Stock-bond Correlations and International Stock Market Return Predictability*

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ABSTRACT

This paper shows that the relationship between a country's stock returns and bond yields strongly predicts countries' stock market returns across countries. The return/yield relationship is associated with time-varying local investor's exposure to global discount rate shocks and the relative level of local volatility. Empirical evidence further reveals that investments in countries with a more negative return/yield relationship generate 6-8% higher future returns, which remains robust after controlling for global yields, standard macroeconomic variables, and well-known return predictors. Countries characterized by higher yield volatility as well as lower yield (volatility) correlation with the global counterpart exhibit negative return/yield relationships.

Keywords: Stock-bond correlation, international stock market, return predictability

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I. Introduction

Should an investor require a higher risk premium for equity markets in a nearby country that faces similar shocks to the home or in a country that is very different from its home? The risk premium may be higher for the stock market of countries that face similar shocks to home as they have a higher beta to the home wealth portfolio. On the other hand, currency values of countries that face similar shocks to home are more likely to comove with those of the home country. Since currency risk is an essential component of international investment risk, investments in these countries may require a lower risk premium.

Existing studies suggest that either of the two is possible. For the global investor, if the capital asset pricing model is the correct model (e.g. Adler and Dumas 1983, De Santis and Gérard 1998), equity investments are riskier if local and global risk factors are highly positively correlated. On the other hand, the model provided by Brandt, Cochrane, and Santa-Clara (2006) implies that there is more risk when the correlation between local and global SDFs is lower. Recent literature on equity home bias also confirms that economically closely linked countries may be perceived as safer places for investment.[1]

This paper shows that the relationship between a country's stock market returns and Treasury bond yield shocks (denoted here as the SB relationship) uniquely captures the time-varying nature of this aspect. Specifically, the SB relationship is more positive when local shocks are similar to global counterparts and when local volatility is lower. The country stock returns are also lower when the SB relationship in a country is more positive.

The empirical analysis of this study confirms these assertions, whereby investments in countries with a negative SB relationship generate 6.48 – 8.52% more than those with a positive relationship. This relationship is robust after controlling for the variation in global bond yields, currency effects, standard country-specific macroeconomic variables, dividend yields, momentum, and term spread. Moreover, a negative SB relationship is associated with a lower corre-

[1] Lettau, Maggiori, and Weber (2014) also demonstrate that the global market factor is priced during bad times, supporting that a high correlation between shocks to the local and global economy is likely to lead to a higher risk premium. However, Hnatkovska (2010), Berriel and Bhattarai (2013), and Stathopoulos (2017) point out that equity investments in countries with shocks similar to the home country are safer. See, for example, Coeurdacier and Rey (2013) for an extensive review of the home bias literature.

lation between local and global bond yields, a lower correlation between local and global stock market volatility, and a higher level of local volatility. Finally, the results confirm that these two dimensions weakly predict international stock returns individually.

The model assumes one large country (denoted by "global") and multiple small countries (considered "local"). Using an international version of the long-run risk (LRR) model of Bansal and Yaron (2004), the risk premium is compared across countries from the global investors' perspective in a common currency. The model's unique feature is that there are two types of firms: (1) domestic firms producing non-tradable goods and (2) firms producing final or intermediate goods to be internationally traded. This distinction results in different sources of the long-run component of dividend growth. The long-run dividend growth of the first firm type is determined entirely locally, whereas global shocks affect the dividend growth rate for the second type.

In a closed economy, long-run growth shocks increase bond yields while also exerting two conflicting effects on stock prices. Higher dividend growth expectation also increases stock prices (expected growth channel), whereas a higher interest rate implies a higher discount rate, lowering current stock prices (discount rate channel). However, as the first effect dominates the second, a long-run growth shock drives stock prices and bond yields in the same direction.

In an open economy, only stock prices are affected by global shocks. Therefore, the expected dividend growth of firms is less likely to move together with changes in bond yields if local and global shocks in that country are dissimilar. The SB relationship is more positive in these countries. Moreover, the SB relationship will be lower when local consumption volatility is higher since the discount rate channel – which moves stock prices and bond yields in the opposite direction – is only affected by the local long-run consumption growth.

The equity risk premium is compared across countries from the global investors' perspective in a common currency. The model parameters that match the moments of the SB relationships show that countries with a low correlation between local and global long-run growth shocks have a higher risk premium. I find evidence that shows the relationship between local and global long-run growth shocks is negatively associated with the risk premium of an international stock market investment.

The empirical analysis strongly supports these predictions. The SB relationship is estimated using changes in ten-year government bond yields regressed on the stock index returns of that country, both denominated in local currency. The results show that, depending on the data frequency, countries with a negative bond yield beta outperform by 6.48 – 8.52% relative to those with a positive relationship. These results are robust to adopting a more extended sampling period, controlling for the global yield changes, and after risk-adjusting returns using the international capital asset pricing model (Dumas and Solnik 1995).

The risk premia of the equity investment embedded in bond yield betas are likely to be time-varying. When future stock returns are regressed both on the rolling-window beta estimate and its time-series average, only the rolling-window beta remains significant. Moreover, in the cross-sectional regression, the yield beta remains significant after controlling for standard macroeconomic variables such as population, total gross domestic product (GDP), GDP growth rate, total exports as a proportion of total GDP, and inflation rate.

The data also strongly confirms that the SB relationship is governed by the countries' time-varying exposure to global discount rate shocks, measured by the correlation between local and global yield shocks or stock market variance shocks, as well as the level of local volatility, proxied by the volatility of bond yields. The bond yield beta is positively associated with the correlation between local and global yield innovations or local and global volatility innovations. The results further show that bond yield volatility, used here as a proxy for local volatility, is negatively related to the bond yield beta and the correlation between stock returns and bond yields.

The empirical analysis also supports the link between the two main drivers of the SB relationship and future stock market returns. However, the evidence for the two drivers is not as strong as when the SB relationship is used as a predictor. Countries with a high bond yield volatility are associated with higher stock returns. Also, those with a lower local/global yield correlation and lower local/global volatility correlations are associated with higher stock market returns.

Government bonds are often regarded as risk-free investments, even though default spreads of sovereign bonds fluctuate over time. Therefore, if sovereign default risk is priced among stocks, a negative SB relationship may be associated with a higher risk premium. To test the possibility that the main result presented in this paper is driven by default risk priced in the stock market, bond yields are decomposed into two components, one that represents the credit default spread and the risk-free element, respectively. The results confirm that the SB relationship's predictive power mainly derives from the risk-free component of the yield changes.

This paper contributes to three research streams, one of which pertains to the international CAPM. Previous studies in this domain find weak support for the unconditional version of the CAPM. Specifically, Dumas and Solnik (1995) add a currency factor to the traditional CAPM to explain the currency effect in international investments. De Santis and Gérard (1998) find substantial exchange risk premium in the conditional CAPM, but weak evidence of the global market factor being priced among international index returns. According to Brusa, Ramadorai, and Verdelhan (2014), the dollar/carry/market three-factor model performs well in pricing international stocks. While the aim of the present study is not to propose a particular asset pricing model, the results reported here confirm the importance of pricing currency-related factors in international stock market returns.

This study is also related to the literature on international stock market predictability. Focusing on the emerging market, Bekaert, Harvey, and Lundblad (2007) document the importance of the global liquidity factor in predicting international equity market returns. On the other hand, Hou, Karolyi, and Kho (2011) argue that global momentum is instrumental in explaining international stock returns. Rapach, Strauss, and Zhou (2013) show a lead-lag relationship between the US and international country stock returns. Yet, Cenedese, Payne, Sarno, and Valente (2016) suggest that international stock returns can be reliably predicted using global momentum, country-level term spread, and dividend yields. In this paper, a new return predictor is introduced under the premise that it likely contains a different type of information about international stock returns.

Finally, the present research contributes to a large body of studies in which links temporal variations in the SB relationship to macroeconomic volatility. In extant literature, the flight-to-quality perspective prevails, as it is generally assumed that the SB relationship is more positive in a riskier economy. For example, using a dynamic equilibrium model, Vayanos (2004) shows that SB correlation is positive when liquidity is low, which typically coincides with periods characterized by high volatility. Similarly, Connolly, Stivers, and Sun (2005) report a positive predictive relationship between stock market volatility and SB relationship, whereas Baele, Bekaert, and Inghelbrecht (2010) document the relationship between higher macro uncertainty and SB correlation. The findings in this paper show that the flight-to-quality mechanism is captured by the common global component of the stock market volatility. After controlling for the global component, the empirical analysis suggests that the bond yield volatility is strictly negatively associated with the SB relationship.

The remainder of the paper is organized as follows: The next section provides a simple model that describes the main intuition of this paper. Section III describes the data used in the analysis. Section IV is designed for the main empirical result, and the paper concludes with the discussion of the main findings, which are presented in Section V.

II. The Model

I consider an open economy with one large country and multiple small countries. I call the large country 'world' or 'global,' and the small country 'local.' The stochastic discount factor (SDF) is represented by recursive preference, as considered by Epstein and Zin (1991) with a risk aversion coefficient of γ and an intertemporal elasticity of substitution coefficient of ψ. Following convention, I let $\theta = \frac{1-\gamma}{1-1/\psi}$. Financial assets are priced by the log of the global SDF, which is defined as:

$$m^*_{t+1} = \theta \log \beta - \frac{\theta}{\psi}\Delta c^*_{t+1} + (\theta - 1)R^*_{TW,t+1}, \tag{1}$$

where β is the time discount factor. Δc^*_{t+1} and $R^*_{TW,t+1}$ are the global consumption growth and the log returns on the global wealth portfolio. Local investor's SDF is represented by the same preference parameters, with the global variables with superscript $*$ replaced by the country-specific variables denoted by superscript i. Superscripts for parameters or variables that are identical across countries are omitted.

1. Consumption dynamics and the wealth portfolio

Global consumption dynamics follow the LRR process as in Bansal and Yaron (2004)

$$\begin{aligned}\Delta c^*_{t+1} &= \mu + x^*_t + \sqrt{v^*_t}\epsilon^*_{c,t+1} \\ x^*_{t+1} &= \xi x^*_t + \sigma_x \sqrt{v^*_t}\epsilon^*_{x,t+1}, \\ v^*_{t+1} &= v_0 + v_1 v^*_t + \sigma_v \sqrt{v^*_t}\epsilon^*_{v,t+1},\end{aligned} \tag{2}$$

where the volatility of the consumption variance is assumed to depend on consumption volatility, but the three error terms $\epsilon^*_c, \epsilon^*_x$, and ϵ^*_v are uncorrelated random variables with mean 0 and standard deviation 1.

The consumption growth and the consumption variance processes of country i follow dynamics:

$$\begin{aligned}\Delta c^i_{t+1} &= \mu + x^i_t + \sqrt{v^i_t}\epsilon^i_{c,t+1} \\ x^i_{t+1} &= \xi x^i_t + \sqrt{v^i_t}\epsilon^i_{x,t+1}, \\ v^i_{t+1} &= v_0 + v_1 v^i_t + \sigma_v \sqrt{v^i_t}\epsilon^i_{v,t+1},\end{aligned} \tag{3}$$

where, for simplicity, I assume that all parameters are essentially the same as those for the global variables. The way that the local country interacts with the global economy is through the cross-sectional correlations of error terms. I let the correlation between the local and global long-run growth process to be $\rho_{x,t}$ or sometimes simply ρ_t, which are time-varying. I also let

$$\mathrm{Cor}_t(\epsilon^i_{v,t+1}, \epsilon^*_{v,t+1}) = \rho_v \rho_t, \tag{4}$$

for all i, where ρ_v is assumed to be constant.

In addition, the covariance between local and global long-run growth process ($\delta_t^i = \rho_t^i \sqrt{v_t^i}\sqrt{v_t^*}$) follows an auto-regressive process

$$\delta_{t+1}^i = \delta_0 + \delta_1 \delta_t^i + \sigma_\delta \sqrt{\delta_t^i}\epsilon_{\delta,t+1}^i,$$

where $\epsilon_{\delta,t+1}^i$ is random with mean 0 and standard deviation 1. The square-root standard deviation ensures that this process always stays positive. The reason for modeling the covariance, instead of the correlation directly, is to obtain a closed-form solution for the correlations between the asset pricing variables considered in this paper. Also, I assume a constant correlation (ρ_c) between local and global consumption shocks.

The return on the global and country i's wealth portfolio can both be linearized as

$$R_{TW,t+1}^{i/*} = \kappa_0 + \kappa_1 z_{t+1}^{i/*} - z_t^{i/*} + \Delta c_{t+1}^{i/*}, \tag{5}$$

where z_t^i or z_t^* is the log wealth-to-consumption ratio of country i and the world, κ_0 and κ_1 are common constants as defined in Campbell and Shiller (1988).

Following Bansal and Yaron (2004), I conjecture that the local wealth-consumption ratio (z_t^i) is represented as a linear function of their own expected growth rate x_t^i and the local volatility process v_t^i. Solving for the Euler equation, it can be shown that

$$z_t^i = A_0 + A_x x_t^i + A_v v_t^i, \tag{6}$$

where

$$A_x = \frac{1 - \frac{1}{\psi}}{1 - \kappa_1 \xi} \tag{7}$$

and A_v solves the quadratic equation

$$\theta(\kappa_1 \sigma_v A_v)^2 + 2(\kappa_1 v_1 - 1)A_v + \theta((1 - \frac{1}{\psi})^2 + (\kappa_1 A_1 \sigma_x)^2) = 0,$$

where only one of the solution provides a reasonable value of $A_v < 0$. Finally, the constant coefficient A_0 can be derived as

$$A_0 = \frac{\log\beta + (1 - \frac{1}{\psi})\mu + \kappa_0 + \kappa_1 A_v v_0}{1 - \kappa_1}. \tag{8}$$

Notice that the superscript is omitted for the values of A_0, A_x, and A_v since they do not depend on any country-specific parameters. For the world, it can be shown that $z_t^* = A_0 + A_x x_t^* + A_v v_t^*$, with identical coefficients.

2. Dividend dynamics

Two types of firms are assumed to operate in country i. The first type produces nontradable goods, which are primarily sold locally. The long-run dividend growth rate of these firms is determined by the local consumption growth. The second type of firm produces final or intermediate goods and services that are sold globally. Therefore, the long-run dividend growth of these firms is more likely to be affected by the global consumption growth. A constant *lambda* denotes the proportion of the second type of a country.[2] I assume that the dividend growth (Δd) dynamics are described as

$$\Delta d_{t+1}^i = \mu_d + \phi_d \left(\lambda x_{t+1}^* + (1-\lambda) x_{t+1}^i\right) + \sigma_{cd}\sqrt{v_t^i}\left(\lambda \epsilon_{c,t+1}^* + (1-\lambda)\epsilon_{c,t+1}^i\right) + \sigma_d \sqrt{v_t^i}\epsilon_{d,t+1}^i, \tag{9}$$

where $\epsilon_{c,t+1}^*$ and $\epsilon_{c,t+1}^i$ are standardized local and global consumption shocks, respectivley, and $\epsilon_{d,t+1}^i$ is the dividend shock to firms in country i, which is assumed to be independent from the two consumption shocks. According to these dynamics, any cross-country difference in the asset pricing moments and their dynamics derives from time-varying state variables.

The first panel of Table I shows the parameter specifications. Most parameters in the model are adopted from previous studies, such as Bansal and Yaron (2004) or Colacito and Croce (2011), with the exception of the level of persistence of the long-run growth component,

[2] This assumption is made for simplicity. In practice, countries tend to differ in their global exposure. However, after adopting different ways of measuring λ (e.g., the fraction of export in GDP), I find weak empirical support that this parameter affects the variables considered in the model in a systematic manner.

the distance parameters associated with the covariance process δ_t^i, and the average consumption μ, which are calibrated from the global stock market, bond yields, their correlation, and consumption data.

The second panel of the table reports the moments of the asset pricing variables. The model-implied stock return and yield moments are compared with the data, which are computed either from (i) the US data only or from (ii) the world average. For stock returns, I use the value-weighted world index, whereas, for bond yields and variance, I take the simple average of the country-level variables. The details on the data sources and measurements are provided in the following section.

Except for currency volatility, the moments and correlations implied by the model are equally good or superior in representing the data compared to the methodologies adopted in existing research.[3] In particular, the calibrated values examined in this paper provide a better fit to the correlations between stock returns and bond yields and the cross-country correlations between bond yields and volatility.

3. Bond yields and stock returns

Bonds are risk-free claims backed by the government that are priced by the SDF of the country. The yield of a sovereign bond for country i (y_t^i) is determined by the expression

$$y_t^i = -E_t[m_{t+1}^i] - 0.5Var_t[m_{t+1}^i]. \tag{10}$$

As in the classical LRR model, local bond yields (y_t^i) can be expressed as a linear function of the state variables. It can be shown that

$$y_t^i = Y_0 + Y_x x_t^i + Y_v v_t^i, \tag{11}$$

[3]For example, Colacito and Croce (2011) adopt preference parameters similar to those considered in the current model. But, they assume that the correlation between the long-run growth process is always one and the global consumption variance is much lower, which results in lower currency volatility. However, the relationship between stock returns and bond yields is not reported.

where the exact formula for the constants $Y_x > 0$ and $Y_v < 0$ are given in the appendix. Then, the conditional variance of the yield can be expressed as $\left((Y_x\sigma_x)^2 + (Y_v\sigma_v)^2\right) v_t^i$.

Local stock returns ($R^i_{m,t+1}$) are expressed as

$$R^i_{m,t+1} = \Delta d^i_{t+1} + \kappa_{m,0} + \kappa_{m,1}(z^i_{m,t+1} - z^i_{m,t}), \tag{12}$$

where z^i_m is the price-dividend ratio, and $\kappa_{m,0}$ and $\kappa_{m,1}$ are constants determined by the average of the price-dividend ratio. Since local dividend growth also depends on global variables, the ratio is conjectured to be a linear function of both local and global state variables:

$$z^i_{m,t} = B_0 + B_{xl}x^i_t + B_{xg}x^*_t + B_{vl}v^i_t + B_{vg}v^*_t + B_\delta \delta^i_t. \tag{13}$$

Solving for the Euler equation again, it can be shown that

$$B_{xl} = \frac{(1-\lambda)\phi_d - \frac{1}{\psi}}{1-\kappa_1\xi} \tag{14}$$

$$B_{xg} = \frac{\lambda\phi_d}{1-\kappa_1\xi}, \tag{15}$$

where the values of other coefficients are given in the appendix. Then, one can also derive the conditional variance of stock returns as

$$\sigma^i_{m,t} = V_0 + V_{vl}v^i_t + V_{vg}v^*_t + V_\delta \delta^i_t,$$

with the expressions for V_0, V_{vl}, V_{vg}, and V_δ also provided in the appendix.

In standard single-country asset pricing models, including the LRR model, the correlation between stock and bond returns is typically negative. For example, an increase in the long-run growth shock increases both bond yields and stock prices. As bond returns and bond yields are almost perfectly negatively related, the corresponding correlation between stock and bond returns is negative. Therefore, the stock return/bond yield relationship, denoted as the SB relationship in this paper, is positive.

To justify this assertion, consider a positive shock in the long-run expected consumption growth. Bond yields will increase as the demand for money is higher. Since there is a strong positive relationship between long-run growth and yield shocks (e.g., Jones and Pyun 2021), positive long-run growth shocks will consistently increase bond yields.

This shock has two conflicting effects on stock prices. The first is exerted through the expected growth channel. As expectations of consumption growth rise, dividends are also expected to grow at a higher rate, and this will increase stock prices. The second effect manifests through the discount rate channel. As the economic growth rate increases, the cost of money increases, and so does the discount rate of future cash flows. A higher discount rate implies lower stock prices. These two forces influence stock prices in opposite directions, but the first generally dominates the second so that the net impact on stock prices is positive.

In an open economy, the expected growth of the dividends is determined by both local and global shocks. On the other hand, the discount rate is entirely determined by local growth rates. Therefore, the second channel, which drives bond yields and stock prices in opposite directions, is amplified.

Mathematically, these two conflicting effects are represented by the two components of the numerator of B_{xl}. The term $(1-\lambda)\phi$ corresponds to the growth rate channel, whereas $-1/\psi$ represents the discount rate effect. In a closed economy, $\phi > 1/\psi$, as the growth rate channel dominates the discount rate channel. In an open economy, as part of the dividend growth rate is affected by the global long-run rate, the discount rate effect would predominate.

Furthermore, the SB relationship will vary as the state variables changes over time. First, the relationship is more positive when shocks to local and global discount rates (i.e., long-run expected growth and variance shocks) are highly correlated. This is a natural outcome since bond yields are unaffected by global long-run shocks that are orthogonal to the local ones. As the correlation between local and global long-run growth shocks is reduced, the strength of the positive SB relationship is also diminished. Since these are times when the local economy is highly exposed to fundamentals of the global economy, hence I refer to it as the 'global discount rate exposure.' Second, the relationship will be less positive and more negative when the local volatility exceeds the global volatility, as high local volatility will induce an increase in the discount rate effect.

These premises are confirmed in the proposed model. The covariance between stock returns and unexpected changes in bond yields can be expressed as

$$Cov_t(R^i_{m,t+1} - E_t[R^i_{m,t+1}], y^i_{t+1} - E_t[y^i_{t+1}]) = SB_{vl}v^i_t + SB_{vg}v^*_t + SB_\delta \delta^i_t, \tag{16}$$

where the expressions for $SB_{vl} > 0$, $SB_{vl} > 0$, and $SB_\delta > 0$ are given in the appendix. The SB relationship can be expressed (i) as a measure of correlation, by dividing the covariance with the standard deviation of bond yields and stock returns or (ii) as bond yield beta, by dividing the covariance with the bond yield variance.

The first two panels of Figure 1 show how the SB relationship is related to the alignment between the local and global discount rate shocks, as measured by their correlation and the local (relative to the global) volatility. The left side of this panel shows the relationship in a 3-dimensional graph, and the right side depicts the same relationship in a contour plot. Panel (a) presents the relationship for the SB correlation and Panel (b) for the bond yield beta.

For both SB relationship measures, these figures show how its strength varies as the two dimensions – the correlation between local and global discount rate shocks and the relative local volatility– of macroeconomic variables change over time. These two figures confirm that stock returns and bond yields are less likely to move in the same direction when the global discount rate exposure of the country decreases or when local volatility is higher.

Based on the parameters considered, the figures suggest that SB covariance is always positive. There are several circumstances that the conditional SB correlation can be negative, one of which is when consumption shocks are negatively correlated to the long-run consumption shocks as shown by Jones and Pyun (2021). This is likely to occur when the economy mainly faces short-term transient shocks, such as uncertainty shocks. The second possibility is that stock returns react negatively to inflation shocks, (e.g., Boons, Duarte, de Roon, and Szymanowska 2020). Another possibility is that the proportion of the tradable sector (λ) is greater than assumed in the current model. In this case, the discount rate channel will dominate the expected growth channel, leading to a more negative SB relationship.

One of the model's implications is the negative link between local consumption variance and the SB relationship. This implication may seem to contradict the empirical observations suggesting that the relationship is more positive when stock market variance is high. The standard premise is that investors prefer safer bond positions over risky stock positions when volatility spikes as they become more risk-averse, commonly known as 'flight-to-quality.' It should be noted that the model of this paper implies that local volatility *relative* to global volatility is negatively related to the SB relationship. These relationships are prudently tested later in the empirical section.

4. Equity risk premia

The previous section shows that the temporal variation in the SB relationship depends on two-state variables – the global discount rate shock exposure and local consumption volatility relative to the global counterpart. This section suggests that these two dimensions are also associated with the time-varying risk premium of country stock market returns.

Dividends or capital gains invested in country i stocks are realized in the currency of country i. Therefore, currency fluctuation is an essential component of risk for the global investor. If the market is complete, Backus, Foresi, and Telmer (2001) for example, represent currency returns (Δq_t^i) by the difference between the local and the global SDF resulting in

$$\Delta q_{t+1}^i = m_{t+1}^i - m_{t+1}^*, \tag{17}$$

where a higher q^i implies a higher currency value for country i. Hence, a negative local shock generally leads to a higher currency value.

Therefore, as shown in the appendix, the risk premium on the stock market investment born by the global investor can be calculated as

$$MRP_t = Cov_t(-m^*_{t+1}, R^{i,*\$}_{m,t+1}) = Cov_t(-m^*_{t+1}, R^i_{m,t+1} + m^i_{t+1} - m^*_{t+1}),$$

where $R^i_{m,t+1}$ is the stock market return of country i in local currency and $R^{i,*\$}_{m,t+1}$ is return denominated in a common global currency.

In the model, the two dimensions that affect the SB relationship – the global discount rate risk exposure and local volatility – each have ambiguous effects on the international stock market risk premium. Investments in equity markets that are highly exposed to global discount rate shocks may be riskier as their payoffs are more likely to be negatively correlated with the global investor's marginal utility. However, at the same time, these investments may be safer since currency values are less likely to fluctuate. Similarly, high local consumption volatility implies a higher risk premium on the stock investment, although it could indicate a future currency depreciation.

Extant literature on CAPM suggests that controlling for currency risk, countries that positively comove with the global value-weighted portfolio must require a higher risk premium. In classical studies, Adler and Dumas (1983) and De Santis and Gérard (1998), for example, account for currency risk in their model by adding currency returns as a control variable and estimating a two-factor model.

However, as suggested by several other research, the two-factor approach may be misleading for cross-country comparisons of the risk premia. For example, the model of Brandt, Cochrane, and Santa-Clara (2006) implies that currency risk is lower when local and global SDF are highly positively correlated. Since a high SDF correlation is likely to lead to a high GCAPM beta, countries with a positive global beta are likely to have less currency risk. In this context, whether high beta countries should have a higher risk premium is ambiguous.

Panel C of Figure 1 shows the relationship between the risk premium on stock market investment and two state variables. For a parametrization considered in this paper, a lower global discount rate shock exposure is associated with a higher risk premium on the international equity investment. Also, for a given level of correlation between local and global discount rate shocks, high local volatility relative to the global volatility is associated with a higher risk premium. In the empirical section, I test the influence of these two dimensions providing strong support for these arguments.

Several other studies support the positive association between local volatility and asset returns in an international context. For example, Brennan and Xia (2006) propose a model in which currency volatility, SDF volatility, and currency risk premia are positively related. Using a habit formation model, Stathopoulos (2017) also suggests a positive relationship between consumption growth volatility and local stock risk premia.

III. Data and Estimation

1. Data

The main implications of the model are tested using data pertaining to 30 countries, selected based on the total stock market capitalization, representativeness within the economic region, and data availability. Fourteen of these countries (Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Norway, Russia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom) are located in Europe, nine (China, India, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, and Thailand) are from Asia, three (Canada, Mexico, and the United States) from North America, two (Australia and New Zealand) are from Oceania, one is from South America (Brazil) and Africa (South Africa), respectively. It is worth noting that two of the G20 countries (Argentina and Saudi Arabia) are excluded from the sample due to insufficient availability of bond yield data at the daily level. Among the top 20 stock market exchanges, only Iran and Taiwan Stock Exchange are omitted for the same reason.

The dataset consists of international stock index and bond yield data obtained from Bloomberg. As a primary specification, the Morgan Stanley Capital International (MSCI) net total returns index represents the aggregate country-level equity prices. It is supplemented by the price index, which is available daily for a more extended sampling period. I use the local currency indices to compute daily, weekly, and monthly stock returns and employ currency returns to convert obtained values to USD, adopting the relevant exchange rates sourced from Bloomberg. In addition to the country-level stock returns, I also compute stock returns of the global value-weighted portfolio. World stock index returns are used to calculate the beta of the global capital asset pricing model (GCAPM), as described in the next section.

Bond yields are represented by the ten-year Treasuries, all of which are denominated in their respective local currency. One of the reasons for choosing the ten-year maturity yields is data availability. Ten-year yields are available for the longest sampling period at the daily interval, which is critical since the sample is mostly restricted by the bond yield data availability. Another reason is compared to short-term yields such as the three-month yields, ten-year yields are less subjected to central bank intervention. To estimate the term spread, which is used as a control variable in the empirical analysis, I also use the one-year Treasuries.

Table II summarizes the sample of this paper, where the means and standard deviations of stock returns, currency returns, bond yields, and the first-difference of the bond yields are reported in Panel A. To ensure a sufficient number of countries have available data at the beginning of the sampling period, the sample based on the total returns index starts in 1999. Those based on the price index commence in 1990. There are only seven countries at the beginning of the price index sample, which subsequently increases to 21 by 1999. One restriction of the more extended price index sample is that the stock index excludes dividend payments.

The first six columns of Table II summarize the average returns and standard deviations of the country stock index returns, with the following two columns designated for the statistics related to currency returns. During the sample period, emerging markets (e.g., China, India, Indonesia, Mexico, South Africa, and Thailand) have higher returns than those typically classified as developed markets (e.g., countries in the EU region or Japan). The next two columns describe the mean level of annualized bond yields and the volatility of the first difference in the bond yields. As can be seen from the data and is commonly conjectured, the bond yields and volatility are higher in the emerging market.

As the distance between local and global discount rates is one of the aspects influencing the SB relationship, in the current analysis, it is proxied using the correlation between local and global bond yields as well as those of the stock market realized variance. The stock market realized variance is computed using the sum of squared five-minute index returns, which is available from the Oxford-Man Realized Library Heber, Lunde, Shephard, and Sheppard (2009). The library is initially sourced from the Thomson Reuters Tick History database and covers realized variance estimates for 20 countries from 2000. Among countries with multiple indices in the database, I choose the BSE Sensex index for India, Shanghai Composite Index for China. In all instances, I use the variance that takes the average over five subsamples to minimize microstructure error.

Several country-level macroeconomic variables are used as control variables. Namely, the global and country-specific inflation rates are obtained from the World Bank, as well as country-level total gross domestic product (GDP), GDP per capita, and total exports, all of which are sourced from the International Monetary Fund database.

Finally, in the last part of the analysis, I use the sovereign credit default swap (CDS) spread to decompose bond yields into sovereign default spread and the risk-free component. The CDS data is obtained from the intercontinental exchange, whereby the last quoted mid-price of the week and month is chosen to compute the implied default spread in the sovereign bonds.

2. Estimation of the stock-bond relationship and the global CAPM

The key variable of interest in the current analysis is the relationship between the first-order difference in bond yields and stock returns. The first-difference from the rationale that yield changes are not predictable from past yield levels. The bond yield beta (β^i), estimated as the slope of the regression of bond yield innovations regressed on stock returns, serves as the main measure of the SB relationship, that is,

$$R^i_{m,t+1} = \alpha^i + \beta^i (y^i_{t+1} - y^i_t) + \epsilon^i_{t+1}, \tag{18}$$

where $R^i_{m,t+1}$ is the log stock return of a country index denominated in local currency and y^i_{t+1} is the yield on a ten-year Treasury bond of country i, also in local currency. The second to the last column of Table II reports the slope of this regression. In this table, I use daily data of net total returns for stock returns and bond yields and estimate the slope of the regression once using the entire sample for each country.

Finally, the last column of Table II summarizes the GCAPM beta of Dumas and Solnik (1995). The currency factor is added when estimating the beta and captures temporary deviations from the parity relationship, which plays a crucial role in international investments. The GCAPM beta is estimated using the following equation:

$$R^{i,USD}_{m,t+1} = a^i + b^i R^{USD}_{\text{MSCI},t+1} + c^i \Delta q^i_{t+1} + \epsilon^i_{t+1}, \tag{19}$$

where $R^{i,USD}_{m,t+1}$ is the log return of the country i's stock index, $R^{USD}_{\text{MSCI},t+1}$ denotes the log returns of the MSCI World Index, and q^i_{t+1} is the log price of country i's currency, all expressed in USD.

The cross-sectional correlations of the average stock returns, currency returns, the GCAPM beta, and the bond yield betas are reported in Panel B of Table II. According to the GCAPM, investments in countries with a high positive beta should yield higher returns unconditionally. However, the table shows that this evidence does not hold empirically, especially for the post-1990 period. In fact, countries with a higher global beta are associated with negative – not positive – if betas are estimated from the net total returns index. For the price index returns, there is no relationship between the two. The connection remains similar regardless of whether currency returns are added to stock returns in local currency.

The correlations between stock or currency returns and the bond yield beta exhibit a similar pattern. When currency returns are excluded, the country stock market with a positive bond yield beta underperforms, consistent with the model implications. However, the bond yield betas are positively related to average currency returns. Therefore, the relationship with the stock returns is ambiguous if these are converted to USD.

These unconditional relationships are consistent with the model of the previous section, as it suggests a lower stock risk premium for countries with a positive SB relationship. A positive relationship between local stock returns and bond yields is associated with a lower local/global correlation of the long-run growth rates and their variance. Currency investments in these countries should have a higher volatility and risk premium.

The positive link between the SB relationship and currency returns, reported in Panel B, is also consistent with recent literature on carry trades (e.g., Lustig and Verdelhan 2007). The model of this paper suggests that the SB relationship is also negatively related to the local volatility. In classical asset pricing models, low volatility is typically associated with higher bond yields. Recent literature suggests that currencies of countries with higher bond yields are more likely to appreciate. As a result, it is natural to expect currencies of countries with a positive SB relationship to appreciate.

Lustig, Roussanov, and Verdelhan (2011), Lustig, Roussanov, and Verdelhan (2014), and Menkhoff, Sarno, Schmeling, and Schrimpf (2017) also show that currencies that provide a hedge against global consumption risk generate lower returns. As the SDF of these countries is more likely to be positively correlated with global SDF, a negative SB relationship is expected. This observation is also consistent with the results reported in Panel B.

IV. Empirical Results

This section presents the main empirical findings, explicating the link between the time-varying SB relationship and the leading country stock market returns. Then, I demonstrate that the SB relationship is connected to how local economic shocks are exposed to global discount rate shocks and to the level of stock return and bond yield volatility. I also show that these two dimensions are associated with the subsequent stock market performance. Finally, I provide some robustness test results.

1. International stock return predictability

The earlier model shows that the relationship between stock returns and bond yields is associated with two macroeconomic dimensions. The model suggests that a lower global discount rate exposure and higher local volatility relative to global volatility precipitate a negative SB relationship. Moreover, both dimensions are positively associated with the risk compensation required by international investors. Together, these implications suggest that stock investments in countries characterized by a more positive relationship between local stock returns and bond yields should generate higher future stock market returns.

To test this hypothesis, I estimate the regression slope (18) using daily, weekly, and monthly rolling-window regressions denoting the slopes by β_d^i, β_w^i, and β_m^i, respectively. Both total return index and price index are used to compute the stock returns. While the total return-based index sample is more accurate, the price index-based sampling period is longer.

The benefit of bond yield beta is that it can be estimated using high-frequency data (i.e., daily returns and yields), which improves accuracy by utilizing more observations. Therefore, the availability of high-frequency data is crucial when the relationship between two financial variables is highly time-varying, as explained by Pyun (2019).

On the other hand, in international asset pricing, controlling for the global price movements is difficult, as the exchange opening hours vary considerably depending on their geographical location. Daily estimates may also be subject to microstructure noise, particularly for emerging markets. In this case, lower frequency, i.e., monthly, data may be more accurate. Still, as many observations are needed to obtain a precise estimate, the sampling frequency cannot be too low. The sampling period needs to be extended to improve the estimation. However, in practice, this may introduce outdated information in the estimate if the relationship is subject to high temporal variation.

Therefore, I use the daily beta from a 183-calendar day rolling window as a primary measure, and the monthly beta estimate from a 36-month rolling window serves as an additional measure. However, whenever daily estimates are inappropriate, e.g., when there is a need to control global variables, the weekly beta from a 52-week rolling window is considered the baseline.

Daily, weekly, and monthly betas are estimated for each country, and then, countries are sorted by the beta estimates. Five stock market index portfolios are formed based on their rankings, and returns are evaluated for the subsequent months. Returns are expressed in USD, computed as the sum of the returns in local currency (Returns in local) and currency returns (Currency). The returns reported in USD are also risk-adjusted using the GCAPM given by Equation (19).

Panel A of Table III shows the results based on the net total returns, whereas values reported in Panel B are based on the price index returns. The results using daily, weekly, and monthly estimates are provided in each panel. Overall, these findings are consistent with the hypothesis. Focusing on the first row in which USD-based returns are presented, it is evident that investments in countries with a negative relationship between stock returns and bond yield generate 0.54 – 0.71% (6.48 – 8.52%) higher returns compared to those with a positive relationship for the following month. The difference in returns remains high and statistically significant across all specifications after risk-adjusting for the sum of global stock and currency returns by applying the GCAPM.

The last two rows of each section of the panel provide the results after decomposing USD denominated returns into stock returns in local currency and currency value changes. The difference is greater if stock returns are expressed in local currency (0.68 – 0.83% per month, 8.16 – 9.96% annualized). The currency returns partially offset the difference earned from local stock returns, although most are statistically insignificant. These results are consistent with the model as described in the previous section.

In estimating the bond yield betas, the beta may be capturing stock returns' sensitivity to global bond yield changes. As also shown in Table I, yield shocks are correlated across countries. In the model developed by Colacito and Croce (2011), bond yield innovations are perfectly correlated across countries. External habit formation (e.g., Stathopoulos 2017) also increases the correlation between financial variables. Hence, a high cross-country correlation between yield shocks implies that the yield betas maybe capturing the stock market's reaction to global long-run growth shocks.

To investigate the possibility that the yield betas are measuring stock markets' reaction to global yield shocks, alternatively, I control for the global yield innovations where the regression slopes are given by

$$R^i_{m,t+1} = \alpha'^i + \beta'^i(y^i_{t+1} - y^i_t) + \gamma^i \sum_{\forall j}(y^j_{t+1} - y^j_t) + \epsilon^i_{t+1}, \tag{20}$$

using either weekly or monthly data to estimate the regression. It should be noted that controlling for the global bond yields at the daily frequency is challenging due to the asynchronous trading hours around the world.

The average returns of the portfolios sorted by the yield beta after controlling for the global yield innovations (β'^i) are reported in Panel C of Table III. Overall, the results are very similar to other panels. The return difference based on monthly data is weaker, where the average return of the high minus low portfolio is -0.40% per month. However, given possible multicollinearity between local and global yield shocks and the number of observations used for the regression (36), a weaker result is expected.

2. Role of country-specific macroeconomic variables

The results reported in Table III show that the bond yield betas are strong predictors of country stock returns. However, the unconditional relationship between bond yield betas and average stock market returns reported in Panel B of Table II is relatively weak. Therefore, together, these results suggest that the yield betas serve as proxies for the time-varying component of the country risk premia.

The analysis and discussion of this section have two purposes. Their first objective is to confirm that the bond yield betas contain information about the time-varying characteristic of the country-specific equity risk premia. The second purpose is to elucidate whether bond yield betas are proxies of standard macro-economic variables that also explain the cross-sectional differences in the equity risk premium.

These hypotheses are studied using a cross-sectional regression. First, the bond yield betas are estimated as described in the previous section. Then, the leading country stock index returns are regressed on lagged yield beta estimates in addition to the macroeconomic variables. I report the average of the coefficients and the Fama-MacBeth standard errors.

Table IV summarizes the cross-sectional regression results. Panel A reports the result for the net total returns index, and Panel B is designed for the price index. The first two models (denoted by Model 1 – Model 2) in both panels do not include any control variables. The slope coefficients for both daily and monthly beta estimates are negative and statistically significant in both panels. These findings confirm the findings of Table III, which offers empirical evidence that stock investments in countries with a negative stock return/bond yield relationship generate higher subsequent returns.

The next two models (Model 3 – Model 4) control for the time-series averages of the daily and monthly betas. It should be noted that as the average is taken from the entire sample, look-ahead bias is possible. Nonetheless, any country-fixed characteristic – such as geographical locations, languages used, culture, or religion – should be captured by the averages. Therefore, the results suggest that this is unlikely to be the case since for both indices, adding the time-series average strengthens the coefficients on the time-varying betas. These results strongly suggest that the estimates contain information about the time-varying component of the risk premia.

The last four models (Model 5– Model 8) incorporates macroeconomic control variables, which includes the per capita GDP (representing whether the country is in a developed or emerging market economy), total GDP (representing the size of the country), country's total export as a fraction of total GDP (equivalent to the λ in the model), the 5-year lagged average growth rate of the country, the inflation rate of the country, and the GCAPM beta estimate of the corresponding index.

Overall, the results are weaker when the control variables are included, suggesting the possibility that the temporal variation may be related to some combination of macroeconomic fundamentals. However, standard macroeconomic variables do not entirely explain the time-variation of the risk premia.

Although the control variables are statistically insignificant, several observations are worth noting. First, a higher GDP growth rate generally implies higher future stock returns, consistent with the general perception that developing countries may have a higher risk premium. The percentage contribution of exports to the total GDP generally has a negative loading, suggesting that it is not necessarily the firm's exposure to the global economy that determines the global stock risk premium. On the other hand, inflation exerts a negative influence, indicating that the main results are unlikely to be driven by the inflation risk component of sovereign bonds. Finally, the significance of the bond yield beta is weaker after controlling for the global CAPM beta. The weaker result is expected due to multicollinearity because GCAPM betas are negatively related to the SB relationship. As the correlation between local and global discount rates increases, GCAPM beta is systematically higher, and the relationship between stock returns and bond yields becomes more negative.

In conclusion, the results reported in this section strongly support the hypothesis that the relationship between stock returns and bond yields captures information on the time-varying characteristic of the stock market risk premia. Moreover, the risk premia captured are not entirely explained by standard macroeconomic variables.

3. Relationship between yield betas and standard return predictors

I next investigate the relationship between bond yield betas and other standard predictors used in the international stock market return predictability literature. In answering this question, I consider the return predictors examined by Cenedese, Payne, Sarno, and Valente (2016). They show that the country level dividend yields, term spread, and momentum are strong predictors of international stock returns.

Following their approach, I estimate the dividend yield of each country annually as the difference between the net total returns and the price returns of the corresponding MSCI index. The term spread is estimated as the difference between ten-year yields and one-year yields, and momentum is the average of the returns preceding the time of measurement by 2 – 12 months. The term spread and momentum are estimated every month on the last trading day.

In line with the methodology of the previous section, I consider the cross-sectional regression of Fama and MacBeth. The results are summarized in Table V. Similar to the arrangement of the previous table, results using net total returns are reported, followed by those obtained from price returns. The first six specifications compare the performance of the yield betas with one additional return predictor in turn, whereas the last two compare the performance with all predictors together.

For all samples and indices considered, the bond yield beta is negatively related to future returns even after controlling for any alternative predictors. Dividend yields and momentum remains significant for the daily yield beta estimate, suggesting that the bond yield beta is unlikely to capture information similar to that implicit in these return predictors. If the term spread is added to the specification, only the bond yield beta is significant. If all three predictors are added along with the yield beta, the bond yield beta remains significant in three of the four specifications. None of the other return predictors remain statistically significant.

4. SB relationship and the exposure to global discount rate shocks

The model presented in this paper suggests that the SB relationship is connected to two dimensions which also drives the risk premia earned on county stock indices. The first dimension relates to a country's exposure to global discount rate shocks, and the second pertains to the volatility of the local consumption growth rate. Hence, in this and the following section, I demonstrate the association of bond yield betas with proxies of the two dimensions. Then, I present empirical evidence that these dimensions are related to the time-varying stock risk premia.

The first dimension that affects the SB relationship is the country's exposure to global discount rate shocks, which is modeled as the correlation between the local and global long-run consumption growth shocks as well as those variance shocks.

Two empirical proxies are developed to measure the relationship. First is the correlation between the local and the worldwide bond yield changes. Theoretically, bond yields are affected by the long-run consumption growth and their variance. In the model, this correlation exactly matches the ρ_t process, as the correlation between local/global long-run growth shocks is proportional to those of the variance shocks. In the context of the closed economy LRR model, Jones and Pyun (2021) show that bond yields move mostly when the long-run consumption growth rate varies.

The second measure is the correlation between local and global stock market variance shocks. The model suggests that correlation between bond yield variance is a superior measure since the stock market variance is also affected by the global component of shocks. However, estimating daily variance shocks using daily data is challenging since variance is a latent process. To overcome this problem, I use intraday stock market index data for 20 countries and apply the HAR-RV model of Corsi (2009) to obtain a predicted value of the realized variance at the daily frequency. Then, in line with the approach adopted by Pyun (2019), I define the variance innovation as the difference between the realized and the predicted value of the realized variance.

When estimating these correlations, it is essential to consider how global yields and variance are defined and measured. Here, I take the simple average of the yields and stock market variance as a proxy for their global counterparts, even though it should be noted that this is not the most accurate measure.

The local/global correlations of yields and variance shocks are estimated using weekly observations to accommodate asynchronous trading hours. The correlations, the bond yield betas, and the SB correlations are all calculated over a three-month rolling window, once every quarter. As in the previous analysis, I perform a panel regression to establish whether the bond yield betas or the correlation between stock returns and local bond yields are positively associated with the correlation between local and global yield or variance. The results are not mechanical as the estimates are non-overlapping.

The panel regression results are reported in Table VI. Panel A focuses on the results of yield correlations. The analysis suggests that local/global yield correlation is positively related to the SB correlations and yield betas. This relationship remains significant after controlling yield volatility, which is negatively associated with bond yield betas or SB correlations.

Panel B shows the local/global variance correlation results. I only consider net total returns in this specification since variance estimates are available for the post-2000 period. The findings indicate that the local/global variance correlation is positively related to the bond yield beta and the SB correlation. The results remain significant even after controlling for the local/global bond yield correlations and yield volatility.

5. SB relationship and bond yield volatility

The second dimension to which the SB relationship relates is the volatility of the local consumption growth relative to the global volatility. The model developed in the previous section implies that higher bond yield volatility is positively associated with the yield beta. The assumption is that bond yield volatility captures the volatility of local fundamental shocks more accurately than the stock return volatility. However, this implied relationship is the opposite to many existing studies of 'flight-to-quality,' where stock return volatility is commonly used instead of yield volatility. In this section, I investigate these relationships in detail.

I apply a panel regression with the bond yield betas and stock returns/bond yield correlations as dependent variables while treating bond yield volatility and stock volatility of the country as explanatory variables. According to the model implications, it is expected that, after controlling for stock market volatility, the relationship between bond beta and bond volatility would be negative.

I choose to estimate the bond betas using the regression as in the main specification but adopting a 30-calendar day rolling window. The reason is simple. Using long-horizon estimates in regressions could be problematic if the dependent variables are based on overlapping regressions, as these may generate spuriousness in regression estimates, especially when explanatory variables are also highly serially correlated[4]. This issue can be partially overcome if, for example, the estimates are non-overlapping.

[4]See, for example, Hodrick (1992) or Stambaugh (1999)

The correlation between the first-difference in bond yields and stock returns (ρ_d^i) is also estimated using the same window. I only present the result using daily betas since it is challenging to use weekly or monthly data using a short sampling window. Bond volatility and stock volatility are also estimated using the same rolling window, and I take logs on both volatility estimates.

Table VII summarizes the panel regression results. Panel A shows the main specification results when volatility, the bond yield beta, and the bond yield/stock return correlations are estimated from daily data. The left side of the panel shows the results obtained using bond beta as the dependent variable. For those presented on the right side, the SB correlation is the dependent variable. The first regression suggests that bond volatility is negatively related to the bond betas, countering the flight-to-quality explanation.

These results may seem counter-intuitive given strong empirical evidence provided by previous studies based on the US and international stock market volatility. The influence of the stock return volatility is further investigated in the second regression by including both the stock and bond yield volatility simultaneously. In this regression, the sign and the significance of the bond yield volatility do not change. If bond betas are regressed on the difference between them, the sign of the coefficient is negative and statistically significant.

One may think that this outcome is mechanically driven since

$$\beta_d^i = \rho_d^i SD(R_m^i)/SD(\Delta y^i),$$

where R_m^i is the stock return, and Δy^i is the first difference of bond yields. If the correlation ρ_d^i is constant, the yield beta is expected to be higher when the stock market volatility is high and when the bond yield volatility is low. Therefore, I consider alternative specifications, where the yield betas are replaced by the correlation between stock returns and bond yields.

Overall, these results are similar even when the correlation is modeled as the dependent variable. Bond yield volatility is negatively related to the correlation, and the sign of the coefficient on the stock market volatility is insignificant. The insignificance may be unexpected as earlier studies find positive statistical significance on this coefficient. One possible explanation for this result may be that the flight-to-quality effect is global. Therefore, only the internationally common volatility component affects stock returns and bond yields in the same direction.

This alternative explanation is tested further in two additional specifications using stock market volatility as a sole independent variable, one of which excludes the time-fixed effect. The values reported in the last two columns of Panel A suggest that the stock market volatility is positively related to the SB correlation only when the time-fixed effect is excluded. These results strongly indicate that the flight-to-quality effect is entirely driven by the worldwide stock market volatility. The results of Panel B that uses the price index instead provide a similar outcome.

The preceding analysis does not rely on any overlapping observations when estimating betas, correlations, and volatility. Therefore, the results are unlikely to be driven spuriously. However, when the dependent and the independent variables are highly persistent, it is still possible that the standard errors reported are biased. To understand whether the results are driven by exceptionally highly serially correlated estimates, I consider an alternative specification with the first-order difference for the daily and weekly bond beta, correlation, and volatility estimates. This approach essentially tests whether volatility shocks in bond yields and stock returns lead to higher or lower yield betas.

Panel C summarizes the results of the first differences. The results for only the total returns are presented as those for the price index are qualitatively similar. Overall, the relationships between yield beta and volatility also hold when first differences are used. Both daily and weekly bond yield betas increase as the bond yield volatility decreases and as the stock market return volatility increases. The same relationship holds for the correlation between stock returns and bond yields. In conclusion, these findings strongly suggest that the correlation between local and global shocks is positively associated with the SB relationship. In the next section, I perform additional analyses to establish whether these two dimensions – the country's exposure to global discount rate shocks and the size of local volatility relative to global volatility – contain information about the stock market risk premium.

6. International stock market risk premium and empirical proxies

The empirical evidence presented in the preceding section indicates that the relationship between stock returns and bond yields is positively related to the global discount rate exposure and bond yield volatility. This section aims to ascertain whether these two dimensions are also associated with future stock market performance.

For this purpose, I estimate the daily and monthly bond yield volatility using the same rolling window as the main specification. The local/global yield correlation is calculated using weekly and monthly observations. The local/global stock return variance correlation is estimated only at the weekly interval. The countries are sorted by these estimates to form portfolios and evaluate the returns for the subsequent month.

Panel A of Table VIII summarizes the results obtained by sorting countries by the local/global yield correlations. The reported values confirm that a lower local/global growth rate correlation is also associated with lower stock returns. The difference in returns of the high minus low portfolio is statistically significant. However, the returns are smaller in magnitude than those sorted by bond yield betas directly.

Panel B shows the returns when countries are sorted by the difference between the log bond and stock volatility. The results are consistent with the hypothesis that higher relative bond volatility is associated with a higher risk premium. Equity investments in countries that have higher relative bond volatility slightly outperform countries with a lower relative bond yield volatility. Similar to Panel A, the differences in returns are much lower than those sorted by yield betas directly.

Finally, Panel C provides the results when countries are sorted by the variance correlation. The difference in returns of the high minus low portfolio is very high at 10% per year. However, the sample is restricted to a lower number of countries, and only the post-2000 period is considered.

In conclusion, these results suggest that these two dimensions are related to the stock market risk premium but individually only capture a fraction of the variation driven by the bond yield betas.

7. Role of sovereign default risk

In this paper, bond yields are estimated using Treasury bonds, which are subject to sovereign default risk. Moreover, empirical evidence suggests that sovereign default risk and the premium are time varying. For example, during the year 2020 alone, Italy's CDS spread reached a maximum of 246bp and a minimum of 96bp. For this reason, in this section, I examine the possibility that the main results of this paper are due to stock returns reacting to sovereign default risk.

Government yields are decomposed into two parts: the default risk premium and the risk-free component. Mathematically, in the absence of any liquidity premium, inflation risk, and double default, bond yield is equivalent to the sum of the risk-free rate and the CDS spread. Hence, any variation in bond yields that is not driven by the default compensation component must be due to the risk-free rate. Therefore, the difference between bond yields and default compensation should be the risk-free yield in a given country. The changes in the bond yield can be represented by

$$\Delta y^i_{t+1} \approx \Delta CDS^i_{t+1} + \Delta RF^i_{t+1}, \tag{21}$$

where CDS^i_{t+1} is the CDS rate and RF^i_{t+1} is the risk-free yield.[5]

I estimate the beta of these two components using the regression

$$R^i_{m,t+1} = \alpha^i + \delta^i_1 \Delta RF^i_{t+1} + \delta^i_2 \Delta CDS^i_{t+1} + \epsilon^i_{t+1}, \tag{22}$$

[5] The approximation comes from assuming

$$\Delta CDS^i_{t+1} \times \Delta RF^i_{t+1} \approx 0$$

.

where $R^i_{m,t+1}$ is the stock return of country i in local currency, and sort the countries by the two beta estimates separately. Then, portfolios are formed and returns for the subsequent month are evaluated as in the previous analysis.

Table IX summarizes the stock returns expressed in USD, the GCAPM risk-adjusted returns, stock returns expressed in the local currency, and currency returns of the portfolios. This analysis is based on weekly and monthly data, as sovereign CDS is not as liquid during the sample's early periods.

If default risk is priced in the stock market, stock prices that react most negatively to an increase in the CDS spread should generate higher returns. However, the tabulated findings suggest no evidence of it. The signs are the opposite to this premise, although the difference is statistically insignificant. Moreover, investments in countries with a high risk-free bond yield beta have lower returns for the subsequent month, consistent with the main explanation of this paper. These findings suggest that default risk is unlikely to be the source driving the main result of this paper.

V. Conclusion

This paper shows that the relationship between domestic stock returns and bond yields is closely related to the international stock market risk premium. Moreover, the stock return/bond yield relationship captures two dimensions of macroeconomic fundamentals, which is likely to be time-varying.

The first dimension is related to a country's exposure to global discount rate shock, captured by local/global correlation of the discount rate shocks. A lower correlation implies that stock returns and bond yields are more likely to move in opposite directions. The second dimension is local volatility of the country relative to the global volatility. The SB relationship is more negative when local volatility is higher since high volatility lowers bond yields and the discount rate of stocks, which implies higher stock prices.

Empirically, these two dimensions are also connected to the risk premium required for a global stock market investment. Investments in countries characterized by higher volatility are riskier, although their expected currency returns may be lower. A higher correlation between local and global discount factor shocks implies lower currency risk, but local shocks may be perceived as riskier by international investors. The analyses presented here show that higher volatility and lower local/global discount rate shock correlation imply a higher risk premium in the model. This intuition is empirically confirmed.

The findings reported in this paper have crucial implications for the performance of the so-called international CAPM, which implies that an investment is likely to have higher future stock returns if the returns covary more with the global wealth portfolio. This paper suggests the opposite. As was shown in the preceding sections, investment in countries whose local shocks are primarily uncorrelated to global shocks is risky for global investors, as such investments involve higher currency risk. Since these countries are also likely to have a lower beta, the international CAPM would fail in this context.

The model presented in this paper explicates why the correlation between stock returns and bond yields varies over time. The standard explanation is that investors react to heightened volatility by reducing their risky stock holdings and increasing their bond holdings. The results reported in this paper suggests that flight-to-quality is led by heightened global uncertainty and is unrelated to local volatility. In particular, empirical evidence presented in this paper indicates that the SB relationship is negative when local bond yield volatility is high.

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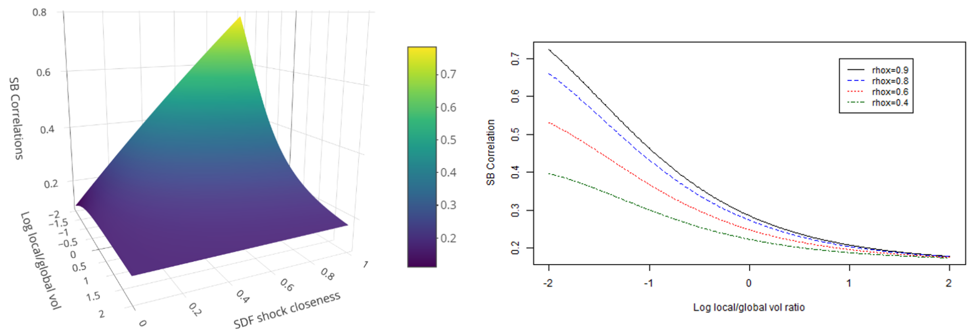
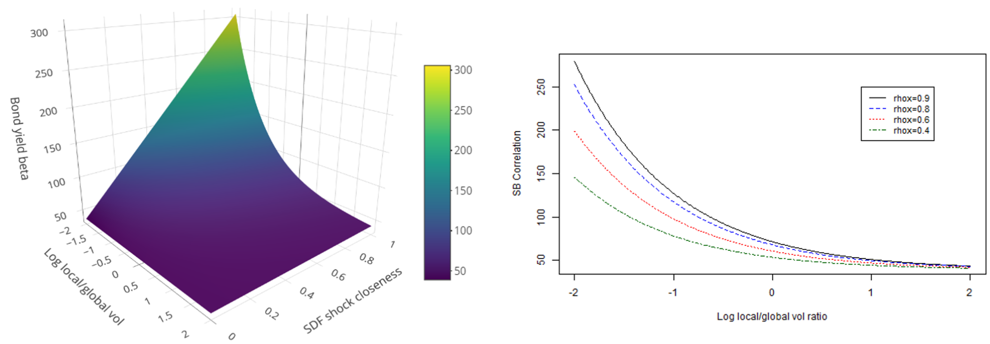
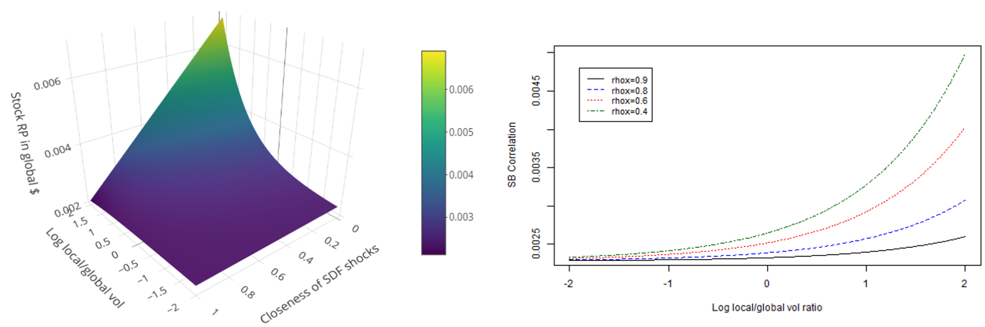


(a) Correlation between stock returns/bond yields



(b) Bond yield beta on stock returns



(c) Stock market risk premium in global currency

Figure 1. SB correlations and the stock market risk premium

This figure shows (a) the level of the correlation between country stock returns and bond yield changes, (b) the slope of bond yields regressed on country stock returns, and (c) the risk premium on the equity portfolio in global currency conditional on i) values of the log of the local/global volatility ratio and ii) the distance between the country and global discount factor shocks measured as the correlation between local and global long-run consumption growth and consumption variance shocks.

Table I
Calibration

This table provides the parameter specification (Panel A) used to show the main implication in Figure 1. The model-implied asset moments based on the parameter specifications are provided in Panel B. $R_m^{\$}$ is the real market return in global currency and y denotes real bond yields. The standard deviation of bond yields (SD(y)), the correlation between stock returns and bond yields Cor(y, R_m), and the correlation between local and global changes in yields Cor(y, y^*) are calculated using nominal values. Cor(σ_m^2,$\sigma_m^{*,2}$) represents the correlation between country-level and world average stock market variance shocks calculated by fitting the HAR-RV model to the intraday sum of five-minute squared returns.

Panel A. Parameter Specification

	Parameters		Parameters
Preference parameters		Consumption parameters	
γ	4.0	μ	0.002
ψ	2.0	ξ	0.947
β	0.998	σ_x	0.044
Distance parameters		Dividend Parameters	
ρ_c	0.3	μ_d	0.0025
ρ_v	1.0	ϕ_d	3.0
$\frac{\delta_0}{1-\delta_1}$	0.8×0.0099	σ_d	4.5
δ_1	0.9	σ_{cd}	4.0
σ_δ	0.08	λ	0.4
Variance parameters			
v_1	0.987		
σ_v	3×10^{-6}		
$\frac{v_0}{1-v_1}$	0.0099		

Panel B. Asset moments

		Data (1990-2020)	
	Model	US	World
μ	2.40%	2.55%	3.40%
σ	3.43%	1.57%	3.51%
$R_m^{\$}$	5.93%	7.07%	5.74%
y	2.93%	1.86%	2.54%
σ_m	18.41%	14.83%	19.09%
SD(y)	0.07%	0.80%	1.73%
Cor(y, R_m)	0.273	0.234	0.224
Cor(y, y^*)	0.800	0.848	0.579^+
Cor(R_m, R_m^*)	0.687	0.895	0.576^+
Cor(σ_m^2,$\sigma_m^{*,2}$)	0.800	0.657	0.609^+
SD(Δq)	15.74%		$9.7\%^{++}$

$^+$: Average correlation between countries and global average
$^{++}$: Average standard deviation of all currencies in the sample

Table II
Summary statistics

This table summarizes the moments of international stock market returns of MSCI net total returns and price index, currency returns, bond yields, and the first-difference of bond yields. Panel A summarizes the means and standard deviations, the stock return/bond yield beta, and the global CAPM beta estimated as described in (18)- (19) in the main text. Daily data is used to estimate the bond yield beta, and net total returns are used to calculate the global CAPM beta. Panel B summarizes the cross-sectional correlations among the beta and correlation statistics.

Panel A. Summary statistics

	Stock Returns						Currency		Bond		SB	CAPM
	Total Returns			Price Index			Returns		Yields		Beta	Beta
Country	Yr–	Mean	Std.	Yr–	Mean	Std.	Mean	Std.	Mean	Std.		(Net)
Australia	1999	0.073	0.137	1990	0.044	0.140	−0.001	0.113	0.056	0.010	4.35	0.73
Austria	1999	0.029	0.247	1993	0.010	0.234	−0.001	0.094	0.036	0.007	7.30	1.22
Belgium	1999	0.011	0.204	1993	0.025	0.191	0.006	0.094	0.038	0.007	3.41	1.07
Brazil	2010	0.093	0.220	2010	0.061	0.221	0.057	0.147	0.109	0.021	−5.16	0.72
Canada	1999	0.067	0.148	1990	0.055	0.147	−0.003	0.078	0.046	0.008	6.73	0.79
China	2006	0.100	0.255	2006	0.077	0.256	0.015	0.035	0.035	0.005	1.73	1.06
Finland	1999	0.040	0.284	1996	0.067	0.286	0.007	0.096	0.031	0.007	12.26	1.37
France	1999	0.043	0.177	1990	0.043	0.168	−0.005	0.096	0.041	0.007	7.86	1.10
Germany	1999	0.040	0.212	1990	0.042	0.196	−0.002	0.097	0.037	0.007	11.88	1.22
India	1999	0.132	0.246	1999	0.124	0.246	−0.025	0.070	0.078	0.010	−2.64	0.73
Indonesia	2004	0.160	0.225	2004	0.137	0.225	−0.027	0.098	0.089	0.023	−3.22	0.74
Italy	1999	0.003	0.205	1993	0.008	0.209	0.006	0.094	0.043	0.011	−4.93	1.07
Japan	1999	0.034	0.179	1990	−0.011	0.194	0.011	0.103	0.019	0.006	12.21	0.77
Korea	2001	0.113	0.208	2001	0.099	0.209	0.013	0.095	0.040	0.009	3.11	1.06
Malaysia	1999	0.067	0.139	1999	0.046	0.174	−0.003	0.062	0.042	0.007	−1.10	0.31
Mexico	2002	0.121	0.152	2002	0.072	0.225	−0.029	0.114	0.075	0.012	−0.33	0.79
Netherlands	1999	0.053	0.181	1991	0.050	0.171	0.000	0.098	0.038	0.007	10.13	1.10
Norway	1999	0.076	0.203	1996	0.049	0.208	−0.007	0.110	0.041	0.008	9.19	1.06
NZ	1999	0.072	0.146	1998	0.025	0.155	0.005	0.114	0.058	0.009	2.00	0.52
Philippines	1999	0.048	0.211	1998	−0.004	0.225	−0.011	0.061	0.095	0.028	−0.73	0.58
Russia	2001	0.090	0.282	2001	0.030	0.325	−0.048	0.122	0.055	0.015	−5.36	1.23
Singapore	2000	0.062	0.203	2000	0.038	0.213	0.011	0.056	0.027	0.008	3.93	0.91
S. Africa	1999	0.132	0.178	1997	0.086	0.197	−0.049	0.160	0.099	0.018	−2.84	0.78
Spain	1999	0.027	0.208	1993	0.043	0.208	0.010	0.099	0.046	0.010	−3.00	1.06
Sweden	1999	0.073	0.211	1991	0.075	0.214	−0.012	0.115	0.045	0.009	10.79	1.25
Switzerland	1999	0.038	0.133	1995	0.050	0.147	0.018	0.101	0.020	0.006	10.41	0.72
Thailand	2001	0.097	0.228	2001	0.067	0.228	0.015	0.057	0.037	0.011	0.19	0.78
Turkey	2011	0.081	0.229	2011	0.056	0.231	−0.141	0.150	0.108	0.035	−3.05	1.07
UK	1999	0.038	0.140	1990	0.031	0.142	−0.007	0.092	0.047	0.009	7.13	0.88
USA	1999	0.064	0.154	1990	0.081	0.149	0.000	0.000	0.044	0.009	8.05	0.95
World	1999	0.070	0.149	1990	0.050	0.151						1.00

Panel B. Correlation matrix

	SB Beta	Net Ret	Price Ret	Currency Ret	Net Ret in USD	Price Ret in USD
GCAPM Beta (Net)	0.342	−0.355		0.294	−0.382	
GCAPM Beta (Price)	0.139		0.055	0.150		0.076
SB Beta	1.000	−0.434	−0.198	0.274	−0.112	0.068

Table III
Bond yield beta and stock returns

This table summarizes the leading month country index stock returns (in USD/local currency), risk-adjusted returns of the GCAPM, and currency returns sorted by their bond yield betas estimated using daily, weekly, and monthly data. The net total returns (Panels A) and the price index returns (Panel B) are used to proxy country stock returns. Portfolios are formed by the yield beta rankings, and the average of the one-month predictive returns and the Newey-West t-statistics are reported.

Panel A. Using net total stock index returns

	Port 1	Port 2	Port 3	Port 4	Port 5	H –L
Daily estimation						
Returns	0.72	0.64	0.61	0.47	0.18	−0.54**
in USD	(1.74)	(1.72)	(1.71)	(1.29)	(0.45)	(−2.44)
GCAPM	0.68	0.45	0.36	0.08	−0.15	−0.83***
	(4.07)	(2.37)	(2.67)	(0.74)	(−1.04)	(−4.16)
Returns	0.90	0.65	0.67	0.39	0.13	−0.76***
in local $	(2.75)	(2.19)	(2.43)	(1.29)	(0.38)	(−3.49)
Currency	−0.18	−0.01	−0.06	0.08	0.05	0.23**
returns	(−1.49)	(−0.10)	(−0.44)	(0.59)	(0.34)	(2.00)
Weekly estimation						
Returns	0.93	0.52	0.53	0.32	0.28	−0.65***
in USD	(2.27)	(1.38)	(1.45)	(0.86)	(0.74)	(−2.73)
GCAPM	0.92	0.30	0.32	0.10	−0.18	−1.11***
	(4.32)	(2.03)	(2.47)	(0.60)	(−1.77)	(−5.16)
Returns	1.05	0.62	0.60	0.26	0.22	−0.83***
in local $	(3.14)	(2.06)	(2.11)	(0.85)	(0.68)	(−3.60)
Currency	−0.11	−0.09	−0.07	0.06	0.06	0.17
returns	(−0.97)	(−0.68)	(−0.47)	(0.41)	(0.40)	(1.59)
Monthly estimation						
Returns	0.71	0.72	0.32	0.26	0.15	−0.57**
in USD	(1.95)	(2.27)	(1.13)	(0.87)	(0.47)	(−2.34)
GCAPM	0.46	0.42	−0.07	−0.01	−0.18	−0.66***
	(2.31)	(2.80)	(−0.43)	(−0.11)	(−1.17)	(−3.27)
Returns	0.80	0.71	0.31	0.30	0.13	−0.68***
in local $	(2.61)	(2.79)	(1.27)	(1.26)	(0.44)	(−3.04)
Currency	−0.09	0.01	0.01	−0.05	0.02	0.10
returns	(−0.80)	(0.05)	(0.10)	(−0.40)	(0.20)	(0.90)

Panel B. Using price stock index returns

	Port 1	Port 2	Port 3	Port 4	Port 5	H –L
Daily estimation						
Returns	0.60	0.67	0.53	0.40	−0.07	−0.66***
in USD	(1.61)	(2.17)	(1.83)	(1.36)	(−0.20)	(−2.70)
GCAPM	0.43	0.33	0.25	0.08	−0.50	−0.93***
	(2.16)	(2.09)	(1.82)	(0.51)	(−3.15)	(−4.50)
Returns	0.73	0.66	0.58	0.39	−0.10	−0.82***
in local $	(2.29)	(2.59)	(2.46)	(1.53)	(−0.34)	(−3.54)
Currency	−0.13	0.01	−0.05	0.02	0.03	0.16
returns	(−1.04)	(0.06)	(−0.46)	(0.15)	(0.28)	(1.22)
Weekly estimation						
Returns	0.66	0.67	0.50	0.23	0.02	−0.66**
in USD	(1.76)	(2.08)	(1.71)	(0.77)	(0.05)	(−2.57)
GCAPM	0.44	0.28	0.22	−0.02	−0.35	−0.81***
	(2.01)	(1.60)	(1.60)	(−0.15)	(−2.45)	(−3.83)
Returns	0.81	0.67	0.49	0.25	0.00	−0.81***
in local $	(2.45)	(2.51)	(2.04)	(1.05)	(0.01)	(−3.40)
Currency	−0.14	0.00	0.02	−0.03	0.01	0.15
returns	(−1.06)	(0.01)	(0.16)	(−0.24)	(0.09)	(1.09)
Monthly estimation						
Returns	0.96	0.87	0.46	0.52	0.55	−0.42**
in USD	(2.68)	(2.67)	(1.57)	(1.81)	(1.72)	(−2.06)
GCAPM	0.85	0.41	0.28	0.08	−0.11	−0.96***
	(4.64)	(2.79)	(2.07)	(0.71)	(−0.85)	(−4.77)
Returns	1.07	0.88	0.57	0.44	0.60	−0.50***
in local $	(3.61)	(3.39)	(2.31)	(1.82)	(2.28)	(−2.72)
Currency	−0.11	−0.01	−0.10	0.07	−0.05	0.07
returns	(−0.93)	(−0.07)	(−0.85)	(0.69)	(−0.40)	(0.64)

Panel C-1. Net total returns controlling for global yields

	Weekly beta					
	Port 1	Port 2	Port 3	Port 4	Port 5	H –L
Returns	0.96	0.85	0.62	0.56	0.25	−0.71***
in USD	(2.67)	(2.67)	(2.15)	(1.89)	(0.78)	(−2.83)
GCAPM	0.78	0.40	0.32	0.13	−0.07	−0.88***
	(3.97)	(2.55)	(2.08)	(1.09)	(−0.59)	(−4.22)
Returns	1.09	0.86	0.62	0.54	0.34	−0.76***
in local $	(3.67)	(3.35)	(2.57)	(2.22)	(1.19)	(−3.54)
Currency	−0.13	0.00	0.00	0.02	−0.07	0.07
returns	(−1.14)	(−0.02)	(−0.01)	(0.18)	(−0.58)	(0.62)

Panel C-2. Net total returns controlling for global yields

	Monthly beta					
	Port 1	Port 2	Port 3	Port 4	Port 5	H –L
Returns	0.75	0.52	0.47	0.51	0.35	−0.40*
in USD	(1.76)	(1.36)	(1.31)	(1.39)	(0.94)	(−1.65)
GCAPM	0.79	0.53	0.20	0.12	−0.17	−0.96***
	(3.99)	(2.74)	(1.76)	(1.19)	(−1.50)	(−5.08)
Returns	0.92	0.60	0.50	0.46	0.30	−0.62***
in local $	(2.65)	(2.03)	(1.83)	(1.49)	(0.92)	(−2.68)
Currency	−0.17	−0.08	−0.02	0.05	0.05	0.22**
returns	(−1.42)	(−0.64)	(−0.16)	(0.39)	(0.34)	(2.01)

Table IV
Cross-sectional regressions

This table summarizes the average and the Fama-MacBeth standard errors of the cross-sectional regression using leading month country stock returns in USD as the dependent variable and daily, weekly, and monthly bond yield betas as independent variables. Control variables include the time-series average of bond yield betas, the GCAPM beta, GDP per capita, population, GDP growth rate, inflation rate, and the percentage contribution of exports to the total GDP. Panel A provides the results for the net total index, and Panel B is designated for the price index.

Panel A. Net total index returns (N=260)

	Dependent variable : Leading monthly returns in USD							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$\hat{\beta}_d^i$	−0.032***		−0.050***		−0.035**	−0.020		
	(−2.70)		(−3.14)		(−2.31)	(−1.50)		
$\hat{\beta}_m^i$		−0.029**		−0.038**			−0.029*	−0.020
		(−2.29)		(−2.25)			(−1.93)	(−1.44)
$\bar{\hat{\beta}}_d^i$			0.022					
			(1.10)					
$\bar{\hat{\beta}}_m^i$				0.016				
				(0.70)				
GDP per Cap					0.000	0.000	0.000	0.000
					(−0.28)	(−0.63)	(−0.14)	(−0.47)
% Export/GDP					0.000	0.000	0.000	0.000
					(0.08)	(−0.07)	(−0.28)	(0.12)
Population					0.000	0.000	0.000	0.000
					(0.82)	(0.84)	(0.56)	(1.03)
GDP Growth					0.010	0.009	0.005	0.005
					(0.90)	(0.90)	(0.46)	(0.55)
Inflation					−0.001	0.000	−0.001	0.000
					(−1.13)	(−1.01)	(−1.11)	(−0.80)
GCAPM Beta						0.000		0.000
						(−0.09)		(−0.14)

Panel B. Price index returns (N=370)

	Dependent variable : Leading monthly returns in USD							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$\hat{\beta}_d^i$	−0.039**		−0.078***		−0.057**	−0.049*		
	(−2.17)		(−3.91)		(−1.98)	(−1.66)		
$\hat{\beta}_m^i$		−0.051***		−0.071***			−0.057**	−0.055**
		(−2.95)		(−3.80)			(−2.47)	(−2.43)
$\bar{\hat{\beta}}_d^i$			0.054**					
			(2.24)					
$\bar{\hat{\beta}}_m^i$				0.024				
				(1.14)				
GDP per Cap					0.000	0.000	0.000	0.000
					(0.66)	(0.56)	(0.58)	(0.45)
Total GDP					0.000	0.000	0.000	0.000
					(−0.97)	(−0.92)	(−0.78)	(−0.71)
% Export/GDP					0.000	0.000	0.000	0.000
					(−0.40)	(−0.40)	(−0.55)	(−0.40)
GDP Growth					0.013	0.014	0.020	0.021
					(0.61)	(0.66)	(0.98)	(1.05)
Inflation					−0.001	−0.001	−0.001	0.000
					(−1.29)	(−1.08)	(−1.18)	(−0.99)
GCAPM Beta						0.003		0.000
						(0.98)		(−0.00)

Table V
Cross-sectional regressions controlling for additional predictors

This table summarizes the average and the Fama-Macbeth standard errors of the cross-sectional regression using leading month country stock returns in USD as the dependent variable and daily, weekly, and monthly bond yield betas as independent variables. Control variables include standard return predictors of international stock returns, such as dividend yields, past annual stock market performance excluding the past month, and term spread. Panel A provides the results for the net total index, and Panel B is designated for the price index.

Panel A. Net total index returns (N=260)

	Dependent variable : Leading monthly returns in USD							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$\hat{\beta}_d^i$	−0.031∗∗∗		−0.029∗∗		−0.029∗∗		−0.027∗∗	
	(−2.80)		(−2.55)		(−2.52)		(−2.36)	
$\hat{\beta}_m^i$		−0.025∗∗		−0.022∗		−0.019∗		−0.021∗
		(−2.08)		(−1.77)		(−1.66)		(−1.75)
Div Yield	0.114∗∗	0.079					0.090	0.077
	(2.02)	(1.51)					(1.59)	(1.48)
Term Spread			0.000	0.000			0.000	0.000
			(0.84)	(0.99)			(0.96)	(0.96)
Momentum					0.012∗	0.011	0.010	0.008
					(1.68)	(1.57)	(1.34)	(1.18)

Panel B. Price index returns (N=370)

	Dependent variable : Leading monthly returns in USD							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$\hat{\beta}_d^i$	−0.054∗∗∗		−0.044∗∗		−0.045∗		−0.058∗∗	
	(−2.95)		(−2.28)		(−1.96)		(−2.30)	
$\hat{\beta}_m^i$		−0.048∗∗∗		−0.043∗∗		−0.039∗∗		−0.029
		(−2.88)		(−2.31)		(−2.16)		(−0.90)
Div Yield	0.178∗∗	0.100					0.186	0.273
	(2.31)	(1.46)					(1.26)	(1.48)
Term Spread			0.000	0.000			0.000	0.000
			(0.21)	(−0.34)			(−0.20)	(−0.82)
Momentum					0.009	0.009	0.003	0.001
					(1.15)	(1.32)	(0.34)	(0.11)

Table VI
SB Relationship and local/global correlations

This table summarizes the panel regression results with the country stock returns' bond yield beta or the correlation between the two variables as the dependent variable. The explanatory variables include the correlation between the first differences in local bond yields and the cross-country average of all bond yields and the correlation between local and cross-country average of stock market variance shocks. The regressions include time and country fixed effects.

Panel A. SB relationship and yield correlations (N=2800)

	Using net total returns				Using price index returns			
Dep. Var.:	$\hat{\beta}_d^i$		$\hat{\rho}_d^i$		$\hat{\beta}_d^i$		$\hat{\rho}_d^i$	
Yield correlation	3.932	4.256	0.121	0.131	4.747	3.242	0.072	0.085
	(2.74)	(3.08)	(2.91)	(3.29)	(2.11)	(2.56)	(1.78)	(2.19)
Yield volatility		−2.729		−0.091		−2.408		−0.074
		(−4.18)		(−5.17)		(−3.59)		(−4.21)
FE Country	Y	Y	Y	Y	Y	Y	Y	Y
FE Time	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.527	0.536	0.610	0.621	0.549	0.657	0.557	0.663

Panel B. SB relationship and stock market variance correlations (N=1225)

	Using net total returns					
	$\hat{\beta}_d^i$			$\hat{\rho}_d^i$		
Variance correlation	2.067	2.507	3.736	0.070	0.083	0.091
	(1.39)	(1.70)	(2.72)	(2.39)	(2.79)	(3.08)
Yield correlation			6.158			0.184
			(2.87)			(3.33)
Yield volatility		−5.812	−5.866		−0.127	−0.126
		(−4.79)	(−4.97)		(−4.03)	(−4.30)
FE Country	Y	Y	Y	Y	Y	Y
FE Time	Y	Y	Y	Y	Y	Y
R^2	0.507	0.531	0.545	0.583	0.599	0.616

Table VII
Panel regressions of stock-bond relationship on volatility

This table summarizes the results of the contemporaneous panel regressions of the estimated bond betas regressed on log bond yield volatility, log stock return volatility, the difference between the log bond and stock volatility with country and time fixed effects. The bond betas ($\hat{\beta}^i$) are estimated using daily data on a 30-day rolling window. In some regressions, the betas are replaced with the correlation between stock returns and the first difference in bond yields ($\hat{\rho}^i$) .

Panel A. Using daily net total returns (N=7185)

	Dependent variable : $\hat{\beta}^i_d$				Dependent variable : $\hat{\rho}^i_d$			
log(bvol)	−3.562		−4.265		−0.076			
	(−5.54)		(−6.07)		(−6.61)			
log(svol)		4.732	5.446		0.010		−0.009	0.083
		(4.86)	(5.74)		(0.62)		(−0.52)	(4.13)
log(bvol/svol)				−4.627		−0.056		
				(−6.76)		(−5.67)		
FE Country	Y	Y	Y	Y	Y	Y	Y	Y
FE Time	Y	Y	Y	Y	Y	Y	Y	N
R^2	0.404	0.408	0.422	0.415	0.492	0.490	0.485	0.277

Panel B. Using price index returns (N=8352)

	Dependent variable : $\hat{\beta}^i_d$				Dependent variable : $\hat{\rho}^i_d$			
log(bvol)	−3.079		−3.689		−0.067			
	(−5.14)		(−5.61)		(−6.13)			
log(svol)		3.263	4.277		0.007		−0.011	0.120
		(3.90)	(4.78)		(0.48)		(−0.67)	(5.80)
log(bvol/svol)				−3.856		−0.048		
				(−5.48)		(−5.15)		
FE Country	Y	Y	Y	Y	Y	Y	Y	Y
FE Time	Y	Y	Y	Y	Y	Y	Y	N
R^2	0.432	0.428	0.427	0.427	0.544	0.543	0.540	0.191

Panel C. First-difference regressions

	Using net total returns				Using price index returns			
Dep. Variable:	$\Delta\hat{\beta}^i_d$		$\Delta\hat{\rho}^i_d$		$\Delta\hat{\beta}^i_d$		$\Delta\hat{\rho}^i_d$	
Δ log(bvol)	−3.945		−0.059		−3.874		(−0.06)	
	(−4.15)		(−4.50)		(−4.64)		−4.64	
Δ log (svol)	3.517		0.001		3.914		0.007	
	(4.30)		(0.08)		(5.12)		(0.39)	
Δ log (bvol/svol)		−4.707		−0.042		−3.886		−0.044
		(−5.47)		(−3.83)		(−5.42)		(−4.03)
FE Country	Y	Y	Y	Y	Y	Y	Y	Y
FE Time	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.193	0.198	0.228	0.227	0.205	0.205	0.231	0.229

Table VIII
Portfolio sorts on alternative variables

This table summarizes the leading month country stock returns (in USD and local currency), risk-adjusted returns of GCAPM, and currency returns of portfolios formed by sorting countries by the CDS beta (Panel A) and the risk-free yield beta (Panel B). The risk-free yield is defined as the difference between nominal yields and the CDS spread. The risk-free yield beta is the regression slope where the risk-free yield changes are regressed on stock returns. The estimates are obtained from monthly data using a 36-month rolling window or weekly data using a 12-month rolling window. Average returns and Newey-West t-statistics are reported.

Panel A. Sorted by local/global yield correlation

	Port 1	Port 2	Port 3	Port 4	Port 5	H –L
Monthly estimate						
Returns	0.74	0.57	0.55	0.28	0.35	−0.38∗
in USD	(1.93)	(1.51)	(1.48)	(0.73)	(0.88)	(−1.72)
GCAPM	0.84	0.46	0.24	−0.10	−0.10	−0.89∗∗∗
	(4.18)	(2.56)	(2.30)	(−0.88)	(−0.84)	(−4.43)
Returns	0.86	0.60	0.53	0.27	0.33	−0.51∗∗
in local $	(2.67)	(1.99)	(1.85)	(0.84)	(1.01)	(−2.50)
Currency	−0.12	−0.02	0.02	0.02	0.02	0.14
returns	(−1.18)	(−0.19)	(0.14)	(0.09)	(0.13)	(1.12)
Weekly estimate						
Returns	0.79	0.69	0.37	0.36	0.39	−0.40∗
in USD	(1.98)	(1.83)	(1.05)	(0.92)	(0.99)	(−1.69)
GCAPM	0.96	0.50	0.08	−0.05	−0.12	−1.08∗∗∗
	(3.48)	(3.42)	(0.80)	(−0.50)	(−1.06)	(−4.20)
Returns	0.91	0.75	0.39	0.34	0.31	−0.61∗∗
in local $	(2.84)	(2.41)	(1.45)	(1.11)	(0.91)	(−2.59)
Currency	−0.14	−0.05	−0.03	0.01	0.09	0.23∗
returns	(−1.39)	(−0.36)	(−0.22)	(0.07)	(0.54)	(1.70)

Panel B. Sorted by bond/stock volatility ratio

	Port 1	Port 2	Port 3	Port 4	Port 5	H –L
Monthly estimate						
Returns	0.27	0.33	0.61	0.68	0.64	0.37∗
in USD	(0.62)	(0.81)	(1.71)	(1.97)	(1.72)	(1.69)
GCAPM	0.00	−0.07	0.17	0.35	0.87	0.87∗∗∗
	(−0.01)	(−0.59)	(1.81)	(2.89)	(4.26)	(4.76)
Returns	0.23	0.35	0.62	0.63	0.77	0.54∗∗
in local $	(0.59)	(1.09)	(2.30)	(2.33)	(2.61)	(2.36)
Currency	0.04	−0.02	−0.01	0.05	−0.13	−0.17
returns	(0.31)	(−0.15)	(−0.07)	(0.45)	(−1.13)	(−1.58)
Daily estimate						
Returns	0.37	0.41	0.48	0.61	0.71	0.35
in USD	(0.84)	(1.06)	(1.33)	(1.79)	(1.89)	(1.50)
GCAPM	−0.01	0.00	0.27	0.25	0.84	0.86∗∗∗
	(−0.07)	(0.01)	(2.51)	(2.17)	(3.93)	(4.58)
Returns	0.34	0.40	0.58	0.56	0.81	0.47∗∗
in local $	(0.84)	(1.25)	(2.09)	(2.13)	(2.76)	(1.99)
Currency	0.03	0.01	−0.10	0.05	−0.09	−0.12
returns	(0.24)	(0.06)	(−0.69)	(0.39)	(−0.79)	(−1.14)

Panel C. Sorted by local/global variance correlation

	Port 1	Port 2	Port 3	Port 4	Port 5	H –L
Returns	0.84	0.17	−0.07	0.13	−0.03	−0.87∗∗∗
in USD	(1.91)	(0.44)	(−0.18)	(0.34)	(−0.08)	(−3.16)
GCAPM	0.45	−0.12	−0.04	−0.27	−0.41	−0.85∗∗∗
	(2.08)	(−0.80)	(−0.24)	(−2.38)	(−3.07)	(−3.57)
Returns	0.80	0.15	−0.03	0.11	−0.09	−0.87∗∗∗
in local $	(2.13)	(0.47)	(−0.09)	(0.33)	(−0.26)	(−3.32)
Currency	0.02	0.03	−0.03	−0.01	0.07	0.04
returns	(0.18)	(0.33)	(−0.25)	(−0.05)	(0.46)	(0.25)

Table IX
Does sovereign default risk explain the results?

This table summarizes the predictive country index stock returns (in USD/local currency), the excess returns of the global CAPM, and currency returns sorted by the CDS beta (Panel A) and the risk-free yield beta (Panel B). The risk-free yield is defined as the difference between nominal yields and the CDS spread. The risk-free bond yield beta is the slope of the country's stock returns regressed on changes in the risk-free yield. The estimates are obtained from monthly data using a 36-month rolling window or weekly data using a 12-month rolling window. One-month predictive returns are evaluated after forming the portfolio and Newey-West t-statistics are reported.

Panel A. Sorted by CDS beta

	Port 1	Port 2	Port 3	Port 4	Port 5	H –L
Weekly Estimate						
Returns	0.38	0.48	0.55	0.49	0.58	0.20
in USD	(0.90)	(1.00)	(1.47)	(1.08)	(1.31)	(1.03)
GCAPM	−0.10	0.12	0.41	0.12	0.08	0.18
	(−0.73)	(0.86)	(3.02)	(0.85)	(0.66)	(1.12)
Returns	0.48	0.54	0.59	0.55	0.59	0.12
in local $	(1.43)	(1.43)	(1.97)	(1.61)	(1.69)	(0.63)
Currency	−0.10	−0.06	−0.04	−0.07	−0.01	0.09
returns	(−0.62)	(−0.42)	(−0.33)	(−0.44)	(−0.08)	(1.14)
Monthly Estimate						
Returns	0.51	0.11	0.62	0.62	0.68	0.17
in USD	(1.16)	(0.24)	(1.73)	(1.40)	(1.49)	(0.91)
GCAPM	−0.04	−0.37	0.45	0.44	0.26	0.30**
	(−0.29)	(−2.63)	(3.52)	(3.22)	(2.32)	(2.16)
Returns	0.63	0.12	0.65	0.77	0.66	0.02
in local $	(1.80)	(0.31)	(2.28)	(2.33)	(1.93)	(0.13)
Currency	−0.12	−0.01	−0.03	−0.14	0.02	0.14
returns	(−0.80)	(−0.07)	(−0.22)	(−0.92)	(0.14)	(1.57)

Panel B. Sorted by risk-free yield beta

	Port 1	Port 2	Port 3	Port 4	Port 5	H –L
Weekly Estimate						
Returns	0.75	0.55	0.49	0.50	0.33	−0.42**
in USD	(1.88)	(1.47)	(1.28)	(1.31)	(0.88)	(−2.04)
GCAPM	0.57	0.24	0.35	0.31	−0.03	−0.60***
	(2.97)	(1.72)	(2.54)	(1.81)	(−0.26)	(−3.16)
Returns	0.89	0.60	0.59	0.41	0.27	−0.62***
in local $	(2.88)	(1.99)	(1.91)	(1.29)	(0.86)	(−3.05)
Currency	−0.14	−0.05	−0.09	0.09	0.06	0.19**
returns	(−0.96)	(−0.36)	(−0.73)	(0.64)	(0.42)	(2.04)
Monthly Estimate						
Returns	0.62	0.59	0.74	0.38	0.23	−0.39*
in USD	(1.59)	(1.48)	(2.11)	(0.99)	(0.59)	(−1.66)
GCAPM	0.59	0.23	0.26	0.28	0.03	−0.56***
	(2.91)	(1.63)	(2.15)	(2.11)	(0.18)	(−2.77)
Returns	0.82	0.55	0.68	0.48	0.14	−0.67***
in local $	(2.70)	(1.74)	(2.36)	(1.56)	(0.42)	(−2.85)
Currency	−0.20	0.03	0.05	−0.09	0.09	0.29**
returns	(−1.41)	(0.24)	(0.43)	(−0.67)	(0.66)	(2.56)

A. Technical Appendix

1. Price-dividend ratio

In the main text, I follow Bansal and Yaron (2004) and conjecture that both the local and global wealth-consumption ratios ($z_t^{i/*}$) are linear functions of their long-run expected growth rate $x_t^{i/*}$ and the local volatility process $v_t^{i/*}$. As local parameters are exactly the same as the global variables, I omit the superscripts. The solution for A_x exactly follows Bansal and Yaron (2004). The coefficient on the variance process can be derived as in Jones and Pyun (2021). The price of each risk factor is derived as

$$m_{t+1} - E_t[m_{t+1}] = \lambda_c \sqrt{v_t} \epsilon_{c,t+1} + \lambda_x \sqrt{v_t} \epsilon_{x,t+1} + \lambda_v \sqrt{v_t} \epsilon_{v,t+1},$$

where $\lambda_c = \gamma$, $\lambda_x = (\theta - 1)\kappa_1 A_x \sigma_x$, $\lambda_v = (\theta - 1)\kappa_1 A_v \sigma_v$, and the superscripts are omitted.

Local and global yields can be derived as

$$-\mathrm{E}_t[m_{t+1}] - 0.5\mathrm{Var}_t[m_{t+1}],$$

where again the superscripts are omitted as parameter for each country is identical. Bond yields can be represented as: $y_t^i = Y_0 + Y_x x_t^i + Y_v v_t^i$, where

$$\begin{aligned} Y_x =& \frac{1}{\psi} \\ Y_v =& (1-\theta)A_v(\kappa_1 v_1 - 1) - 0.5\left(\lambda_c^2 + \lambda_x^2 + \lambda_v^2\right) \\ Y_0 =& -\theta \log \beta + \gamma\mu - (\theta - 1)(\kappa_0 + (\kappa_1 - 1)A_0 + \kappa_1 A_v v_0). \end{aligned}$$

It is straightforward to show that Y_v is always negative.

Similar to other studies in LRR, as suggested in the main text, the price-dividend ratio ($z_{m,t}^i$) is conjectured to be a linear function of the local and global state variables: $z_{m,t}^i = B_0 + B_{xl} x_t^i + B_{xg} x_t^* + B_{vl} v_t^i + B_{vg} v_t^* + B_\delta \delta_t^i$. The solutions for the coefficients can be solved using the Euler equation

$$\mathrm{E}_t[m_{t+1}^i + R_{m,t+1}^i] + 0.5\mathrm{Var}_t[m_{t+1}^i + R_{m,t+1}^i] = 0,$$

Plugging in the formula for the Campell-Shiller decomposition and the dividend process of the main text, one can collect the terms associated with x_t^i, x_t^*, v_t^i, v_t^*, and δ_t^i to solve for the coefficients.

Collecting terms associated with v_t^i and setting them to 0, B_{vl} will solve the quadratic equation

$$
\begin{aligned}
&(\kappa_{m,1}B_{vl}\sigma_v)^2 + 2\left(\kappa_{m,1}v_1 - 1 + \lambda_v\kappa_1\sigma_v\right)B_{vl} \\
&+ \sigma_d^2 + \left(\sigma_{cd}(1-\pi) + \lambda_c\right)^2 + \left(\sigma_{cd}(1-\pi) + \lambda_c\right)\pi\sigma_c d\rho_c + \left(\lambda_x + \kappa_{m,1}B_{xl}\sigma_x\right)^2 + \lambda_v^2 + 2(\kappa_{m,1}v_1 - 1)A_v(\theta - 1) = 0.
\end{aligned}
$$

Similarly, collecting terms associated with v_t^* and setting them to 0, B_{vg} solves

$$
(\kappa_{m,1}B_{vg}\sigma_v)^2 + 2\left(\kappa_{m,1}v_1 - 1\right)B_{vg} + \left(\kappa_{m,1}B_{xg}\sigma_x\right)^2 = 0.
$$

Finally, for B_δ obtain by collecting terms associated with δ_0 to get

$$
B_\delta = \frac{1}{1-\kappa_{m,1}\delta_1}\left[(\lambda_x + \kappa_{m,1}B_{xl}\sigma_x)(\kappa_{m,1}B_{xg}\sigma_x) + (\lambda_c + (1-\pi)\sigma_{cd})\pi\sigma_{cd}\rho_c + (\lambda_v + \kappa_{m,1}B_{vl}\sigma_v)(\kappa_{m,1}B_{vg}\sigma_v)\rho_v\right].
$$

2. SB relationship

To compute the covariance between stock returns and changes in bond yields, I first compute the unexpected changes in bond yields.

$$
y_{t+1}^i - E_t[y_{t+1}^i] = Y_x\sigma_x\sqrt{v_t^i}\epsilon_{x,t+1}^i + Y_v^i\sqrt{v_t^i}\sigma_v\epsilon_{v,t+1}^i,
$$

and the unexpected stock returns is

$$
\begin{aligned}
R_{m,t+1}^i - E_t[R_{m,t+1}^i] =& \sigma_d\sqrt{v_t^i}\epsilon_{d,t+1}^i + \sigma_{cd}\sqrt{v_t^i}\left(\pi\epsilon_{c,t+1}^* + (1-\pi)\epsilon_{c,t+1}^i\right) \\
&+ \kappa_1 B_{xl}\sigma_x\sqrt{v_t^i}\epsilon_{x,t+1}^i + \kappa_1 B_{xg}\sigma_x\sqrt{v_t^*}\epsilon_{x,t+1}^* + \kappa_1 B_{vl}\sigma_v\sqrt{v_t^i} + \kappa_1 B_{vg}\sigma_v\sqrt{v_t^*}\epsilon_{v,t+1}^*
\end{aligned}
$$

Obtaining the covariance matrix of bond yields and stock returns is also straightforward.The conditional variance of stock returns is

$$
\begin{aligned}
&Var_t[R_{m,t+1}] = \left[\sigma_d^2 + \sigma_{cd}^2 + 2\pi(1-\pi)\rho_c + (\kappa_1 B_{xl}\sigma_x)^2 \right. \\
&+ \left[(\kappa_1 B_{xg}\sigma_x)^2 + (\kappa_1 B_{vg}\sigma_v)^2\right]v_t^* + \left[(\kappa_1 B_{xg}\sigma_x)(\kappa_1 B_{xl}\sigma_x) + (\kappa_1 B_{vl}\sigma_v) + (\kappa_1 B_{vg}\sigma_v)\rho_v\right]\delta_t,
\end{aligned}
$$

and the conditional variance of bond yields is $\left[(Y_x\sigma_x)^2 + (Y_v\sigma_v)^2\right]v_t^i$. Finally, the stock return - bond yield covariance is

$$
SBCov = \left[Y_x\kappa_1 B_{xl}\sigma_x^2 + Y_v\kappa_1 B_{vl}\sigma_v^2\right]v_t^i + \left[Y_x\kappa_1 B_{xg}\sigma_x^2 + Y_v\kappa_1 B_{vg}\sigma_v^2\rho_v\right]\delta_t^i.
$$

The bond yield beta is computed by dividing the covariance with yield variance, and the correlation is calculated by dividing by the standard deviations of yield and return shocks.

3. The stock risk premium in global currency

For the international investor, the return of a stock investment is the sum of the currency returns and stock returns in local currency. This is represented by

$$\frac{Q^i_{t+1}}{Q^i_t}\tilde{R}^i_{m,t+1},$$

where $\tilde{R}^i$ is the simple return of country i. Assuming returns are log normally distributed, the excess returns of investing in country i for the global investor is

$$\log E_t[\frac{Q^i_{t+1}}{Q^i_t}\tilde{R}^i_{m,t+1}] - y^*_t = E_t[\Delta q^i_{t+1} + R^i_{m,t+1}] + 0.5Var_t[\Delta q^i_{t+1} + R^i_{m,t+1}] + E[m^*_{t+1}] + 0.5Var[m^*t+1].$$

The Euler equation for the global investor is

$$E_t[m^*_{t+1} + \Delta q^i_{t+1} + R^i_{m,t+1}] + 0.5Var_t[m^*_{t+1} + \Delta q^i_{t+1} + R^i_{m,t+1}] = 0$$

Since $\Delta q_{t+1} = m_{t+1} - m^*_{t+1}$, the Euler equation becomes

$$E_t[m^*_{t+1} + m_{t+1} - m^*_{t+1} + R^i_{m,t+1}] + 0.5Var_t[m^*_{t+1} + m_{t+1} - m^*_{t+1} + R^i_{m,t+1}] = 0.$$

Decomposing the expectation and the variance term,

$$Cov_t(-m^*_{t+1}, m_{t+1} - m^*_{t+1} + R^i_{m,t+1}) = E_t[m_{t+1} - m^*_{t+1} + R^i_{m,t+1}] + 0.5Var_t[m_{t+1} - m^*_{t+1} + R^i_{m,t+1}] - y^*_t,$$

which suggests that the left-hand sides is exactly the log expected excess returns of the global investor.

The risk premium for the global investor can further be solved as:

$$\begin{aligned} Cov_t(-m^*_{t+1}, m_{t+1} - m^*_{t+1} + R^i_{m,t+1}) = {} & -\lambda_c\sqrt{v^*_t}\left(-\lambda_c\sqrt{v^*_t} + (\pi + (1-\pi)\rho_c)\sigma_{cd}\sqrt{v^i_t} + \rho_c\lambda_c\sqrt{v^i_t}\right) \\ & - \lambda_x\sqrt{v^*_t}\left(\kappa_1 B_{xl}\sigma_x\sqrt{v^i_t}\epsilon^i_{x,t+1}\rho_t + \kappa_1 B_{xg}\sigma_x\sqrt{v^*_t}\epsilon^*_{x,t+1} - \lambda_x(\sqrt{v^*_t} - \rho_t\sqrt{v^i_t})\right) \\ & - \lambda_v\sqrt{v^*_t}\left(\kappa_1 B_{vl}\sigma_v\sqrt{v^i_t}\epsilon^i_{v,t+1}\rho_t\rho_v + \kappa_1 B_{vg}\sigma_v\sqrt{v^*_t}\epsilon^*_{v,t+1} - \lambda_v(\sqrt{v^*_t} - \rho_t\rho_v\sqrt{v^i_t})\right). \end{aligned}$$