Does Total Risk Matter? The Case of Emerging Markets

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This paper examines the relationships between market risk premiums, time-varying variance and covariance in forty-eight emerging, and seven developed capital markets. We allow each market's risk premium generating process to be state-dependent by accounting for negative and positive market price of variance and covariance risk. We find that half of the emerging markets exhibit reward to world variance while for the other half are only sensitive to local risk factors. We also find evidence of a negative relationship between reward to local risk and reward to world risk. Accordingly, the relative importance of one reward versus the other depends on the ever-changing correlation with the world market. Finally, we show that correlation is not a factor that explains reward to local risk in few segmented capital markets (JEL: G12; G15).

Keywords: reward to risk, conditional risk, market price of risk, multivariate GARCH.

I. Introduction

Although there is a huge volume of literature investigating the relationship between return and concomitant risk, there is no conclusive agreement. Early studies reveal that cross-sectional stock returns have no relationship with beta, while studies like Ferson and Harvey (1991), and Stein (1996) mention that macroeconomic and market factors have significant predictive power for stock returns. One possible reason for beta not being able to explain the risk-return relationship is that these studies assume the return distribution to be identical in different

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economic states. For instance, Avard, Nam and Pyun (2001) and Pettengill, Sundaram and Mathur (1995) recognize the problem of using realized returns to proxy for expected returns and suggest adjusting for expectations regarding negative market excess returns. Using this line of argument, Pettengill et al. (1995), Jagannathan and Wang (1996), and Fletcher (1997, 2000) find considerable support for cross-sectional beta in the developed markets. The issue of relating risk and return in the emerging markets differs from that of developed markets as emerging markets are characterized by (i) high volatility, (ii) low integration and correlation with the world market , and thus (iii) high diversifiable risk (Harvey 1995a, 1995b).[12] In fact, Estrada (2000) summarizes previous studies and concludes that betas and stock returns in emerging markets do not seem be related.

Harvey (1995c) investigates risk-return relationships in twenty emerging markets using both conditional and unconditional asset pricing models without making assumptions about different market states. Bekaert and Harvey (1995) use a regime switching approach to study market integration and risk-return relationships in emerging markets. This paper differs from (a) Harvey (1995c) as we test risk return relationships in emerging markets using a state-dependent approach, and (b) Bekaert and Harvey (1995) as we assume the market to be in one state or the other without allowing for transition probabilities as required in their regime-switching model. This paper also differs from Bekaert and Harvey (1995) in other respects. Bekaert and Harvey (1995) investigate the issue of capital market integration, while we are interested in studying risk-return relationships in emerging capital

1. According to the World Bank, capital markets are considered as “emerging” based on the country’s GNP per Capita as compared to the U.S. Note that Greece has been upgraded to a “developed” capital market in 2001. In our study, which traces back to 1988, we treat Greece as an emerging market. For sake of simplicity, we label all non-developed markets as emerging markets; in reality some of the markets studied are not even considered as emerging markets by the World Bank.

2. High global stock market correlations do not indicate market integration. Goetzmann, Li and Rouwenhorst (2002) suggest that during periods of capital market integrations, correlations tend be higher than during periods of segmentation. Bekaert and Harvey (1995) state that in an integrated world, the expected returns are linked to the covariance with world market returns and local return volatility under segmentation. The authors also find that integration causes the equity market to become significantly more correlated with world market. Dumas, Harvey and Ruiz (2003) also find correlations of stock returns to be larger in integrated markets than in segmented markets. Although we do not suggest that high correlation is simply a matter of integration, we contend, like other researchers, that integration is accompanied with an increase in correlation.

markets. Bekaert and Harvey (1995) study risk-return relationships but only report diagnostic tests. They do not discuss risk-return relationships as diagnostic tests reject their models for most countries. Finally, we find support for our approach in countries where Harvey (1995c) and Bekaert and Harvey (1995) do not find any support for their approach. A possible reason for this could be that we use a different sample period, and a different data frequency.

This paper contributes to the finance literature as we extend Harvey (1995c) and Bekaert and Harvey (1995) by including more countries over a longer sample period. Another feature of this paper is that we apply the Pettengill et al. (1995) framework in the approach used by Avard et al. (2001), which has never been done before while testing international asset pricing models. Pettengill et al. (1995) use the sign of the realized risk premium as a trigger to differentiate cross-sectionally between upstate and downstate, and find beta and returns to be highly significant in U.S. markets.[3] A simple application of Pettengill et al. (1995) to study the risk-return relationship in emerging markets is fraught with problems, as beta does not give a complete picture of risk in markets characterized by high diversifiable risk. Like Avard et al. (2001) we use total risk as measured by variance of returns. Like Harvey (1995c) and Bekaert and Harvey (1995), we also investigate if systematic risk as measured by covariance between local market and world returns has any explanatory power.

The paper investigates the return generating process for 56 index series. We use daily index time series from the equity markets of fourteen European countries, eleven Asian countries, eleven Middle East and North African countries, seven Latin American countries, and five African countries. G-7 countries are also included as control variables. The world "all countries" block index is used as a proxy for the world market. As we take the perspective of a U.S. investor, series are denominated in U.S. dollars.[4]

The findings suggest that conditional variance explains risk premiums over time in all markets. We also find that conditional

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3. We use the term state-dependent when we refer upstate and downstate together.

4. Gerard and Desantis (1997), Chan, Karolyi and Stulz (1992), Harvey (1991,1995c) use dollars as a numeraire, and assume that investors do not cover their exposure to exchange risk–i.e., the market price of currency risk is zero. To measure the dimension of market price of currency risk relative to reward to market risk leads to important issues that go beyond the scope of our paper, we will leave it to future research.

covariance describes risk premiums over time in seven developed markets and some emerging markets. The tests on cross sections of state-dependent market price of variance and covariance risk reveal that market price of risk is indeed a combination of reward to local and world variance.[5] We notice that the relative importance of reward to local variance versus world variance depends on the ever-changing correlation with the world market. Finally, we show that correlation is not a factor that explains reward to local risk in few segmented capital markets. Other local risk components may be relevant in explaining risk premiums in these markets.

The rest of the paper is organized as follows: Section II discusses methodology, Section III discusses data, and Section IV discusses the results, while Section V is the conclusion.

II. Methodology

Despite the plethora of articles investigating the inter-temporal generating process of local market risk premium, there is no clear empirical consensus on how local market risk premium relates to inherent conditional total risk. Theoretically, there should be a direct relationship between market excess return and the conditional variance, and the conditional covariance with the world market.

Harvey (1995c) investigates risk return relationships in twenty emerging countries for the period between March 1986 and June 1992 and concludes that standard asset pricing models which assume complete market integration between capital markets fail to explain the cross-section of average returns. Harvey (1995c) also points out that emerging markets returns are more likely to be influenced by local information. Consequently, emerging markets would not price world market covariance risk but would rather price the local risk, perhaps measured by total risk.[6] Bekaert and Harvey (1995) consider a

5. Market price and reward to risk is used interchangeably–i.e., $(R_i - R_f)/\sigma_i^2$ is the reward to total risk or market price of total (variance) risk and $(R_i - R_f)/\sigma_{i,m}$ is the reward to systematic risk or market price of systematic (covariance) risk.

6. In his approach, Harvey (1991, 1995c) allows required returns to be determined by a (time-varying) weighted average of a global beta and a local standard deviation. This conditional beta approach leads the author to findings contrary to what would be expected in a capital asset pricing framework. Furthermore, Ghysels and Garcia (1996) question the structural stability of the Harvey's (1995c) prediction model. As DeSantis and Gerard (1997)

conditional regime-switching approach with both world market covariance and local market variance and still reject their model specification for ten of the twelve countries they study.

The model in Bekaert and Harvey (1995) can be represented as:

$$E_{t-1}\lfloor r_{i,t}\rfloor = \varphi_{i,t-1}\lambda_{i,t-1}\mathrm{cov}_{t-1}\lfloor r_{i,t},r_{w,t}\rfloor + (1-\varphi_{i,t-1})\lambda_{i,t-1}\mathrm{var}_{t-1}\lfloor r_{i,t}\rfloor \tag{1}$$

Here the parameter $\varphi_{i,t-1}$, has values that fall in the interval [0,1] and represents the likelihood estimations of markets integration with the world market. Our approach differs from Bekaert and Harvey (1995) in that we do not allow the value of $\varphi_{i,t-1}$ to vary between 0 and 1, but rather it can only take values 0 or 1, depending whether it is a down market or an up market respectively. A down market is defined as a market state when the market risk premium is negative, while an up market state is defined as the market state when the market risk premium is positive. The study differs from Bekaert and Harvey (1995) in another respect. Bekaert and Harvey (1995) are interested in testing risk-return relationships while making consideration for the level of integration with the world market. We, on the other hand, do not consider level of integration at all, but rather look at how risk – covariance or variance – is related to return in two different market states.

There is ample evidence for state-dependency in the return-generating process. For instance, Boudoukh, Richardson and Smith (1993) find that, in the United States, negative risk premia are associated with downward markets. They also state that an alternative model is needed to accommodate negative equity premia, as the one-factor model which imposes a non-negativity constraint on the market risk premium cannot fully explain the dynamics of international expected returns. Furthermore, Desantis and Gerard (1997) show that the findings of Boudoukh, Richardson and Smith (1993) also hold in international markets.

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states, Harvey's (1991) representation only parameterizes the dynamics of first moments. They add that as evidenced by Engle, Frankel, Froot and Rodrigues (1995), a large body of research in finance shows that models that predict second moments are much more successful and powerful than models that predict first moments. Besides, DeSantis and Gerard (1997) argue that many variables of interest depending on the conditional second moments cannot be recovered in Harvey's model–the impact of these variables could be captured if additional moment restrictions are imposed.

Pettengill et al. (1995), and Fletcher (1997, 2000) differentiate between upstate and downstate and find considerable support for state-dependent cross-sectional betas in developed market. However, the use of state-dependent beta in emerging markets is problematic, as correlations of emerging markets with the world market are typically weak and often highly volatile. Hence, like Bekaert and Harvey (1995), we consider both covariance and variance risk.

In finance literature, state-dependency is accounted for in two ways. One stream of research incorporates a good/bad news effect using lagged residuals into an equation that relates returns to forecasted variance (Glosten, Jagannathan and Runkle[1993], Avard et al, [2001]). Another stream of research uses the sign of the realized risk premium as a trigger to differentiate between upstate and downstate (Pettengill et al, [1995], Fletcher, [1997,2000] Estrada, [2000]). Although the two approaches are fundamentally different, they have a common denominator: a piece-wise determination of the variance function is likely to provide a linear explanation of concomitant risk premiums.

The rationale behind state-dependency can be explained as follows. In empirical tests, realized market risk premium is used as an unbiased estimate of the expected market risk premium. Consistent with rational expectations, the ex-ante market price of risk should always be positive. However, ex-post, the market price of risk may be negative, particularly in downstate markets, and that would imply a negative risk premium. Subsequently, the effect of volatility on investor behavior and consequent risk-return relationship would be state-dependent. Thus, a negative market price of risk would be associated with downstate markets and a positive market price of risk would be consistent with upstate markets.[7]

We use a multivariate state-dependent-GARCH(1,1)-M (SDMGARCH-M), which is expected to portray the hypothesized state-dependent reward to variance and covariance risk. As in De Santis and Gerard (1997), we use a slightly modified multivariate GARCH

7. Pettengill, Sundaram and Mathur (1995) state "the existence of a large number of negative market excess return periods suggests that previous studies that test for unconditional positive correlation between beta and realized returns are biased against finding a positive relationship." The idea of the state-dependent approach is to account for the negative portion of the realized market risk premium distribution. Indeed, investors have perfect market timing ability in their rational expectations and will always choose between the market return and the risk-free rate, whichever is the greatest. After the fact, investors do not have perfect market ability and may allocate funds in a market, which realized return is smaller than the risk-free rate.

model formally described in Engle and Kroner (1995). The multivariate GARCH model allows for time varying local, and world market variances, as well as their time varying covariances.[8] To generate parameter estimates, a system of six equations is solved simultaneously for each market. The first equation (2a) relates market risk premium with forecasted state-dependent covariance. The following two equations (2b and 2c) relate risk premium for a market and the world using inherent forecasted state-dependent variance. The next two equations (2d and 2e) forecast the variance of the two portfolios. The final equation (2f) forecasts the covariance between a local market and the world. The SDMGARCH-M specifications are as follows:

$$RP_{i,t} = \alpha_i + \varphi_i RP_{i,t-1} + \lambda_i \sigma_{i,m,t} + \lambda_{i,m,2}(1-\delta_i)\sigma_{i,m,t} + e_{i,m,t} \tag{2a}$$

$$RP_{i,t} = \alpha_i + \varphi_i RP_{i,t-1} + \lambda_{i,1}\delta_i \sigma^2_{i,t} + \lambda_{i,2}(1-\delta_i)\sigma^2_{i,t} + e_{i,t} \tag{2b}$$

$$Rp_{m,t} = \alpha_m + \varphi_m RP_{m,t-1} + \lambda_{m,1}\delta_m \sigma^2_{m,t} + \lambda_{m,2}(1-\delta_m)\sigma^2_{m,t} + e_{m,t} \tag{2c}$$

$$\forall i$$

$$\sigma^2_{i,t} = \gamma_i + \omega_i e^2_{i,t-1} + \psi_i \sigma^2_{i,t-1} \tag{2d}$$

$$\sigma^2_{m,t} = \gamma_m + \omega_m e^2_{m,t-1} + \psi_m \sigma^2_{m,t-1} \tag{2e}$$

$$\sigma_{i,m,t} = \gamma_i \gamma_m + \omega_i \omega_m e_{i,t-1} e_{m,t-1} + \psi_i \psi_m \sigma_{i,m,t-1} \tag{2f}$$

Here $RP_{i,t}$ is the realized risk premium in market i. $RP_{m,t}$ is the realized risk premium in the world market. $\sigma_{i,m,t}$ is the conditional covariance between the world and a given market. $\sigma^2_{m,t}$ is the variance of the world market. $\lambda_{i,m,1}$ and $\lambda_{i,m,2}$ are up-state and down-state reward to global risk factors. $\sigma^2_{i,t}$ is the conditional variance in a local market. $\lambda_{i,1}$ and $\lambda_{i,2}$ are up-state and down-state reward to local risk factors. δ_i is a dummy variable that takes the value of one in an upstate environment (positive contemporaneous market risk premium) and zero in downstate

8. DeSantis and Gerard (1997) and Engle, Frankel, Froot and Rodrigues (1995) mention that a large body of research in finance shows that models that predict second moments are more successful than models that predict first moments. Furthermore, we are using a bivariate GARCH which has the advantage of using only two assets. Therefore, we do not need to impose restrictions on the covariance generating process. This means that the bivariate model compute variances and covariances that depend on past residuals, autoregressive component and cross-products of past residuals. Thus, as Desantis and Gerard (1997) point out, the model allows for time-varying correlations–this is critical knowing that correlations among asset returns change with market conditions (Karolyi and Stulz, 1996).

conditions (negative contemporaneous market risk premium). The coefficient α_i (abnormal return) is expected to be insignificant. The coefficient φ_i measures the one-lag predictability of the dependent variable.[9] $e^2_{i,t-1}$ is the lag of the squared residual from the mean equation and provides news about volatility clustering. $\sigma^2_{i,t-1}$ is last period's forecast variance. If the sum of ω_i and ψ_i equals 1, it implies that a current shock persists indefinitely in conditioning the forecasted variance. The sum of ω_i and ψ_i also represents the change in the response function of shocks to volatility per period, a greater value than one implies that the response function of volatility is explosive and a value less than unity implies that shocks decay with time. We use a Bollerslev-Wooldridge heteroskedasticity consistent covariance to compute the Quasi Maximum Likelihood (QML) covariances and standard errors as described by Bollerslev and Wooldridge (1992).

We also examine the case of no state-dependency in equation 2, i.e., in equations (2a), (2b) and (2c). Specifically we look at two relationships (i) between risk premiums and conditional variance, and (ii) between risk premiums and conditional covariance. This representation is similar to the one used by Harvey (1995c) in which he finds that model specifications do not explain risk return relations. Since the data period and data frequency used in this paper are different from that of Harvey (1995c), we think it is important to investigate, if Harvey's (1995c) findings change across sample periods, and are different when a higher data frequency is used.

III. Data

The data consists of 56 index series including 48 emerging market indices, indices of G-7 countries and a world index. The emerging markets indices consists of 14 European, 11 Asian, 7 Latin American, 11 Middle East and North African (MENA), and 5 African countries. The G-7 countries are: U.S., U.K., France, Italy, Japan, Canada and Germany, while the world market is the MSCI "All Countries" world index. The primary data source for this study is Datastream. The

9. We include a lagged risk premium in the mean equation to take into consideration serial correlation in risk premiums and thus, improve numerical optimization. Serial correlation is likely to happen with daily data in emerging markets, which are characterized with microstructure inefficiencies arising from political risk, official restrictions, discriminatory taxes, foreign exchange risk, market thinness or simply lag in price recording.

database contains several reliable sources for international stock market returns series including Morgan Stanley Capital International (MSCI), the International Finance Corporation (IFC) and the Hong Kong and Shanghai Banking Corporation (HSBC), and local market series.[10] The problem with these sources is that they do not include indices for all the countries. If they do, the countries coverage does not start at the same time. While selecting an index, we first identify the sources in which it is available and then select the source in which it is available for the longest period. Thirty-six of the fifty-six indices come from MSCI. It includes the seven developed markets, twenty-eight emerging markets and the world market (MSCI All Countries World Index). Of the remaining twenty emerging market series, five come from IFC, five from HSBC and ten are local series (Bulgaria, Estonia, Iceland, Ukraine, Bangladesh, Kuwait, Lebanon, Tunisia, Kenya and Mauritius).[11]

All series end as of December 30th, 2001, but the coverage periods for all countries are not the same: twenty one series start on January 1st, 1988; fourteen series start on January 1st, 1993; six series start on January 1st, 1995; five series start on January 1st, 1996; eight series start on January 1st, 1998; two series start on April 20th, 2000. One issue of concern is that, as coverage of the return series differ, inter-market comparisons are difficult. However, due to the number of emerging markets covered in this paper, this problem is inevitable.

We use daily returns data calculated from the percent logarithmic difference between closing prices.[12] The construction of return indices is based on value-weighted portfolios. MSCI, IFC and HSBC indices for

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10. These are handled by the local stock exchange itself.

11. The reliability of local series might be considered as suspicious because there is no guaranty of synchronization of price recording. IFC has started to cover Bangladesh, Tunisia, Kenya and Mauritius as "Frontier Markets" in a monthly frequency since the beginning of 1996, as well as Estonia and Ukraine since the beginning of 1998. We found that the local series "Dahka SE" (1996:01 to 2001:12), "TUNINDEX" (1998:01 to 2001:12), "Nairobi SE" (1996:01 to 2001:12), "SEMDEX" (1996:01 to 2001:12), "ARIPAEV INDEX" (1998:02 to 2001:12) and "KP-Dragon" (1998:02 to 2001:12) have correlation of 0.91 or greater with the corresponding IFCM "Frontier" index.

12. We use daily data to capture potential short-lived interactions because it is well known in the literature (Cho and Engle, [1999]) that using monthly data may not be appropriate in describing the effect of capital movement (an intrinsically short-term occurrence). Also it is usually argued that high frequency data can be problematic when infrequent trading occurs. This is a trade off we are willing to accept because the numerical optimization of univariate or bivariate GARCH models will not be achieved with too few monthly data points.

TABLE 1. Descriptive Statistics on Daily market risk premiums

Europe	Source	Start Date	Number of Obs.	Mean	Std. Dev	Skew	Kurt	Corr.	Beta
Bulgaria ‡	BSE Sofia Lazard	Jan ‘98	1035	–42.07%	47.45%	0.06	44.61	0.06	0.199b
Croatia	HSBC	Jan ‘98	1035	–19.55%	35.24%	0.22	9.57	0.15	0.356a
Czech Rep.	MSCI	Jan ‘95	1821	–11.29%	24.51%	–0.09	5.07	0.31	0.586a
Estonia ‡	ARIPAEV INDEX	Jan ‘96	1748	18.63%	38.21%	–0.75	22.6	0.07	0.205b
Greece	MSCI	Jan ‘88	3626	4.37%	31.14%	0.11	8.01	0.23	0.604a
Hungary	MSCI	Jan ‘95	1821	3.96%	34.45%	–0.56	12.38	0.35	0.955a
Iceland ‡	ICEX	Jan ‘93	2339	6.40%	9.78%	–0.38	10.41	0.00	0.002
Latvia	HSBC	Jan ‘98	1035	–25.91%	32.33%	1.77	38.39	0.09	0.182c
Poland	MSCI	Jan ‘93	2342	10.19%	40.46%	–0.17	6.50	0.21	0.701a
Romania	HSBC	Jan ‘98	1108	–50.93%	36.34%	0.04	8.34	0.04	0.089
Russia	MSCI	Jan ‘95	1821	6.37%	62.37%	–0.29	9.39	0.31	1.506a
Slovakia	HSBC	Jan ‘96	1557	–24.74%	28.68%	–0.59	7.55	0.00	0.007
Slovenia	HSBC	Jan ‘96	1557	–11.22%	25.52%	1.06	18.24	–0.01	–0.021
Ukraine ‡	KP-Dragon	Jan ‘98	1208	–20.66%	36.19%	–0.77	8.79	0.02	0.043
Asia									
Bangladesh ‡	Dahka SE	Jan ‘93	3112	–1.97%	30.14%	0.46	109.27	0.01	0.014
China	MSCI	Jan ‘93	2342	–21.64%	33.88%	0.21	7.75	0.18	0.520
India	MSCI	Jan ‘93	2342	–5.49%	26.66%	–0.09	5.50	0.06	0.137b
Indonesia	MSCI	Jan ‘88	3647	–7.50%	46.72%	0.21	47.09	0.08	0.318a
Korea	MSCI	Jan ‘88	3647	–6.05%	38.05%	0.45	16.55	0.16	0.500a

(*Continued*)

TABLE 1. (Continued)

Asia	Source	Start Date	Number of Obs.	Mean	Std. Dev	Skew	Kurt	Corr.	Beta
Malaysia	MSCI	Jan ‘88	3647	–3.05%	32.66%	–0.77	56.53	0.20	0.542a
Pakistan	MSCI	Jan ‘93	2342	–16.89%	31.39%	–0.58	11.66	0.03	0.091
Philippines	MSCI	Jan ‘88	3647	-3.46%	27.02%	0.75	16.07	0.13	0.304a
Sri Lanka	MSCI	Jan ‘93	2342	–18.46%	20.15%	0.06	8.12	0.03	0.044
Taiwan	MSCI	Jan ‘88	3647	–0.88%	34.08%	0.00	5.53	0.12	0.343a
Thailand	MSCI	Jan ‘88	3647	–8.54%	34.15%	0.41	10.23	0.19	0.552a
Latin America									
Argentina	MSCI	Jan ‘88	3647	12.54%	64.27%	–2.98	102.23	0.14	0.746a
Brazil	MSCI	Jan ‘88	3647	8.92%	46.73%	–0.46	10.79	0.25	0.985a
Chile	MSCI	Jan ‘88	3647	7.60%	20.42%	–0.50	15.07	0.23	0.395a
Colombia	MSCI	Jan ‘93	2342	–11.32%	21.62%	0.30	11.74	0.08	0.146a
Mexico	MSCI	Jan ‘88	3647	13.76%	32.10%	–0.14	16.11	0.37	0.983a
Peru	MSCI	Jan ‘93	2342	–0.63%	26.88%	0.11	8.51	0.26	0.578a
Venezuela	MSCI	Jan ‘93	2342	–2.82%	45.05%	–6.73	185.6	0.15	0.571a
MENA									
Bahrain	IFC	Apr ‘00	436	–19.51%	8.83%	–0.03	11.28	0.02	0.011
Egypt	MSCI	Jan ‘95	1819	–3.31%	22.08%	0.40	7.26	0.00	0.005
Israel	MSCI	Jan ‘93	2342	–0.72%	26.35%	–0.31	7.2	0.39	0.864a
Jordan	MSCI	Jan ‘88	3647	–9.16%	16.45%	–10.81	358.91	0.00	0.005
Kuwait ‡	KIC	Jan ‘95	1805	1.54%	11.03%	0.23	6.51	0.01	0.005

(*Continued*)

TABLE 1. (Continued)

MENA	Source	Start Date	Number of Obs.	Mean	Std. Dev	Skew	Kurt	Corr.	Beta
Lebanon ‡	BLOM	Jan ‘96	1543	–17.03%	16.35%	0.39	7.27	0.02	0.024
Morocco	MSCI	Jan ‘95	1819	0.38%	11.82%	0.38	10.19	0.00	0.001
Oman	IFC	Apr ‘00	436	–31.99%	13.27%	2.97	32.8	–0.03	–0.024
Saudi Arabia	IFC	Jan ‘98	1036	0.45%	14.27%	0.61	13.32	0.06	0.054
Tunisia ‡	TUNINDEX	Jan ‘98	1036	2.38%	11.52%	–1.60	100.5	–0.03	–0.025
Turkey	MSCI	Jan ‘88	3647	–2.02%	53.24%	–0.10	8.06	0.12	0.522a
Africa									
Kenya ‡	Nairobi SE	Jan ‘93	3115	0.89%	11.86%	2.43	39.62	–0.01	–0.006
Mauritius ‡	SEMDEX	Jan ‘93	3251	5.73%	9.22%	0.68	19.30	0.02	0.013
Nigeria	IFC	Jan ‘96	1689	13.89%	16.35%	0.13	11.35	0.01	0.014
South Africa	MSCI	Jan ‘93	2342	0.63%	24.70%	–0.42	11.04	0.37	0.761a
Zimbabwe	IFC	Jan ‘96	1689	–4.22%	35.11%	–2.20	30.91	0.09	0.238b

(*Continued*)

TABLE 1. (Continued)

G7 markets	Source	Start Date	Number of Obs.	Mean	Std. Dev	Skew	Kurt	Corr.	Beta
Canada	MSCI	Jan '88	3647	0.65%	15.84%	–0.77	11.89	0.58	0.768a
U.S.A.	MSCI	Jan '88	3647	6.21%	15.09%	–0.41	8.46	0.72	0.912a
Japan	MSCI	Jan '88	3647	–7.31%	23.01%	0.41	7.60	0.60	1.154a
France	MSCI	Jan '88	3647	4.60%	18.44%	–0.27	6.26	0.61	0.941a
Germany	MSCI	Jan '88	3647	3.16%	20.62%	–0.62	10.70	0.59	1.013a
Italy	MSCI	Jan '88	3647	–1.55%	22.38%	–0.21	6.30	0.45	0.852a
U. K.	MSCI	Jan '88	3647	0.98%	15.89%	–0.06	5.28	0.62	0.823a
World index									
"All Countries"	MSCI	Jan '88	3647	1.55%	11.95%	–0.22	6.52	1	1

Note: All returns are computed from daily price series in U.S. dollars. "‡" indicates that the source is a local index. Risk premiums are daily differences between daily market return and daily three-month Treasury Bill rate. Mean risk premiums and standard deviation of risk premiums are annualized by multiplying by 252 and $\sqrt{252}$, respectively. Correlation (Corr.) is computed relative to the MSCI AC World. Jarque Bera tests (not reported) indicate rejection of the null hypothesis for normality in all markets. Ljung-Box statistics (1 to 12 lags) for serial correlation are significant for all series (not reported). For each country, we regress each market premium ($RP_{i,t}$) series against world risk premiums ($RP_{m,t}$)–i.e., $RP_{i,t}=\alpha+\beta RP_{m,t}+e_t$. Betas and their level of significance are reported. Ljung-Box statistics (1 to 12 lags) on residuals (e_t) and squared residuals are significant for all series (not reported); a, b, c denote rejection of the null hypothesis at the 1, 5 and 10 percent level, respectively.

individual markets are usually highly correlated and reflect a constant methodology across markets. They capture the spirit of an all-share index by including replicable subsets of shares and targeting sixty percent of total market capitalization. These indices do not take into consideration restrictions on foreign ownership.

MSCI, IFC, and HSBC series are available in both local currency and hard currencies like the dollar, euro, pound, yen etc. For the study we use the U.S. dollar denominated indices, thereby the market price of currency risk is set equal to zero.[13] Liew (1995) also suggests that this is appropriate because hyperinflation trends usually prevalent in some emerging markets are thereby taken care of. Also, it provides uniformity in the comparison of one market to another. Furthermore, global institutional investors generally hold investments in hard currencies. For the ten local series, however, the indices are converted into U.S.-dollar denominated series by using daily exchange rates. When calculating daily risk premiums (return minus risk-free rate), we use the daily three-month U.S. T-bill rate as a proxy for the risk-free rate.[14] Exchange rates and U.S. T-bill rates are also obtained from DataStream. Table 1 summarizes the data sources, coverage periods and the number of observations.

We divide the data sample into two periods. The first period is between January 1988 and December 1992, and the second period is between January 1993 and December 2001. The reason behind this unequal sample division is that the first sample period matches closely the sample period, between March 1986 and June 1992, used by Harvey (1995c). This helps in comparing equation 2 with a state-independent

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13. Dumas, Harvey and Ruiz (2003) also use market series expressed in U.S. dollars. They argue that "randomly fluctuating exchange rates can cause a disconnection of realized returns expressed in local currency since, in theory, they ought to be linked by an equilibrium pricing relationship applicable to returns expressed in a common currency." They further indicate that their findings are not affected by the choice of unit because stock returns expressed in Dollars exhibit approximately the same measured correlations as do stock returns expressed in the respective local currencies. Viallet and Korajczyk (1989) report results using US Dollars as numeraire stating that asset pricing tests are not affected by the currency chosen.

14. As Assoe (1998) indicates, "the reliability of inflation data in many emerging markets is doubtful; furthermore, there is a lack of reliable short-term interest rate data in many emerging economies." Using a short term treasury bill as a proxy for the risk-free rate has been warranted by previous research. For instance, Kraus and Litzenberger (1976) use the rate on 90-day Treasury Bills to compute excess returns. Viallet and Korajczyk (1989), and Desantis and Gerard (1997) also use short-term Treasury bill rates as a proxy for the risk free rate.

approach similar to that used by Harvey (1995c). If we do not find any significance for the state-independent model specifications for the first sample period, the results would be consistent with that of Harvey (1995c) and we can safely conclude that Harvey's (1995c) results are consistent irrespective of data frequency. If we do not find any significance for state-independent approach for the second period, the findings of Harvey (1995c) are consistent across sample periods. However, if the state-dependent version of equation 2 points to significant parameters and model diagnostics for both sample periods, and the overall period, we would have support for the contention that risk return relationships in emerging markets, needs to be investigated on a piece-wise basis as done by Pettengill et al. (1995), Fletcher (1997, 2000) and Estrada (2000).

IV. Empirical Results

A. Distributional characteristics of the data

Table 1 presents the descriptive statistics of daily market risk premiums for all series. Mean risk premiums range from –7.31 percent (Japan) to 6.21 percent (United States) for developed markets, and –50.93 percent (Romania) to 18.63 percent (Estonia) for emerging markets. Annualized standard deviations vary from 15.09 percent (United States) to 23.01 percent (Finland) in developed markets, and 8.83 percent (Bahrain) to 64.27 percent (Argentina).

Each country's market risk premium series is characterized by high skewness, and excess kurtosis. Non-normality is a common characteristic.[15] Serial correlation, residual autocorrelation and volatility clustering (autocorrelation in squared residuals) are present in each risk premium time series.[16] Residual autocorrelation and volatility clustering suggest that variance is conditional, and hence a GARCH

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15. Jarque-Bera test for normality have been performed but not reported. For all series, the null hypothesis of normality is rejected.

16. Ljung-Box statistics for autocorrelation in returns, residuals (from OLS regression of market premium series with world premium series) and squared residuals (from OLS regression of market premium series with world premium series) have been computed for each series but not reported for sake of brevity. These statistics suggest significant autocorrelation for low lags (lag 1 to lag 10) as well as for high lags (lag 50 and 100) for most series. Results are available upon request.

TABLE 2A. Relevant Statistics for the State-Independent and State-Dependent ICAPM

Equation 2a	State-Ind.		State-Dep.		
	$\lambda_{I,m}$	adjR^2	$\lambda_{i,m,1}$	$\lambda_{i,m,2}$	adj R^2
Europe					
Bulgaria †					
Croatia †					
Czech Rep.	–8.23	0.02	171.83a	–184.47a	0.27
Estonia †					
France (G7)	12.16c	0.01	142.82a	–176.03a	0.41
Germany (G7)	5.01	0.00	153.96a	–179.72a	0.33
Greece	–4.20	0.02	247.43a	–263.17a	0.16
Hungary	–2.12	0.00	197.17a	–224.56a	0.31
Iceland †					
Italy (G7)	3.60	0.01	162.08a	–170.18a	0.33
Latvia †					
Poland	–8.17	0.02	204.27a	–208.9a	0.17
Romania †					
Russia	–18.93	0.00	217.79a	–246.93a	0.25
Slovakia †					
Slovenia †					
UK (G7)	10.86	0.01	163.35a	–155.7a	0.53
Ukraine †					
Asia					
Bangladesh †					
China	–9.05	0.04	338.31a	–292.62a	0.23
India †					
Indonesia	–1.90	0.04	237.64a	–233.78a	0.10
Japan (G7)	14.61b	0.01	148.09a	–128.4a	0.42
Korea	2.62	0.01	203.46a	–183.38a	0.21
Malaysia	6.97	0.00	233.26a	–196.43a	0.14
Philippines	–10.48	0.04	238.22a	–248.22a	0.17
Pakistan †					
Sri Lanka †					
Taiwan	2.22	0.00	186.49a	–153.77a	0.11
Thailand	2.27	0.02	220.40a	–234.91a	0.20
North America					
Canada (G7)	6.14	0.01	142.87a	–159.51a	0.36
US (G7)	7.87	0.00	124.86a	–114.92a	0.42
Latin America					
Argentina	3.42	0.02	143.52a	–157.87a	0.12
Brazil	0.26	0.02	147.37a	–156.79a	0.23
Chile	3.77	0.05	202.86a	–153.17a	0.12

(*Continued*)

TABLE 2A. (Continued)

Equation 2a	State-Ind.		State-Dep.		
	$\lambda_{I,m}$	adjR^2	$\lambda_{i,m,1}$	$\lambda_{i,m,2}$	adjR^2
Latin America					
Colombia †					
Mexico	7.50	0.02	143.41a	–162.62a	0.17
Peru	–19.20	0.04	238.1a	–249.74a	0.19
Venezuela	–7.51	0.04	321.86a	–335.00a	0.11
MENA					
Bahrain †					
Egypt †					
Israel	5.80	0.00	184.62a	–181.21a	0.33
Jordan †					
Kuwait †					
Lebanon †					
Morocco †					
Oman †					
Saudi Arabia †					
Tunisia †					
Turkey †					
Africa					
Kenya †					
Mauritius †					
Nigeria †					
South Africa	0.89	0.01	190.49a	–206.72a	0.28
Zimbabwe †					

(*Continued*)

parameterization is appropriate to model the behavior of daily risk premiums.[17] It is important to notice the extreme levels of skewness and kurtosis might suggest that, theoretically, a GARCH parameterization accommodating for both skewness and kurtosis (such as a skewed density or generalized error densities) could be more adapted. Yet, to our knowledge, it is not clear how to implement a multivariate GARCH with these attributes.

Developed markets have coefficients of correlation with the world portfolio ranging from 0.45 (Italy) to 0.72 (United Stated); their betas

17. We should mention that the empirical modeling of daily return volatility might be affected by the near-unit-root problem due to positive autocorrelation of squared returns for long lag length. Methods proposed to model this kind of behaviors can use the FIGARCH approach proposed by Baillie, Bollerslev and Mikkelson (1996).

TABLE 2A. (Continued)

Equation 2b	State-Ind.		State-Dep		
	λ_i	adj.R^2	$\lambda_{i,1}$	$\lambda_{i,2}$	adjR^2
Europe					
Bulgaria †	2.02	0.01	48.10a	–1.25a	0.49
Croatia †	0.60	0.00	25.59a	–36.33a	0.39
Czech Rep.	–1.97	0.02	41.28a	–42.59a	0.19
Estonia †	0.70	0.02	19.19a	–19.54a	0.26
France (G7)	6.42	0.00	59.05a	–70.81a	0.30
Germany (G7)	2.77	0.00	52.13a	–60.35a	0.44
Greece	1.23	0.02	32.75a	–32.07a	0.39
Hungary	0.74	0.00	29.74a	–28.24a	0.27
Iceland †	–16.81	0.01	103.28a	–100.74a	0.43
Italy (G7)	1.75	0.01	49.35a	–52.41a	0.39
Latvia †	–0.33	0.02	17.22a	–22.02a	0.33
Poland	0.90	0.02	26.71a	–24.94a	0.27
Romania †	–2.68	0.01	16.35a	–34.08a	0.34
Russia	1.11	0.00	17.61a	–14.79a	0.38
Slovakia †	0.77	0.00	35.8a	–36.04a	0.25
Slovenia †	1.54	0.00	43.83a	–43.79a	0.20
UK (G7)	6.69	0.00	76.54a	–73.27a	0.42
Ukraine †	–1.58	0.03	25.17a	–22.43a	0.36
Asia					
Bangladesh †	–0.78	0.06	17.49a	–12.42a	0.16
China	1.85	0.04	33.14a	–27.75a	0.35
India †	2.50	0.01	42.48a	–37.96a	0.39
Indonesia	–0.04	0.04	9.40a	–16.68a	0.50
Japan (G7)	4.89b	0.00	52.31a	–45.37a	0.38
Korea	0.87	0.00	33.28a	–28.72a	0.29
Malaysia	0.76	0.00	35.74a	–38.04a	0.50
Philippines	0.06	0.04	39.50a	–39.40a	0.35
Pakistan †	1.94	0.00	32.38a	–29.73a	0.24
Sri Lanka †	1.89	0.08	47.24a	–38.21a	0.34
Taiwan	1.81	0.00	35.06a	–30.33a	0.42
Thailand	0.35	0.02	28.22a	–28.83a	0.49
North America					
Canada (G7)	3.23	0.01	69.53a	–74.98a	0.50
US (G7)	4.87	0.00	73.21a	–68.04a	0.49
Latin America					
Argentina	0.37	0.02	18.90a	–18.98a	0.51
Brazil	0.44	0.02	22.92a	–21.16a	0.41
Chile	4.18c	0.05	47.69a	–51.07a	0.42

(*Continued*)

TABLE 2A. (Continued)

Equation 2b	State-Ind.		State-Dep		
	λ_i	adjR^2	$\lambda_{i,1}$	$\lambda_{i,2}$	adjR^2
Latin America					
Colombia †	1.98c	0.12	33.7a	–35.67a	0.50
Mexico	2.97	0.01	33.51a	–37.23a	0.40
Peru	3.03	0.04	36.63a	–35.36a	0.33
Venezuela	0.64	0.04	23.78a	–20.56a	0.16
MENA					
Bahrain †	23.34	0.02	160.62a	–46.07a	0.12
Egypt †	1.04	0.00	47.99a	–30.79a	0.39
Israel	0.70	0.00	38.64a	–41.26a	0.33
Jordan †	–3.20	0.09	103.44a	–52.58a	0.43
Kuwait †	–0.21	0.01	78.11a	–93.45a	0.16
Lebanon †	5.04	0.03	64.38a	–35.62a	0.41
Morocco †	9.28	0.01	89.75a	–92.16a	0.32
Oman †	38.41c	0.09	113.27a	–5.2	0.12
Saudi Arabia †	3.45	0.01	92.8a	–44.48a	0.26
Tunisia †	5.24	0.06	85.04a	–5.92b	0.35
Turkey †	1.14	0.01	21.64a	–19.16a	0.54
Africa					
Kenya †	16.22	0.15	83.17a	–69.67a	0.39
Mauritius †	5.26	0.02	147.53a	–54.52a	0.24
Nigeria †	2.66	0.04	52.65a	–52.87a	0.14
South Africa	2.92c	0.01	41.73a	–40.91a	0.32
Zimbabwe †	–0.94	0.01	11.42a	–14.02a	0.34
Equation 2c					
World	9.15b	0.03	97.62a	–94.27a	0.22

Note: In the state-independent version of equation 2, δ is 1. "†" in front of the name of a country indicates that the covariance equation 2a cannot be estimated reliably for that market–i.e., we fail to find or improve a likelihood value after 5,000 iterations. Durbin Watson Statistics are not reported but range from 1.8 to 2.1 for all series. ARCH LM tests on standardized squared residuals in the mean equations 2.a, 2.b and 2.c are not reported but suggest rejection of heteroskedasticity.; a, b and c denote rejection of the null hypothesis at the 1, 5 and 10 percent level.

are all significant at 1 percent level and range from 0.77 (Canada) to 1.15 (Japan). Emerging markets have coefficients of correlation from –0.03 (Oman and Tunisia) to 0.39 (Israel). While 21 emerging markets out of 48 exhibit insignificant betas that take values between –0.03 (Tunisia) and 0.09 (Pakistan). Amongst the other 27 emerging capital markets, betas are significant at least at the 10 percent level and range from 0.14 (India and Colombia) to 1.51 (Russia).

We can draw several conclusions from these observations. Firstly, emerging markets, except for Middle East and African markets, are generally more volatile than developed markets but also offer greater return and loss potentials.[18] Secondly, there is a wide range of degree of correlation with the world market. G-7 markets are usually more integrated with the world portfolio (a coefficient of correlation greater than 0.4) while emerging markets are more segmented (correlation with the world market of less than 0.4). Consequently the world market index may not be an appropriate benchmark for the emerging markets thereby complicating the use of local market beta as an appropriate measure of risk.

B. Time Series Analysis

As beta cannot be reliably computed for the emerging markets with low correlation with the world market portfolio, we address return dispersion in terms of variance of local risk premium. For markets with sufficient correlations with the world market, we investigate both the variance and the covariance risk. We initially examine equation (2) without considering state dependency i.e., $\delta_i = 1$ in equations (2a), (2b) and (2c). Specifically we look at two relationships (i) between risk premiums and conditional variance, and (ii) between risk premiums and conditional covariance. Results for both the state-dependent and the state-independent forms of equation 2 for the whole sample period are reported in table 2. The reward to variance and covariance risk ($\lambda_{i,1}$ and $\lambda_{i,m,1}$) is almost never significant. Equations 2a and 2b in the state-independent approach do a poor job in modeling the contemporaneous relationship between risk premiums and time-varying volatility and covariance as evidenced by the low adjusted *R*-squared values. These findings are similar to French, Schwert and Stambaugh (1987), Baillie and DeGennaro (1990), and Scruggs (1998) who also find a flat relationship between return and risk.

When we introduce state-dependency, the findings of equation 2b (table 2A) reveal significant positive ($\lambda_{t,1}$) and negative ($\lambda_{t,2}$) reward to variance risk in upstate and downstate for all markets respectively. Furthermore, adjusted *R*-squared values, which range from 0.12 in

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18. Although, the MENA are less volatile than the other emerging markets, they are not necessarily less risky. Micro-structural or other inefficiencies may be the reason for MENA countries to be less volatile and yet as risky as other emerging markets.

Bahrain and Oman to 0.54 in Turkey, reveal a better explanatory power for a contemporaneous relationship between risk premium and conditional variance. Overall, most adjusted *R*-squared are between 0.3 and 0.5. Results are summarized in table 2A.

For 28 of the 56 markets, Maximum likelihood estimation of parameters does not converge even after 5000 iterations for equation (2a). These 28 markets are emerging capital markets and most of them (20) do not have a significant beta in table 1 (for the eight remaining markets, one is significant at 10 percent level, four are significant at 5 percent, and three are significant at 1 percent level). The other 28 countries converge for equation (2a), and for these countries we observe betas to be significant at 1 percent level. The results for equation (2a) are presented in table 2A. We only report the results for the countries, whose maximum likelihood estimations converge.[19]

For these 28 capital markets we find coefficients of variables representing positive ($\lambda_{t,m,1}$) and negative ($\lambda_{t,m,2}$) market price of covariance risk in upstate and downstate to be significant at 1 percent. Furthermore, the model provides a significant explanatory power for a contemporaneous relationship between risk premium and conditional covariance–i.e., adjusted *R*-squared values are greater than 0.1.

Table 2B provides results of log-likelihood functions for both state-dependent and state-independent approaches of equations 2a, 2b and 2c. It also provides the likelihood ratio tests for the comparison between the two approaches for each of the three equations. Although tests were carried out for all the countries for both approaches, the log likelihood functions for equation 2a and the likelihood ratio tests are presented only for those counties for which the models converge in table 2A.

It can be observed from the likelihood ratio tests, that the state-dependent approach is far superior from that of the state-independent approach in 47 out of 56 countries.

Further diagnostic tests show that the predictability with lagged risk premiums (φ_i) is significant in all markets.[20] By allowing serial correlation, we find that the Durbin Watson statistics for equations (2a), (2b) and (2c) for all series are closer to 2 than without serial correlation.

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19. Although parameters were estimated, we do not report them, as we are unsure of their meaningfulness.

20. Although we do not report the results for sake of brevity, results are available upon request.

TABLE 3. Relevant Statistics for the State-independent and State-dependent ICAPM (1988–1992)

Equation 2a	State-Ind.		State-Dep.		
	$\lambda_{I,m}$	adjR^2	$\lambda_{i,m,1}$	$\lambda_{I,m,2}$	adjR^2
Europe					
France (G7)	15.52c	0.01	146.97a	–161.00a	0.36
Germany (G7)	1.56	0.01	151.06a	–172.09a	0.26
Greece	–7.78	0.02	269.71a	–252.31a	0.22
Italy (G7)	12.06	0.02	170.20a	–194.12a	0.22
U.K. (G7)	22.75b	0.01	163.83a	–140.43a	0.47
Asia					
Indonesia	1.81	0.00	154.76a	–154.22a	0.14
Japan (G7)	16.11c	0.01	116.53a	–90.33a	0.47
Korea	1.27	0.00	181.87a	–164.76a	0.16
Malaysia	–2.59	0.02	122.54a	–97.88a	0.21
Philippines	2.29	0.02	190.29a	–169.10a	0.10
Taiwan	17.91	0.01	159.74a	–151.69a	0.17
Thailand	4.90	0.01	154.39a	–203.32a	0.18
North America					
Canada (G7)	5.57	0.03	145.18a	–171.16a	0.47
U.S. (G7)	15.40	0.00	143.91a	–115.80a	0.45
Latin America					
Argentina	–12.62	0.01	253.15a	–247.54a	0.09
Brazil	–14.59	0.04	206.82a	–259.74a	0.20
Chile	10.60	0.03	210.61a	–179.76a	0.08
Mexico	0.09	0.09	112.10a	–156.55a	0.23
MENA					
Jordan †					
Turkey	–10.51	0.04	216.62	–221.16	0.09

(*Continued*)

Finally, using ARCH LM and Ljung-Box tests (lags 1 to 10, 50 and 100) on equation two's squared residuals, we reject heteroskedasticity for all markets (to the exception of Pakistan at lag 50 and Bulgaria, Malaysia, Egypt and Zimbabwe at lag 100).

In sum, the results point to positive and negative reward to local and world variance. Subsequently, the findings show that the effect of risk on investor behavior and consequent risk-return relationship is state-dependent.

Table 3 contains the relevant statistics for the sub-period between January 1988 and December 1992 for both the state-dependent and state-independent approaches. We present the result for the twenty

TABLE 3. (Continued)

Equation 2b	State-Ind.		State-Dep.		
	λ_i	adjR^2	$\lambda_{i,1}$	$\lambda_{i,2}$	adjR^2
Europe					
France (G7)	6.06	0.00	59.49a	–65.23a	0.49
Germany (G7)	1.59	0.01	49.85a	–53.20a	0.36
Greece	1.52	0.01	29.7a3	–25.87a	0.39
Italy (G7)	1.23	0.02	51.30a	–52.15a	0.45
U.K. (G7)	12.68	0.00	70.50a	–67.67a	0.54
Asia					
Indonesia	–1.20c	0.06	18.56a	–18.31a	0.34
Japan (G7)	5.77	0.01	49.06a	–38.70a	0.45
Korea	2.15	0.00	41.87a	–33.62a	0.47
Malaysia	–0.80	0.03	40.12a	–32.25a	0.29
Philippines	–2.25	0.02	38.45a	–37.93a	0.39
Taiwan	0.77	0.00	30.55a	–27.27a	0.55
Thailand	2.26	0.01	37.78a	–34.13a	0.20
North America					
Canada (G7)	9.81	0.03	94.21a	–87.86a	0.52
U.S. (G7)	5.69	0.00	77.09a	–65.35a	0.46
Latin America					
Argentina	0.13	0.01	13.63a	–13.32a	0.36
Brazil	0.32	0.03	19.30a	–20.19a	0.37
Chile	5.55b	0.03	41.94a	–45.47a	0.32
Mexico	2.68	0.09	38.71a	–32.29a	0.28
MENA					
Jordan †	–1.24	0.01	14.65a	–14.29a	0.13
Turkey	2.32	0.04	21.91a	–18.00a	0.52
Equation 2c					
World	12.14c	0.03	98.35a	–74.85a	0.51

Note: Equation 2 is evaluated for two periods, one between January 1988 and December 1992, and the other between January 1993 and December 2001. The sample reduces to 7 developed and 13 emerging markets. Results for the second period are not reported but are available upon request. We find that in the state-independent version of Equation 2, ? are generally not significant in period 2 for the 20 markets. However, 40 of the 42 upstate and downstate coefficients are significant. ”†” in front of the name of a country indicates that the covariance equation 2a cannot be estimated reliably for that market–i.e., we fail to find or improve a likelihood value after 5,000 iterations. Durbin Watson Statistics are not reported but range from 1.8 to 2.1 for all series. ARCH LM tests on standardized squared residuals in the mean equations 2.a, 2.b and 2.c are not reported but suggest rejection of heteroskedasticity. a, band c denote rejection of the null hypothesis at the 1, 5 and 10 percent level.

countries which coverage is available prior to December 1992. Results show that the state-independent approach does not have any explanatory power for the return generating process in these twenty capital markets,

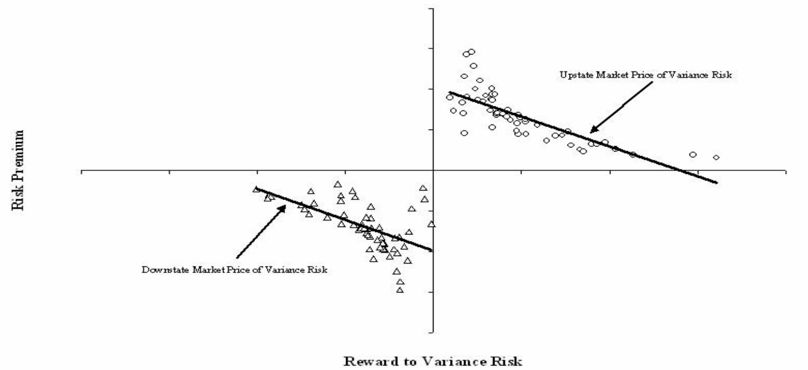

Figure 1- Cross-section of Upstate and Downstate Reward to Variance Risk and Average Positive and Negative Risk Premium

which is consistent with Harvey (1995c) and indicates that his findings are consistent irrespective of the data frequency. Although we do not provide the parameter estimates and model diagnostics for the period between January 1993 and December 2001, we find the state-independent approach not to have any explanatory power for the return generating process for these twenty capital markets, suggesting that Harvey's (1995c) approach is consistent across periods.[21]

The results of tables 2A, 2B and 3 can be summarized as follows: (i) A state-independent approach similar to Harvey (1995c) does not explain the return generating process in emerging markets even after controlling for data frequency and sample period. (ii) A state-dependent approach represented by equation 2, is better at explaining the return generating process in most emerging market. (iii) The state-dependent model parameters are significant for most emerging markets for the overall sample period, and for the two sub-periods. This confirms the contention that risk-return relationships in emerging markets need to be investigated on a piece-wise basis.

21. For comparison purposes, we have carried out equation 2 for the period between January 1993 and December 2001 for the twenty countries in table 3.

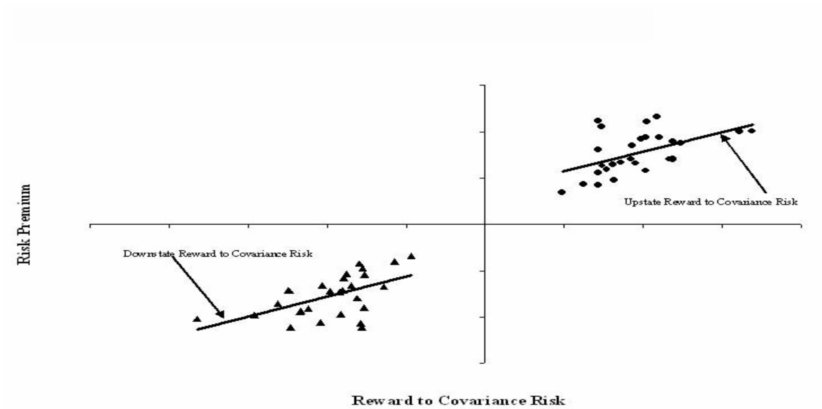

Figure 2–Cross-section of Upstate and Downstate Reward to Covariance Risk and Average Positive and Negative Premium

C. *Cross-sectional implications*

We investigate the time series findings on a cross-sectional basis as well. We plot cross-sections of upstate and downstate market price of variance risk ($\lambda_{t,1}$ and $\lambda_{t,2}$ from table 2A), upstate and downstate market price of covariance risk ($\lambda_{t,m,1}$ and $\lambda_{t,m,2}$ from table 2A) against average positive and negative risk premiums, and correlation. Results are presented in figures 1, 2, and 3. Table 4 shows OLS regression statistics corresponding to figures 1 and 2. Table 5 shows OLS regression statistics corresponding to figure 3.

Figure 1 represents the plot of risk premium against reward to variance risk. We find a significant and inverse relationship. The adjusted R^2 are 0.6186 and 0.3205 (table 4) for the upstate and downstate series respectively. Countries that are more integrated with the world benchmark tend to have a greater reward to total risk, while countries that are less integrated tend to have lower reward to total risk. For example, consider two countries U.S. and Venezuela. There is about three times more compensation for the same level of total risk in the U.S. market as compared the Venezuela market.[22] At the same time,

22. According to Table 2A, the reward to total risk is the U.S. is 73.21 in upstate and –68.04 in downstate; the reward to total risk in Venezuela is 23.78 and –20.56, respectively. Thus, the compensation to total risk is approximately 3 times greater in the U.S. as compared to Venezuela (73.21/23.78=3.1 in upstate and –68.04/–20.56=3.3 in downstate).

TABLE 4. Cross-sectional OLS Regression of Average Positive (RP+) and Negative (RP–) Market Risk Premium with $\lambda_{i,1}$, $\lambda_{i,2}$, $\lambda_{i,m,1}$ and $\lambda_{i,m,2}$.

Dependent Variable Independent Variable	RP+	RP–	RP+	RP–
Intercept	2.071a	–1.9816a	0.7229a	–0.6884a
$\lambda_{i,1}$ (eq 2b)	–0.0148a			
$\lambda_{i,2}$ (eq 2b)		–0.0152a		
$\lambda_{i,m,1}$ (eq 2a)			0.0042a	
$\lambda_{i,m,2}$ (eq 2a)				0.0043a
F	90.20a	26.94a	9.42a	11.34a
Adj R^2	0.6186	0.3205	0.2376	0.277
N	56	56	28	28

Note:

$$RP_i^{+}=\alpha_1+\beta_1\lambda_{i,1}+\varepsilon_{1,i}$$
$$RP_i^{-}=\alpha_2+\beta_2\lambda_{i,2}+\varepsilon_{2,i}$$
$$RP_i^{+}=\alpha_3+\beta_3\lambda_{i,m,1}+\varepsilon_{3,i}$$
$$RP_i^{-}=\alpha_4+\beta_4\lambda_{i,m,2}+\varepsilon_{4,i}$$

RP+ (RP–) is the average of positive (negative) risk premium for each series. $\lambda_{i,1}$, $\lambda_{i,2}$, $\lambda_{i,m,1}$ and $\lambda_{i,m,2}$ are the same as in table 2A. a, band c denote rejection of the null hypothesis at the 1, 5 and 10 percent level.

Venezuela risk premium is about 1.75 times greater than the one of the U.S.[23] Basically, this means that as the market price of variance risk increases, the required risk premium is lower indicating that investors pay more to make less risky investments.

Figure 2 represents the plot of risk premium against reward to systematic risk as measured by the covariance of local returns with the world benchmark. The adjusted R^2 are 0.2376 and 0.2770 (table 4) for the upstate and downstate series, respectively. Countries that are more integrated with the world benchmark tend to have a smaller reward to systematic risk, while countries that are less integrated tend to have higher reward to systematic risk. The relationship in figure 2 is direct and significant; it reinforces the discussion in the previous paragraph. For instance, consider U.S. and Venezuela again. As in figure 1, there

23. According to table 4 (columns 2 and 3), the slopes of the cross-sectional regression are –0.0148 in upstate and –0.0152 in downstate, intercepts are 2.071 and –1.9816, respectively. Thus, for a compensation to total risk that is three times greater in the U.S. as compared to Venezuela, the required risk premium is approximately 1.7 times less in the U.S. as compared to Venezuela (using the equations from the regressions in table 2A, [23.78 x –0.0148 +2.071]/[73.21 x –0.0148 +2.071] = 1.74 in upstate and [20.56 x –0.0152–1.9816]/[68.04 x –0.0152–1.9816] = 1.76 in downstate).

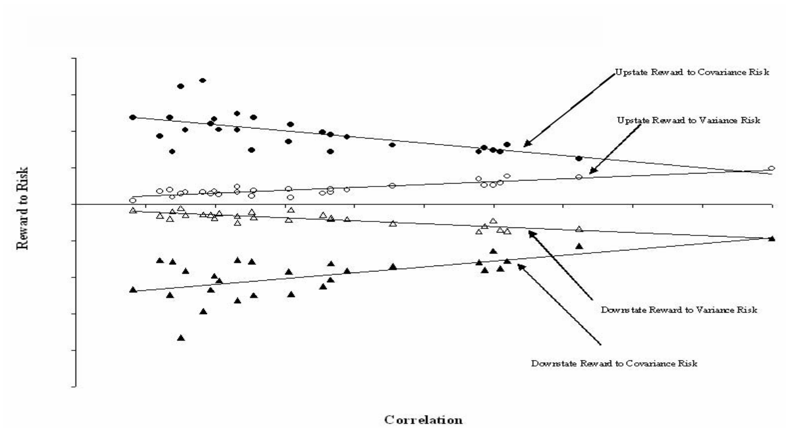

Figure 3–Cross-sections of Implied Upstate and Downstate Reward to Variance and Covariance Risk with Correlation

is about three times more compensation for the same level of systematic risk in the U.S. market as compared the Venezuela market.[24] Again, Venezuela risk premium is about 1.75 times greater than that of the U.S.[25] Thus, as the reward to systematic risk increases the required risk premium is higher, meaning that investors pay less to make more risky investments.

Indeed, as countries become more integrated with the world market, they tend to have higher correlations with the benchmark, and the covariances start to resemble the variances more closely. It indicates that total risk for integrated countries is mostly comprised of systematic risk, implying that the portion of systematic risk in total risk for the more integrated market is higher than for the less integrated markets.

The discussions in the previous three paragraphs are aptly represented in figure 3, which represents the plot of reward to (variance

24. According to table 2A, the reward to systematic risk is the U.S. is 124.86 in upstate and –114.92 in downstate; the reward to systematic risk in Venezuela is 321.86 and –365.00, respectively. Thus, the compensation to systematic risk is approximately 3 times greater in Venezuela as compared to the U.S. (321.86/124.86=2.6 in upstate and –365/-114.92=3.2 in downstate).

25. According to table 4 (columns 4 and 5), the slopes of the cross-sectional regression are 0.0042 in upstate and 0.0043 in downstate, intercepts are 0.7229 and –0.6884, respectively. Thus, for a compensation to systematic risk that is three times greater in Venezuela as compared to the U.S., the required risk premium is approximately 1.75 times less in the U.S. [321.86 x 0.0042 +0.7229]/[124.86 x 0.0042 +0.7229] = 1.7 in upstate and [-365 x 0.0043–0.6884]/ [114.92 x 0.0043–0.6884] = 1.8 in downstate).

TABLE 5. Cross-sectional OLS Regression of Correlation with $\lambda_{i,1}$, $\lambda_{i,2}$, $\lambda_{i,m,1}$ and $\lambda_{i,m,2}$.

Dependent Variable Independent Variable	$\lambda_{i,1}$ (eq 2b)	$\lambda_{i,2}$ (eq 2b)	$\lambda_{i,m,1}$ (eq 2a)	$\lambda_{i,m,2}$ (eq 2a)
Intercept	13.985a	-12.3961a	252.7115a	-251.2334a
Correlation (ρ_{im})	78.5113a	-81.7929a	-170.671a	158.3965a
F	96.99a	86.79a	23.23a	15.59a
Adj R^2	0.7805	0.7606	0.4515	0.3509
N	28	28	28	28

Note:

$$\lambda_{i,1}=\alpha_5+\beta_5\rho_{i,m}+\varepsilon_{5,i}$$
$$\lambda_{i,2}=\alpha_6+\beta_6\rho_{i,m}+\varepsilon_{6,i}$$
$$\lambda_{i,m,1}=\alpha_7+\beta_7\rho_{i,m}+\varepsilon_{7,i}$$
$$\lambda_{i,m,2}=\alpha_8+\beta_8\rho_{i,m}+\varepsilon_{8,i}$$

"Correlation" between the local indices and the world (MSCI AC World) portfolio is obtained from table 1. $\lambda_{i,1}$,$\lambda_{i,2}$, $\lambda_{i,m,1}$ and $\lambda_{i,m,2}$ are the same as in table 2A. a, b and c denote rejection of the null hypothesis at the 1, 5 and 10 percent level.

or covariance) risk against the correlation between the local market and the world market. We find that (1) upstate reward to local variance and downstate reward to world variance are significantly positively related to correlation with the world market, and (2) upstate reward to world variance, and downstate reward to local variance are significantly negatively related to correlation with the world market. The *F*-statistic for each regression is significant at the 1 percent level and the adjusted R^2 are 0.7805, 0.3509, 0.7606 and 0.4515, respectively (table 5). Therefore, we conclude that capital markets are rewarded differently to variance risk and covariance risk, depending on the level of correlation with the world market. Indeed, investors in more segmented (integrated) markets give a higher price to covariance (variance) risk. It means that if an investor is expected to receive more reward to local risk, she will require a lesser rate of return on an investment in the local market. However, if an investor can obtain a greater reward to world risk, she will require a higher rate of return in the local market. In conclusion, as the countries become more integrated with the world benchmark investors are willing to pay a higher price for systematic risk and expect a lower return. On the other hand, investors are still concerned with total risk in segmented markets and would pay less to be compensated for the additional diversifiable risk they take.

As a result, it must be true that risk aversion to local risk is inversely

TABLE 6. Cross-sectional OLS Regression of $\lambda_{i,m,1}$ with $\lambda_{i,1}$ and $\lambda_{i,m,2}$ with $\lambda_{i,2}$,

Dependent Variable Independent Variable	$\lambda_{i,m,1}$ (eq 2a)	$\lambda_{i,m,2}$ (eq 2a)
Intercept	257.4364912a	-268.7783705a
$\lambda_{i,1}$ (eq 2b)	-1.55440611a	
$\lambda_{i,2}$ (eq 2b)		-1.779014803a
F-stat	11.45904932a	18.15502608a
Adj. *R* squared	0.279212887	0.388518083
N	28	28

Note:

$$\lambda_{i,m,1} = \alpha_9 + \beta_9 \lambda_{i,1} + \varepsilon_{9,i}$$
$$\lambda_{i,m,2} = \alpha_{10} + \beta_{10} \lambda_{i,2} + \varepsilon_{10,i}$$

λi,1, λi,2, λi,m,1 and λi,m,2 are the same as in table 2A. a, b and c denote rejection of the null hypothesis at the 1, 5 and 10 percent level.

related to risk aversion to world risk and that this relationship changes over time as market integration (correlation with the world portfolio) changes. The trade-off between reward to local risk factors and reward to global risk factors is clearly depicted in figure 4, which shows significant inverse relationships between reward to local variance and reward to world variance in upstate as well as in downstate. Table 6, which shows two OLS regressions corresponding to figure 4, depicts *F*-statistics significant at the 1 percent level and adjusted R^2 of 0.279 and 0.389, respectively. Thus, the relative importance of one reward to risk component is at the expense of the other reward to risk component, depending on the level of correlation with the world market.

The findings support Beakaert and Harvey (1995) in that the increase in the cross-country correlation in stock returns is driven by two factors. The first is the decrease in the conditional variance of cross-country stock returns. The second is the increase in the covariance between stock returns across countries markets.

In order to check for the robustness of their findings, we repeat the cross-sectional analysis during the two periods (1998–1992 and 1993–2001). Figure 5 depicts the cross-sections of risk premium against reward to variance and covariance risk. Figure 6 shows the cross-sections between reward to variance and covariance risk against the correlation between the local market and the world market. As shown in figure 5, an increase in market price of variance risk goes in pair with a decrease in required risk premium indicating that investors pay more to make less risky investments. Furthermore, an increase in

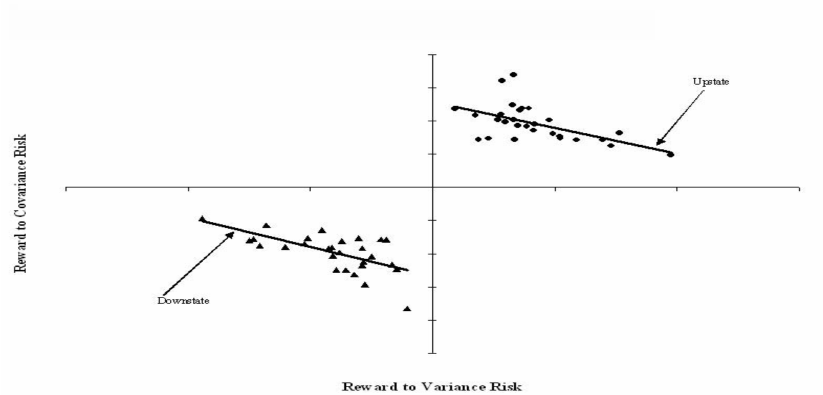

Figure 4– Cross-section of Upstate and Downstate Reward to Variance Risk with Upstate and Downstate Reward at Covariance Risk

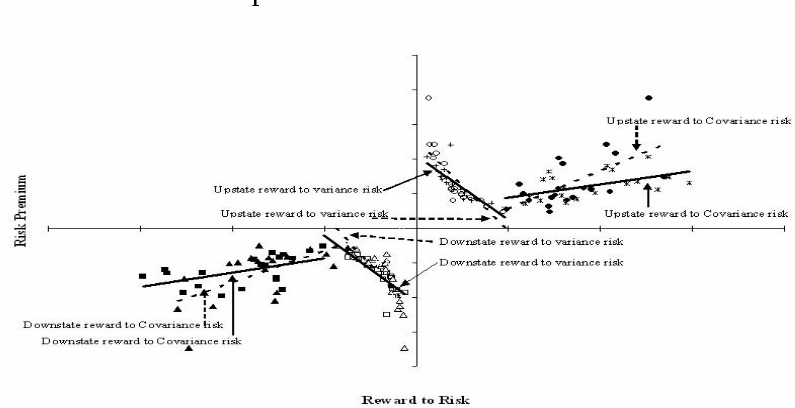

Figure 5– Cross-sections of Upstate and Downstate Reward to Risk and Average Positive and Negative Risk Premium– Period 1 (1988 –1992) and Period 2 (1993–2001).

the reward to systematic risk comes with an increase in the required risk premium, meaning that investors pay less to make more risky investments. These findings are the same across periods and confirm the conclusion for the overall period (figures 1 and 2).

Figure 6 complements figure 5 by showing that countries with higher correlations with the benchmark have covariances that resemble the variances more closely. So, findings pertaining to figure 3 are true across periods – i.e., capital markets are rewarded differently to variance risk and covariance risk, depending on the level of correlation with the world market.

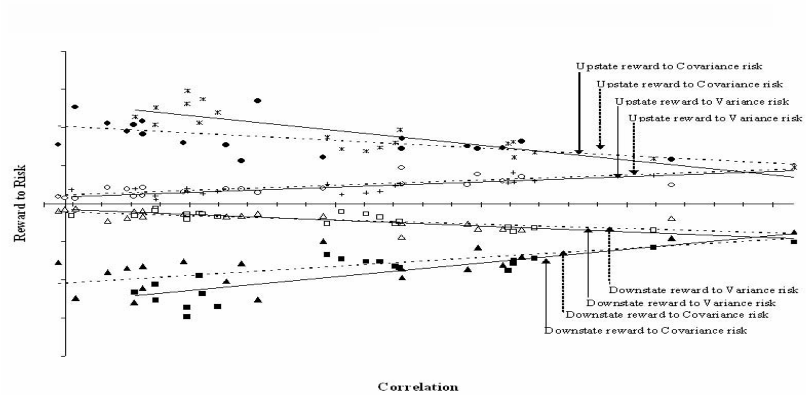

Figure 6–Cross-section of Implied Upstate and Downstate Reward to Risk with Correlation – Period 1 (1988–1992) and Period 2 (1993–2001).

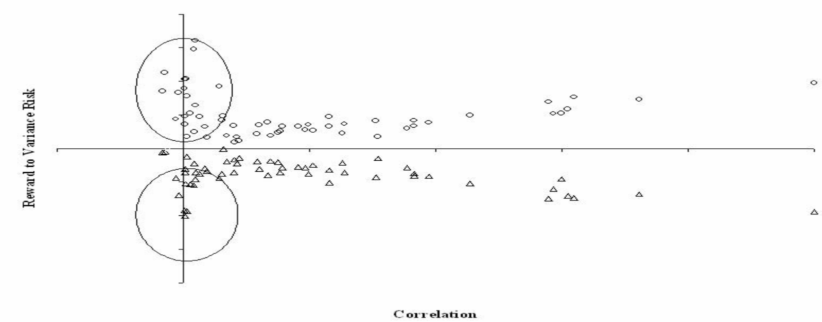

Figure 7– Cross-section of Implied Upstate and Downstate Reward to Variance Risk with Correlation (all markets).

The analysis also leads to an interesting conclusion. As pointed out by Scruggs (1998), systematic risk plays no further role in explaining price behavior if total risk is considered. More specifically, combining the findings from tables 1 and 2A, one can see that reward to total risk is the sole connection between risk premiums and risk in emerging markets with little or no correlation with the world market. Furthermore, cross-sections of reward to systematic risk (when it can be computed) and risk premiums do not reveal idiosyncratic price behaviors that are not described by the cross-sections of reward to total risk and risk premiums – i.e., the cross-section of reward to total risk and risk premiums is sufficient by itself.

Figure 7, which depicts the cross-sections between reward to total risk and correlation with the world benchmark for all 56 markets, provides further insights to the previous paragraph. We circled two areas corresponding to the plot of markets with little to no correlation with the world—i.e., Bulgaria, Iceland, Bahrain, Jordan, Kuwait, Lebanon, Morocco, Oman, Saudi Arabia, Tunisia, Kenya, Mauritius, and Nigeria. We can clearly see that correlation is not a factor that determines reward to risk in these markets. Thus, it is likely that a more optimal measure of risk could result from including other risk components. For instance, Harvey (1991), Domowitz, Glen and Madhavan (1998), Dumas and Solnik (1995), DeSantis and Gerard (1997) and Jan Chou and Hung (2000) suggest that currency risk is likely to be an important factor in global asset pricing models. Possibly dividends and earnings can be more important in some markets than in others (Jermakowicz and Gornik-Tomaszewski, [1998], Travlos, Trigeorgis and Vafeas, [2001]). Risk factors such as economic, financial and political risk composites could also very well explain risk beyond variance of returns in highly illiquid and isolated capital markets (Harvey [1995c], Erb, Harvey and Viskanta, [1996]).

V. Conclusion

The paper investigates the relationship between market risk premium and conditional variance and covariance in 56 capital markets and the world portfolio from January 1988 to December 2001. We propose a SDMGARCH-M approach that is theoretically sound, intuitively plausible and quite powerful. Indeed, for each markets, we find a significant piecewise relationship between risk premiums and conditional variance. We also find that all developed markets and only half the emerging markets have a significant piecewise relationship with conditional covariance. When we investigate the cross-sections of state-dependent market price of variance and covariance risk, we find that market price of risk is a combination of reward to local and world variance depending on the correlation of a market with the world market. This conclusion is important because it explains why risk aversion to local variance and world variance is different across markets and over time. However, we also find that correlation is not a factor that explains reward to local risk in few highly segmented capital markets.

Thus, it is possible that other local risk components, not studied in this paper, may be relevant in explaining risk premiums in segmented capital markets.

The market beta factor, which is a measure of risk in the ICAPM, provides theoretically accurate results but is not always applicable in highly segmented emerging markets. This is due to the weak correlation between segmented local markets and the world portfolio. The state-dependent framework shows that the variance of risk premiums is a more accurate indicator of risk than beta in segmented markets. While the variance factor provides the best indicator of risk, it is likely that a more optimal measure of risk could result from including other risk components. For instance, if the constantly evolving globalization phenomenon that characterize capital markets, explains how risk is treated in each market, then forward looking variables that reflect expectations on changes in correlation with the world portfolio could be instrumental in an "out-of-the-sample" forecast of market returns.

The findings have interesting policy implication: If markets are not fully integrated and really do offer positive expected returns for diversifiable risk, then financial intermediaries will enter and include these securities in global asset allocation products. This is a profit opportunity for the intermediaries.

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