}_{t-1} + \mathrm{B}_3 Spp_{t-1} + \mathrm{B}_4 Term_{t-1} + \mathrm{B}_5 Moody_{t-1} + e_t$$

TABLE 9
Method of Moments Estimations

| | $X^2$[21] | $e_{it}$[22] | $e_{wt}$[23] | $h_{it}$[24] |
|---|---|---|---|---|
| Argentina | 20.8179 | -0.053 | -0.036 | -0.023 |
| Brazil | 37.6507 | -0.037 | -0.036 | -0.051 |
| Chile | 64.1824 | -0.052 | -0.036 | -0.017 |
| Mexico | 32.2864 | -0.045 | -0.036 | -0.042 |
| Turkey | 71.9196 | -0.056 | -0.036 | 0.116 |

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[21] $X^2$ values are estimated by using method of moments, on equation (27)

[22] $e_{it}$ is the error terms from equation . $R^2$ values are obtained from the regression of $e_{it}$ on the local information variables
The variables are used as follows: Retu = country returns, Prer = price earning ratios,
Diyi = dividend yields. The following equation is estimated:
$e_{it} = \text{Constant} + \beta_0 \text{Retu}_{t-1} + \beta_1 \text{Prer}_{t-1} + \beta_2 \text{Diyi}_{t-1} + e_t$

[23] $e_{wt}$ is the error terms from equation . $R^2$ values are obtained from the regression of $ew_t$ on the global information variables
The variables are used as follows: Spp =Dividend yield of standard and Poor Stock index,
Term =U.S. term structure premia( the difference between 10 year U.S. bond yield and yield on 3 month U.S. T bill) Moody =U.S. default risk yield spread( Moody's Baa minus Aaa bond yields)
The following equation is estimated:
$e_{wt} = \text{Constant} + \beta_0 Spp_{t-1} + \beta_1 Term_{t-1} + \beta_2 \text{Moody}_{t-1} + e_t$

[24] $h_{it}$ is the error terms from equation . $R^2$ values are obtained from the regression of $h_{it}$ on the local and global information variables The variables are used as follows: Retu = country returns,
Prer = price earning ratios, Diyi = dividend yields. Spp =Dividend yield of standard and Poor Stock index, Term =U.S. term structure premia( the difference between 10 year U.S. bond yield and yield on 3 month U.S. T bill), Moody =U.S. default risk yield spread( Moody's Baa minus Aaa bond yields)
The following equation is estimated:
$\text{Retu}_t = \text{Constant} + \beta_0 \text{Retu}_{t-1} + \beta_1 \text{Prer}_{t-1} + \beta_2 \text{Diyi}_{t-1} + B_3 Spp_{t-1} + B_4 Term_{t-1} + B_5 Moody_{t-1} + e_t$

TABLE 10
Test of Constancy of Price of Variance, Price of Covariance, and Integration

| | Price of Variance[25] | Price of Covariance[26] | Integration[27] |
|---|---|---|---|
| Argentina | 55.7817[0.0] | 12.8325[0.0] | 58.3704[0.0] |
| Brazil | 58.9544[0.0] | 25.0693[0.0] | 58.9996[0.0] |
| Chile | 56.0013[0.0] | 20.5335[0.0] | 57.9697[0.0] |
| Mexico | 53.1381[0.0] | 17.5657[0.0] | 57.4445[0.0] |
| Turkey | 31.3364[0.0] | 21.8927[0.0] | 49.2024[0.0] |

[25] Price of variance is estimated by using equation (19)
[26] Price of covariance is estimated by using equation (18)
[27] Integration measure is estimated by using equation (30)

TABLE 11
Test of Integration Versus Segmentation

| | Test of Integration[28] | Test of Segmentation[29] |
|---|---|---|
| Argentina | 3.0194 | 2.2487 |
| Brazil | 0.1562 | 9.5353 |
| Chile | 10.6347 | 2.09E-07 |
| Mexico | 10.8224 | 1.5999 |
| Turkey | 5.382 | 1.0458 |

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[28] For the test of segmentation
$r_{it} = \gamma_0 + \gamma_2 Var_{t-1}\left[r_{it} \middle| Z_{i't-1}\right] + e_{it}$ is tested against
$r_{it} = \gamma_0 + \gamma_1 Cov_{t-1}\left[r_{it} r_{wt} \middle| Z_{w't-1}\right] + \gamma_2 Var_{t-1}\left[r_{it} \middle| Z_{i't-1}\right] + e_{it}$

[29] For the test of market integration
$r_{it} = \gamma_0 + \gamma_1 Cov_{t-1}\left[r_{it} r_{wt} \middle| Z_{w't-1}\right] + e_{it}$ is tested against
$r_{it} = \gamma_0 + \gamma_1 Cov_{t-1}\left[r_{it} r_{wt} \middle| Z_{w't-1}\right] + \gamma_2 Var_{t-1}\left[r_{it} \middle| Z_{i't-1}\right] + e_{it}$

TABLE 12
ARCH Estimates

| Argentina | Variable | Coeff | Std Error | T-Stat | Signif |
|---|---|---|---|---|---|
| | $B_0$ | 88.9574 | 0.2933508 | 303.24 | 0 |
| | $B_1$ | 0.9529 | 0.0003238 | 2943.17 | 0 |
| | $B_2$ | 0.3585 | 0.0062136 | 57.69 | 0 |
| | $B_3$ | -15.5162 | 0.1501113 | -103.36 | 0 |
| | $\alpha_0$ | 237.3773 | 0.9035176 | 262.72 | 0 |
| | $\alpha_1$ | 0.1048 | 0.001806 | 58.03 | 0 |
| Brazil | $B_0$ | 41.0186 | 1.21296067 | 33.81 | 0 |
| | $B_1$ | 0.8382 | 0.00549574 | 152.53 | 0 |
| | $B_2$ | -0.0012 | 0.00033241 | -3.74 | 0.00018325 |
| | $B_3$ | -2.0539 | 0.10600801 | -19.37 | 0 |
| | $\alpha_0$ | 49.2176 | 0.96636812 | 50.93 | 0 |
| | $\alpha_1$ | 0.3731 | 0.0261171 | 14.28 | 0 |
| Chile | $B_0$ | 277.3046 | 3.4818221 | 79.64 | 0 |
| | $B_1$ | 0.8561 | 0.000516 | 1659.26 | 0 |
| | $B_2$ | 24.2055 | 0.2117998 | 114.28 | 0 |
| | $B_3$ | -25.956 | 0.3192629 | -81.29 | 0 |
| | $\alpha_0$ | 137.7738 | 2.5030182 | 55.04 | 0 |
| | $\alpha_1$ | 0.1039 | 0.0015124 | 68.72 | 0 |
| Mexico | $B_0$ | -213.5957 | 3.0817671 | -69.3 | 0 |
| | $B_1$ | 1.0768 | 0.0006661 | 1616.66 | 0 |
| | $B_2$ | -0.309 | 0.2376507 | -1.3 | 0.19343432 |
| | $B_3$ | 74.4285 | 0.5881281 | 126.55 | 0 |
| | $\alpha_0$ | 111.8728 | 2.8490762 | 39.26 | 0 |
| | $\alpha_1$ | 0.0969 | 0.0016972 | 57.1 | 0 |
| Turkey | $B_0$ | 143.5519 | 2.729554 | 52.59 | 0 |
| | $B_1$ | 1.0075 | 0.001392 | 723.96 | 0 |
| | $B_2$ | -14.0117 | 0.246601 | -56.81 | 0 |
| | $B_3$ | 17.4792 | 0.417456 | 41.87 | 0 |
| | $\alpha_0$ | 1042.609 | 13.910602 | 74.95 | 0 |
| | $\alpha_1$ | 0.0465 | 0.0002 | 159.74 | 0 |

The following model is estimated : $r_{it} = \lambda_{i't-1} Var_{t-1}\left[r_{it} \middle| Z_{t-1}\right] + e_{it}$

$$\lambda_{i't-1} = \exp(Z_{i't-1}\beta_i)$$

$$h_t = \alpha_0 + \alpha_1 \sum_{q=1} e_{t-q} e_{t-q}$$

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# IMAGE EVALUATION TEST TARGET (QA-3)

150mm

6″