Market Volatility Risk and Stock Returns around the World: Implication for Multinational Corporations*

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Abstract

We investigate the pricing of market volatility risk as a risk factor – the innovation risk and as a characteristic risk – the level risk. We find that the pricing of the country-level (local) market volatility risk factor is not robust across 21 developed markets and that the global market volatility risk factor prices 21 developed market portfolios after controlling for global market, value, and size factors. Capturing various market information, idiosyncratic market volatility as a country-specific characteristic risk dominates global market, value, size, and market volatility risk factors in predicting returns of market portfolios. Countries with higher investor protection and accounting standards have higher country-specific market volatility. Market volatility is higher in these countries because corporate managers take higher risks on innovative projects that benefit economic growth.

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Abstract

We investigate the pricing of market volatility risk as a risk factor – the innovation risk and as a characteristic risk – the level risk. We find that the pricing of the country-level (local) market volatility risk factor is not robust and that the global market volatility risk factor prices 21 developed market portfolios after controlling for global market, value, and size factors. Capturing various market information, idiosyncratic market volatility as a country-specific characteristic risk dominates global market, value, size, and market volatility risk factors in predicting returns of market portfolios. Countries with higher investor protection and accounting standards have higher country-specific market volatility. Market volatility is higher in these countries because corporate managers take higher risks on innovative projects that benefit economic growth.

JEL Classification: G11, G12, G15

Keywords: Market volatility risk, global volatility risk, total market volatility, idiosyncratic market volatility, cost of capital

1. Introduction

Corporate investment is the driving force of a country's economic development and growth. In the meantime, the cost of capital is crucial for corporations around the world to make their investment decisions. Therefore, it is very important for corporations and investors to know the determinants of the cost of capital or the expected return in a country, in the context of the capital asset pricing model (CAPM) of Sharpe (1964) or the intertemporal CAPM (ICAPM) of Merton (1973). This is especially the case for multinational corporations and global investors. Global investors are concerned whether the level risk of market volatility or the innovation risk of market volatility is important for stock returns (corporate-level cost of capital) and for market portfolio returns (country-level cost of capital). In this paper, we focus on how a market portfolio's volatility affects its expected returns across 21 developed countries in a global setting.

Seeking potentially higher returns and diversification across the globe is becoming increasingly popular among investors, as documented by de Santis and Gerrard (1997). Global investors' investment in global index funds and exchange-traded funds (ETFs) has rapidly increased in the past two decades. Global index funds are mutual funds that track a particular global index, such as country funds, emerging market funds, European funds, international funds, etc. ETFs are traded on a stock exchange and track a particular country's market portfolio, or a cluster of stocks or a specific industry portfolio that can be either country-specific or global.

Ang, Hodrick, Xing, and Zhang (2006) and Adrian and Rosenberg (2008) show that the market volatility risk factor is a systematic pricing factor in addition to market, value, size, and momentum factors in the U.S. market. Ang et al. (2006) construct their market volatility risk factor as the tradable portfolio that mimics the innovation in market volatility (i.e., the change in the aggregate market portfolio's return volatility) in the U.S. The negative pricing of the market volatility risk factor documented by Ang et al. (2006) and Adrian and Rosenberg (2008) is consistent with Merton's (1973) ICAPM because this market volatility risk factor represents investment opportunities. As Campbell (1993; 1996) and Chen (2003) have shown, investors want to hedge against the innovation in market volatility since an increase in market volatility indicates shrinking investment opportunities. As a result, global investors and multinational corporations are eager to know (1) whether the local market volatility risk factor – a local market volatility innovation risk is a systematic pricing factor for stocks within each of the developed countries and (2) whether the global market volatility risk factor – a global market volatility innovation risk is a systematic pricing factor for locally diversified market portfolios. Our paper addresses these issues at both the individual stock and market portfolio levels within and across 21 developed countries.

Ang, Hodrick, Xing, and Zhang (2006, 2009) also show that higher idiosyncratic stock volatility is associated with lower expected returns on individual stocks in each of the G7 countries and in European and Asian economies. Research by Ang et al. (2006, 2009) suggests that companies with lower volatility will have a higher expected return, which appears to be inconsistent with Merton's (1987) incomplete information CAPM.[1] The model argues that investors should be compensated with higher returns with higher idiosyncratic volatility. In contrast, Bali and Cakici (2010) find that a high total or idiosyncratic volatility of a market portfolio is associated with a higher expected return for 37 market portfolios consisted of 21 developed markets and 16 emerging markets. Their findings are consistent with the global version of the incomplete information CAPM of Merton (1987). However, it is unclear whether Bali and Cakici's (2010) results are driven by the exposure of a market portfolio to the global market volatility risk factor because this global risk factor demands a negative pricing premium if Ang et

[1] These results also contradict Barberis and Huang's (2001) behavioral model, which predicts that individual stocks with higher idiosyncratic volatility should have higher expected returns.

al.'s (2006) results carry over to the market portfolio level.[2] If Bali and Cakici's (2010) findings are robust after controlling for the global market volatility risk factor, we can infer that countries with higher country-specific market volatility will have fewer investment opportunities for multinational corporations and global investors. The reason is that the higher countrywide cost of capital will lead to fewer projects with positive net present value (NPV) available to corporations in these countries.

It is also critical for global investors and multinational corporations to know how a market portfolio's volatility, as a country characteristic – the level risk, competes with global risk factors including the global volatility innovation risk, in predicting the future return of market portfolios. In other words, are betas of global systematic risk factors more important than country-specific market volatility – the level risk in predicting the expected returns of market portfolios? Do market volatility level risk still demand a positive pricing premium after controlling for global risk factors? If so, what are the economic forces and rationale behind this asset pricing phenomenon? The second task of this paper addresses these global asset pricing issues, and international business and international financial management issues.

Liang and Wei (2012) find that the country-level corporate governance has a significant relation with the countrywide market-liquidity risk premium. In particular, they find that countries with more effective corporate boards and less insider trading activities have lower market-liquidity risk premiums because these countries have lower monitoring risk and lower regulation risk. Therefore, if market volatility drives the expected returns of market portfolios, global investors and multinational corporations would also eager to know whether country-level corporate

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2 Ang et al. (2006) also show that their findings in the U.S. are not caused by a stock's exposure to the market volatility factor and that analyst coverage, institutional ownership, and skewness of stock returns do not explain this puzzling phenomenon. Guo and Savickas (2008) also find that the average idiosyncratic stock volatility can predict stock market returns in G7 countries. Carroll and Wei (1988) and Fu (2008) also find that stock returns correlate positively with idiosyncratic risk. In addition, Huang, Liu, Ghon, and Zhang (2010) find that the negative relation between a stock's idiosyncratic volatility and its returns disappears after controlling stock return reversal.

governance is associated with country-level market portfolios' volatility. Our third task addresses this international business issue by investigating how market portfolio's volatility is associated with country-level corporate governance measures, including earning management, accounting standard, anti-director, corporate board, and insider-trading indexes.

We construct two volatility measures from (1) daily returns of the past month and (2) monthly returns of the past three years.[3] We also employ Fama and MacBeth's (1973) regressions to test the same hypothesis as Ang et al. (2006). Moreover, we incorporate additional local and global market volatility risk factors across stocks and market portfolios. First, we find that the pricing of local market volatility risk factor – the innovation risk is not robust because the pricing premium of a country changes from significance to insignificance when we use different representative testing portfolios. These portfolios are constructed based on different betas of stocks to the local market volatility risk factor.

Second, we find that the global market volatility factor systematically and negatively prices locally diversified market portfolios after controlling for Fama and French's global three factors. Our results suggest that global investors should be concerned about global market volatility risk when they invest in a country portfolio. The same is true for multinational corporations when they invest in their projects in a country. This finding also suggests that if a country's market portfolio has a higher global volatility risk beta, this country has a lower countrywide expected return and cost of capital. This implies that ceteris paribus multinational corporations may consider locating their new projects in a country with its market portfolio having a higher global volatility risk beta.[4] We further interpret our results that the global stock market has become more integrated than the sample period in Bekaert and Harvey (1995) because the pricing of the local market volatility risk

[3] The first measure is the same as in Ang et al. (2006) and the second measure is the same in Carrol and Wei (1988).
[4] In this case, the corporations' prime objective is to reduce the cost of capital of their investment projects.

factor is not robust across 21 developed markets while the global market volatility risk factor demands a significant pricing premium across 21 market portfolios.[5]

Third, we find that the idiosyncratic volatility of market portfolios estimated from daily returns dominates the sensitivity of these portfolios to Fama and French's global three factors and prevails over the global market volatility risk factor in driving the expected returns of market portfolios. In addition, the sensitivities of market portfolios to Fama and French's global three factors and the global market volatility risk factor are not important. The results are similar when we estimate market volatility in the local currency. Our findings suggest that the country-specific idiosyncratic volatility of a market portfolio – the level risk is the most important country-specific risk characteristic in predicting the expected returns of market portfolios. This result implies that ceteris paribus multinational corporations may consider investing their projects in a country with low idiosyncratic market volatility.[6]

Forth, we find that countries with higher accounting standards and stronger anti-director rights have higher idiosyncratic market volatility constructed from daily returns. This result seems to be inconsistent with the traditional view in finance. However, it is consistent with a new view proposed by Bartram, Brown, and Stulz (2012): the so-called good volatility hypothesis. They argue that volatility can be good or bad and that the volatility of firms in the U.S. is higher mainly because they increase patents, R&Ds, financial market development, and investor protection. In other words, good volatility is associated with risky but also with innovative investments and economic growth. Therefore, a U.S. multinational corporation may want to invest its new project in a country with good corporate governance although high market volatility, since this good institution environment encourages managers to take on risky but more innovative projects that

[5] The study on how the world market is integrated or segmented is out of the scope of this paper.
[6] The corporations' prime objective is also to lower the cost of capital of their projects.

generate high expected returns, which in turn benefit shareholders. The economic reason is that the level of market volatility captures and reflects the quality of the corporate governance in a country. A country's good accounting standard helps multinational corporations to have better transparence and better management flow so that they can take on more rewarding projects with higher risk. This economic rationale also applies to the high standard of anti-director index because corporations with the higher independence and better governed corporate board can take on more innovative projects with higher risk. The cost of information flow is lower because the effectiveness of the management decisions' executions is higher in the countries with higher corporate governance standards. Therefore, the good corporate governance of a country encourages managers of corporations to take on more innovative projects with higher risk. Their risk-taking management style in these countries are beneficial not only for shareholders by earning higher expected returns on investments but also for society by generating higher economic growth. As a result, our international evidence is consistent with and supports the good volatility argument suggested by Bartram, Brown, and Stulz (2012).

Our study enriches the limited international literature on the cross-sectional relation between market volatility and the expected return of market portfolio across 21 developed countries at the global level and the pricing of the local or global market volatility risk factor across stocks and market portfolios. Our results suggest that international investors and multinational corporations ought to be aware of that the global market volatility risk factor is a global asset-pricing factor across 21 developed markets. In addition, idiosyncratic volatility of market portfolios dominates Fama and French's global three factors and the global market volatility risk factor in predicting the expected returns of market portfolios. We contribute to the literature by investigation on why the level of market volatility demand a positive and significant pricing premium across 21 developed markets. It is because the level of market volatility captures the bright side of volatility termed by Bartram et al. (2012). Our results and analysis show that investing in countries with good market volatility can be rewarding, not only for global investors but also for multinational corporations.[7] Our results also have important implications not only for global investors but also for corporations in general and multinational corporations in particular. Our results show that corporations located in countries with higher market volatility have a higher market-level expected return and cost of capital. In addition, high market volatility is associated with high accounting standards and strong investor protection. The positive relation between market volatility and the expected return of market portfolios across developed countries reflects that corporations located in countries having higher market volatility (also better corporate governance) invest in risky but more innovative projects (e.g., Aghion, Reenen, and Zingales (2013)), which generate higher investment returns and in turn higher economic growth. In other words, market volatility in these countries is good volatility as argued by Bartram et al. (2012).

2. Theoretical motivation

In this section, we theoretically argue that if the innovation in market volatility (change in market portfolio's volatility) affects investment opportunities in each country, this market-wide risk factor prices stock returns according to Merton's (1973) ICAPM. This theoretical argument also applies to the innovation in global market portfolio's volatility. According to Merton's (1987) incomplete information CAPM, international investors are compensated with higher returns for taking on higher idiosyncratic market volatility of a country. Global investors ought to understand which economic force, either a global market risk factor or local country-specific market volatility, drives the expected return of a market portfolio.

[7] These empirical tests and results are distinct from those of Bali and Cakici (2010) who investigate whether idiosyncratic market volatility, as a country-specific risk, predicts the expected return of a market portfolio after only controlling for a market portfolio's global market beta.

2.1. *The pricing of market volatility risk factor*

Merton's (1973) ICAPM predicts that any factor affecting investment opportunities should demand a pricing premium. Campbell (1993; 1996) shows that investors are concerned about changes in the forecasts of a country's future market return in addition to its market risk. Chen (2003) extends the Campbell model to accommodate time-varying covariance and stochastic market volatility in a specific country. He shows that assets should have lower expected returns when they have higher covariance with a variable that predicts market volatility. Both Chen and Campbell argue that investors would want to hedge against market volatility. In addition, Bakshi and Kapadia (2003) discover that stocks with a high sensitivity to the market volatility risk factor in a country provide a hedge against market downside risk. These empirical findings suggest that an increase in market volatility in a country reflects shrinking investment opportunities. Thus, the change in market volatility (market volatility innovation) gives rise to fewer investment opportunities in Merton's (1973) ICAPM framework that predicts that the innovation in the volatility of a market portfolio as a risk factor should have a negative pricing premium. Bates (2001) provides a structural model showing that market volatility risk factor has a negative risk premium in a reduced-form factor structure.

2.2. *A Country's Market Volatility as a Risk Factor or Country-Specific Characteristic Risk?*

According to Merton's (1987) incomplete information CAPM, which is supported by Bali and Cakici's (2010) empirical findings, international investors are compensated with higher returns for exposing themselves to higher idiosyncratic market volatility in a specific country. Ang et al. (2006; 2009) find that individual stocks with high idiosyncratic volatility have low expected returns in the U.S., G7 countries, and European and Asian economies. Their findings appear to be in line with Miller's (1977) analysis of stock performance when opinions differ under short-sale constraints. However, short sales were not commonly restricted in most of the developed countries in the past 40 years. Ang et al.'s (2006; 2009) findings are inconsistent with existing asset pricing theories and Merton's (1987) incomplete information CAPM.

We restate Merton's (1987) incomplete information CAPM and its implication for the relation between idiosyncratic volatility and expected returns at the stock level. This model shows that expected stock returns are positively related to idiosyncratic risk, reflecting incomplete information as follows,

$$E(R_j) = \beta_j^m E(MKTX) + \delta w_j \sigma_j^2 / q_j , \quad (1)$$

where E is the expectation operator and $E(R_i)$ and $E(MKTX)$ are expected excess returns (i.e., raw returns minus the risk-free rate) on stock j and the market portfolio respectively; δ is the investor risk aversion parameter; w_i is the weight of stock j in a market portfolio; q_j is the fraction of investors who have complete information about the stock; σ_j^2 is the residual variance of the idiosyncratic component ($\varepsilon_{j,t}$) of asset returns; and β_j^m is the slope coefficient estimated from the following regression after adjusting for the returns on the market portfolio.

$$R_{j,\tau} = \alpha_j + \beta_j^m MKTX_\tau + \varepsilon_{j,\tau}. \quad \tau = 1,..,T \quad (2)$$

In this model, most investors are not completely informed in each month with T trading days. They spend a great deal of time, effort, and money to gain information about a particular stock. Therefore, they expect higher compensation in return. This model also suggests that if market information in a country is asymmetric between local and foreign investors, foreign investors should also be compensated for the costs incurred in obtaining information about this country's market. Therefore, Merton's (1987) incomplete information CAPM in equation (1) can be extended to a global setting to argue that a country's market portfolio with high idiosyncratic market volatility should have high expected return.

Since we expect the innovation of global market volatility to be a pricing factor for global stock markets, it is critical whether a local market portfolio's sensitivity to this global market volatility risk factor is the driving force for Bali and Cakici's (2010) empirical findings. Therefore, we investigate how the exposure of a market portfolio to this global market volatility risk factor competes with local market volatility as a country-specific characteristic risk. Global investors ought to understand which economic force, either the global volatility risk factor or local market volatility as a country-specific characteristic risk, drives stock market returns in the global setting. In addition, we examined 21 developed markets around the world to find out whether a country's market volatility dominates global market, value, size, and market volatility risk factors in driving the expected return of a country's market portfolio or vice versa.

3. Data, volatility measures and market factors

In this section, we describe the sources of our data sample covering 21 developed countries. We explain how we construct local market risk factors and global market risk factors as well as the economic portfolios for tracking the innovation of market volatility. In addition, we also discuss the two local market idiosyncratic volatility measures we construct from daily and monthly returns.

3.1. Data description

We select 21 countries that are classified as developed by both the International Monetary Fund (IMF) and the International Financial Corporation (IFC) of the World Bank Group. These countries constitute the Morgan Stanley Capital International (MSCI) world index and cover the majority of the world market in terms of market value. These countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Italy, Ireland, Japan, the Netherlands, New Zealand, Norway, Singapore, Spain, Sweden, Switzerland, the U.K., and the U.S. Their daily total market return indices, market capitalization (firm size), and exchange rates were retrieved from Datastream for the period January 1975 to December 2010.

We also retrieve monthly returns and market capitalization of all traded stocks in these countries to construct the global value factor in each year. From Datastream we obtain monthly stock returns, market capitalization and exchange rate in the period of analysis for all markets except the U.S. We obtain data for the U.S. market from the Center for Research in Security Prices (CRSP) for the same period. If there is zero trading volume for a stock in a particular month, we delete this stock from our sample for that month. We then convert returns on a stock or a market portfolio and the stock's market capitalization into U.S. dollars. We use the yield on one-month U.S. Treasury bills in U.S. dollars as the risk-free rate when constructing excess returns on both stocks and market portfolios of countries. We also download daily total market return index and daily exchange rate for each country from Datastream and compute the total daily and monthly returns of each market which include dividends and are value-weighted returns.

As reported in Table 1, we find that Hong Kong's stock market gives the highest average monthly return and Italian is the second highest. The U.S. market is the largest and accounts for about one-third of the observations in our sample in December 2010. Japan's is the second largest market in terms of the number of stocks and market capitalization. The U.K. market is worth close to three trillion U.S. dollars and had over 1,600 stocks in December 2010. Australia, Canada, Germany, France, Hong Kong, and Switzerland all have total market capitalizations of over one trillion U.S. dollars at the end of 2010. They play important roles in the global market. New

Zealand is the smallest developed market in our sample with a market capitalization of just 45 billion U.S. dollars and Ireland has only 52 traded stocks in December 2010.

[Insert Table 1 here]

3.2. Local market factors

When testing the pricing of local market volatility risk for stocks in each market, we need to construct local factors from stocks in each country. We define the local market factor (*MKTX*) as the market portfolio return minus the risk-free rate in U.S. dollars. We construct the local size factor (*SMB*) from stock returns in each country. All traded stocks within a country are first sorted into the top 30% (big), the middle 40% (medium), and the bottom 30% (small) portfolios based on their market capitalization at the end of the preceding year. The local size factor is the value-weighted return on the local small-minus-big (*SMB*) portfolio. In a similar way, the local value factor (*HML*) is constructed for each country. All stocks in a country are sorted by their book-to-market ratios at the end of the preceding year into the top 30% (high), the middle 40% (medium), and the bottom 30% (low) portfolios. The local value factor is the value-weighted return on the local high-minus-low (*HML*) portfolio.

To construct a tradable mimicking factor for the innovation of local market volatility and empirically test whether it is a systematic pricing factor for stocks in each country, we also construct eight country-level economic portfolios based on a stock's characteristics to track this market volatility risk. In this case, the tracking portfolio is a tradable asset and the mimicking factor is the local market volatility risk factor. The stock characteristics are book-to-market ratio (*BM*), earnings-to-price ratio (*EP*), cash earnings-to-price ratio (*CP*), and dividend yield (*YLD*). All stocks in each of the 21 countries are sorted based on these characteristics into the top 30% (high), the middle 40% (medium), and the bottom 30% (low) portfolios. Our eight country-level economic tracking portfolios are value-weighted portfolios consisting of stocks in the top *BM*, bottom *BM*, top *EP*, bottom *EP*, top *CP*, bottom *CP*, top *YLD* and bottom *YLD* groups. These portfolios are tradable and based on a stock's fundamental values. We can follow Lamont (2001) to track the local market volatility innovation by using an AR(1) process in equation (7) stated in later section.

3.3. Global risk factors

In our tests for the pricing of global market volatility risk factor, we control for the global market, size, and value factors. The global market factor (*MKTXG*) is the value-weighted return in U.S. dollars on all market portfolios of the 21 countries minus the risk-free rate because it contains all stocks in these 21 markets and is much bigger than the MSCI world index which contains a much less stocks than all stocks in these 21 markets. We also construct the global size factor (*SMBG*) and the global value factor (*HMLG*) using all stocks in the 21 countries. We first sort all stocks into the top one-third (big), the middle one-third (medium), and the bottom one-third (small) based on their market values at the end of the preceding month. The global size factor is the value-weighted returns on the global small-minus-big portfolio. We also construct an alternative global size factor by using 21 developed market portfolios. We sort 21 market portfolios into the bottom 30% (small), middle 40% and top 30% (large) based on each market's total capitalization (size). We then use the difference between the value-weighted returns of the small group and the large group. To construct the global value factor, we sort all stocks in our sample into the top 30% (high), the middle 40% (medium), and the bottom 30% (low) based on their book-to-market ratios at the end of the preceding year. The global value factor is the value-weighted return on the global high-minus-low portfolio.

We also construct eight global economic portfolios, based on a stock's characteristics, to mimic the innovation of global market volatility and estimate the pricing of this tradable portfolio in equation (13) and equation (18). These firm characteristics are book-to-market ratio (*BM*), earnings-to-price ratio (*EP*), cash earnings-to-price ratio (*CP*), and dividend yield (*YLD*). Based on these characteristics we sort all stocks in the 21 countries into the top 30% (high), the middle 40% (medium), and the bottom 30% (low) portfolios. The eight global economic tracking portfolios are value-weighted portfolios consisting of stocks in the top *BM*, bottom *BM*, top *EP*, bottom *EP*, top *CP*, bottom *CP*, top *YLD* and bottom *YLD* groups.

3.4. Market volatility measures

In this subsection, we describe our procedures for measuring idiosyncratic and total volatility at the stock and market portfolio levels, as well as for measuring the innovation of local and global market volatility. We also construct a second measure of idiosyncratic market volatility in the same way as Bali and Cakici (2010) to ensure that our empirical results of idiosyncratic market volatility are not an artifact of measurement.

Local total volatility of a market portfolio

We construct our local total volatility for country $i, TVOL_{i,t}$, in month t as the standard deviation of the daily return ($r_{i,t}$) on the country-specific market portfolio at month t in U.S. dollars:

$$TVOL_{i,t} = \sqrt{Var(r_{i,t})}, \tag{3}$$

where $Var(r_{i,t})$ is the variance of $r_{i,t}$. Our local total market volatility measure is the same as the volatility measure adopted by Ang et al. (2006, 2009).

Local idiosyncratic volatility of a market portfolio

We use monthly returns of a country's market portfolio in the past three years to construct our local idiosyncratic market volatility as denoted by $IVOL_{i,t}$, as the standard deviation of residuals in a *monthly* Fama and French's three-factor model. We want to keep consistence with the literature and construct this measure as same in Carrol and Wei (1988). We define local idiosyncratic market volatility ($IVol_{i,t-1} = \sqrt{Var(\varepsilon_{i,t-1})}$) in month *t*-1 on country portfolio *i* as the standard deviation of the idiosyncratic component ($\varepsilon_{i,t}$) in the following regression for the period from month *t*-36 to month *t*-1:

$$R_{i,\tau} = \alpha_{i,t-1} + \beta^{m}_{i,t-1} MKTXG_{\tau} + \beta^{h}_{i,t-1} HMLG_{\tau} + \beta^{s}_{i,t-1} SMBG_{\tau} + \varepsilon_{i,\tau}, \ \tau = t-36,..,t-1, \quad (4)$$

where $R_{i,\tau}$ is the excess return on country portfolio *i* in month τ, *MKTXG* is a global market factor that is equal to the global market return minus the U.S. T-bill rate, *HMLG* is the global value factor, and *SMBG* is the global size factor.

Alternative measure of local idiosyncratic volatility

For a robustness check in a later section, we construct our second measure of idiosyncratic market volatility as denoted by $IVOL^{II}_{i,t} = \sqrt{Var(\varepsilon_{i,t})}$ in month *t*. This measure is the standard deviation of the *daily* idiosyncratic component ($\varepsilon_{i,t}$) in month *t* from the following regression:

$$R_{i,\tau,t} = \alpha_{i,t} + \beta^{m}_{i,t-1} MKTXG_{\tau,t} + \varepsilon_{i,\tau,t}, \ \tau = 1,..,D_{t}, \quad (5)$$

where $R_{i,\tau,t}$ is the daily market portfolio excess return in country *i* on day τ in month *t*, *MKTXG* is the global market excess return, and D_t is the number of trading days in month *t*.[8] We also want to be unbiased and consistent with the literature so that we construct this measure the same as in Bali and Cakici (2010).

Statistical summary of local market volatility

We first report the time-series average total and idiosyncratic market volatilities using the daily returns on country-specific market portfolios in U.S. dollars in Table 2. We find that Finland has the highest total market volatility. The U.K. has the lowest total market volatility in U.S. dollars and in pounds sterling. Switzerland has the lowest idiosyncratic market volatility. The measure of idiosyncratic market volatility based on Fama and French's three-factor model using monthly returns also has a high correlation of 0.38 with returns on country-specific market portfolios. These simple summary statistics suggest that stock markets with higher volatilities are cross-sectionally associated with higher returns. In addition, the simple average total market volatilities in both U.S. dollars and the local currency are highly correlated (0.40 and 0.46, respectively) with monthly returns on country-specific market portfolios.

[Insert Table 2 here]

3.5. Local market volatility innovation

There are two measures of market volatility. One is the variance of market portfolio return. Another one is the standard deviation of market portfolio return. We follow Ang et al. (2006) to

[8] Ang et al. (2006, 2009) document that their stock idiosyncratic volatility adjusted daily for the Fama and French three factors has a correlation of 0.99 with the one that is also adjusted daily but for market excess returns only.

measure market volatility innovation ($\Delta VOL_{i,t}$) in country i in month t as the change in the variance of market portfolio i's daily returns in the following equation (6).

$$\Delta VOL_{i,t} = Var(r_{i,t}) - Var(r_{i,t-1}), \tag{6}$$

where $r_{i,t}$ is the country-specific market portfolio's daily returns in month t and $Var(r_{i,t})$ is the variance of $r_{i,t}$. We can also construct our second measure of local market volatility innovation ($\Delta VOL^{II}_{i,t}$) in country i in month t as the change in the standard deviation of a market portfolio's daily return in the following equation (6b).

$$\Delta VOL^{II}_{i,t} = \sqrt{Var(r_{i,t})} - \sqrt{Var(r_{i,t-1})}\ . \tag{6b}$$

3.6. Global market volatility and its innovation

We construct our daily value-weighted return of global market portfolio after converting all country-specific market returns and values into U.S. dollars. Again, there are two measures of global market volatility. The first measure is the variance of daily global market portfolio return. The second measure is the standard deviation of daily global market portfolio return. We show the second measure of global market volatility in Figure 1. We find that the highest global market volatility occurred in the financial crisis of 2008 and the second highest global market volatility was in the 1987 "Black October" crash. The events of 911, two Iraq wars, and the collapse of Long-Term Capital Management L.P. (LTCM) also created very high volatility worldwide. The world market was much more volatile in the period from the Asian financial crisis to the end of the economic recession around the early 21st century than in other periods in history except for the "Black October" period. World stock markets have also become much more sensitive to international events since globalization of the world economy in the late 1990s. We expect that global market volatility innovation will affect the expected return of market portfolio. As in equation (6), we construct the global market volatility innovation (ΔVOL_t) as the change in the variance of global market portfolio's daily returns in month *t*.

[Insert Figure 1 here]

3.7. Country-level corporate governance indices

We can infer from Tables 1 and 2 that local market volatility differs across 21 developed markets. As shown in section 6, we also find that local market volatility risk factor is a critical factor in predicting the expected return of country-specific market portfolio. This expected return is the countrywide cost of capital in CAPM and has important implications for investment evaluation and decision in 21 developed countries. We therefore investigate how country-level corporate governance mechanisms affect local market volatility and the inter-country difference in the pricing of market volatility risk factor. We examine several widely used country-level corporate governance indices.[9] Leuz et al. (2003) construct an earnings management index, which is the aggregate earnings management score in a country. A higher score indicates more earnings management activities in a country. As proxy for investor protection, we use the 2005 value of index of anti-director rights from Spamann (2010), who provides a significant revision of the data reported by La Porta et al. (1998). A higher value on this index means better shareholder protection in a country. We also use the accounting standards index from La Porta et al. (1998), who extract the annual reports of a country's companies in 1990 to construct the index. A high score of this index means high accounting quality in a country. The Institution for Management Development International (IMD) compiles the corporate board index and the insider-trading index of each country. We use the values of these indices in 2004. A higher score of the corporate board index

[9] Liang and Wei (2002) examine how these indices are related to the liquidity risk premium of a country and find that the pricing premium of a country's liquidity risk is smaller where the country-level corporate board is more effective and there is less insider trading.

means a more effective board in a country, while a higher score of the insider-trading index means less insider-trading activities in a country's market.

4. The pricing of local market volatility risk factors in 21 developed countries

In this section, we investigate whether and how both local and global market volatility risk factors are priced at both stock and market portfolio levels within and across 21 developed countries. As the market volatility innovation (change in market volatility) is not a tradable asset, we construct mimicking portfolios to track local and global market volatility innovation, and we discuss how this is done in the next section.

4.1. The mimicking factor for local market volatility innovation

Local market volatility innovation in a country is not a tradable asset. Consistent with Ang et al. (2006, 2009), we follow Breeden, Gibbsons, and Litzenberger (1989) and Lamont (2001) to use an economic tracking portfolio that mimics the local market volatility innovation stated in equation (6). We obtain the mimicking factor after controlling for local market volatility innovation in the last period as described in the following AR(1) regression (the Economic Tracking Model):

$$\Delta Vol_{i,t} = \beta_0 + \beta_F^{'} MF_{i,t} + \theta \Delta Vol_{i,t-1} + \varepsilon_{i,t}, \tag{7}$$

where MF_t is an 8×1 vector containing eight local economic tracking portfolios—the high *BM*, low *BM*, high *E/P*, low *E/P*, high *CE/P*, low *CE/P*, high *YD* and low *YD* portfolios. The portfolio weights in equation (7) do not need to sum to one according to Lamont (2001). We define this tradable portfolio (*MVol*) as the mimicking factor of local market volatility innovation in the following equation.

$$MVol_{i,t} \equiv \beta_F^{'} MF_{i,t}, \tag{8}$$

where $\beta_F^{'} MF_{i,t}$ is as stated in equation (7). This mimicking factor is our local market volatility risk factor.

4.2. The premium for local market volatility risk factor

To estimate the pricing premium of local market volatility risk factor in each country, we construct stock portfolios according to their sensitivity to local market volatility risk factor. This approach can reduce the measurement errors in individual stocks. For each country, we first sort stocks into 20 portfolios monthly based on their past volatility betas ($\beta_{i,j}^{v}$) from the following regression for the period from month *t*-60 to month *t*-1.

$$R_{i,j,\tau} = \alpha_{i,t-1} + \beta_{i,j,t-1}^{m} MKTX_{i,\tau} + \beta_{i,j,t-1}^{h} HML_{i,\tau} + \beta_{i,j,t-1}^{s} SMB_{i,\tau} + \beta_{i,j,t-1}^{v} MVol_{i,\tau} + \varepsilon_{i,j,\tau},$$

$$\tau = t-60,...,t-1, \quad (9)$$

where $R_{i,j,\tau}$ is the excess return on stock *j* in country *i* in month τ, $MKTX_{i,\tau}$ is the local market excess return, $HML_{i,\tau}$ is the local value factor, $SMB_{i,\tau}$ is the local size factor, and $MVol_{i,\tau}$ is the local market volatility risk factor. We adjust the *t*-statistics according to Newey and West (1987).

We then re-estimate the time-series betas for these 20 sorted portfolios from equation (9) by substituting stock excess returns with the 20 portfolio excess returns. We perform the following Fama and Macbeth regression on these 20 portfolios to investigate whether the mimicking factor is priced in each country. [10]

$$R_{i,j,t} = \alpha_{i,t-1} + \beta_{i,j,t-1}^{m} \lambda_{i,m,t} + \beta_{i,j,t-1}^{h} \lambda_{i,h,t} + \beta_{i,j,t-1}^{s} \lambda_{i,s,t} + \beta_{i,j,t-1}^{v} \lambda_{i,v,t} + \eta_{i,j,t}, \quad (10)$$

[10] Researchers have used this standard procedure to test whether a market factor is a systematic pricing factor for stock returns (see Fama and French (1993), Ang et al. (2006), Hou, Karolyi and Kho (2011), and Liang (2018)).

where $R_{i,j,t}$ is the excess return on stock portfolio *j* in country *i* during month *t*, $\beta^{m}_{i,j,t-1}$, $\beta^{h}_{i,j,t-1}$, $\beta^{s}_{i,j,t-1}$, and $\beta^{v}_{i,j,t-1}$ are respectively the market, value, size, and market volatility risk factors' betas for portfolio *j* in country *i* estimated from month *t*-60 to month *t*-1. $\lambda_{i,m,t}$, $\lambda_{i,h,t}$, $\lambda_{i,s,t}$, and $\lambda_{i,v,t}$ are estimated regression coefficients for the local market, value, size, and market volatility risk factors in country *i* during month *t*, respectively. We then compute the means of these time-series estimates as our estimates of factor risk premiums. We also compute the standard deviations of these time-series estimates to conduct *t* tests. As reported in Table 3, we find that local market volatility risk factor is negatively priced in Spain and the U.K.

[Insert Table 3 here]

As a robustness check, we also construct local market volatility innovation as the change in market portfolio returns' *standard deviation* described in equation (6b). We also use our eight local economic portfolios to track this new local market volatility innovation and construct a new mimicking factor using equation (7) and equation (8). As reported in Panel B of Table 3, we find that this new local market volatility risk factor is negatively priced with a pricing premium of -0.04 and a *t*-statistic -1.73 in the U.S. market.[11] We also find that this local market volatility risk factor significantly prices stock returns with a pricing premium of -0.04 with a t-statistic of -1.86 in the U.K. market. However, the pricing premium in Spain is not significant in this test.

In order to perform a thorough study, we also estimate the sensitivity of a stock or portfolio's return to the first measure of local market volatility innovation stated in equation (6) from the following regression for the period from month *t*-60 to month *t*-1:

$$R_{i,j,\tau} = \alpha_{i,t-1} + \beta^{m}_{i,j,t-1} MKTX_{i,\tau} + \beta^{v}_{1,i,j,t-1} \Delta VOL_{i,\tau} + \beta^{v}_{2,i,j,t-1} \Delta VOL_{i,\tau-1} + \varepsilon_{i,j,\tau}. \qquad (11)$$

[11] This is similar to the results in Ang et al. (2006).

We define stock *j*'s market volatility risk beta as $\beta^{v}_{i,j,t-1} = \beta^{v}_{1,i,j,t-1} + \beta^{v}_{2,i,j,t-1}$. In this way, the market volatility innovation will play a role in the asset's sensitivity. We then form 20 equally weighted stock portfolios and 20 value-weighted portfolios based on this new volatility beta ($\beta^{v}_{i,j,t-1}$).

We then repeat the same procedures and perform the Fama and MacBeth (1973) regression in equation (10) for the first mimicking factor of the first measure of local market volatility innovation stated in equation (6). As reported in Table 4, we also find that the first local market volatility risk factor is negatively priced only in Canada with a negative premium of -0.06 (t-statistic = -1.90), when we use these 20 equal-weighted stock portfolios sorted with the new beta of market volatility innovation. We also use 20 value-weighted portfolios to estimate the pricing premium of the first local market volatility risk factor. As reported in Panel B of Table 4, we find that the local market volatility risk factor significantly prices stock returns only in Australia, Belgium, and Norway but not in Canada. The pricing premium in Belgium and Norway is negative, but the pricing premium in Australia is positive. The positive premium is inconsistent with Merton's (1973) ICAPM. Furthermore, the pricing premiums in UK and Spain are not significant in these two tests.

One might interpret our results that the market volatility risk factor is significantly priced if at least one of four pricing premiums of the local market volatility risk factor is negative and significant. Then, there are six countries where at least one of these pricing premiums is significantly negative. They are Canada, Belgium, Norway, Spain, the U.K., and the U.S. However, we interpret our empirical results that the pricing of local volatility risk factor is not robust because the pricing is not consistent across different methods of estimating the betas and of constructing the testing stock portfolios. Our results suggest that it is difficult for global investors to determine the cost of capital at the corporation-level based on the local volatility risk beta for their investment projects in each of developed countries.

[Insert Table 4 here]

5. The pricing of global market volatility risk factor

5.1. Mimicking global market volatility innovation

We use our eight global economic portfolios to mimic the global market volatility innovation because the change in the global market portfolio's volatility is also not a tradable asset. These eight global economic tracking portfolios are constructed in Section 3. We obtain the factor that mimics global market volatility innovation using the following equation.

$$\Delta Vol_{i,t} = \beta_0 + \beta_F^{'} MF_{i,t} + \theta \Delta Vol_{i,t-1} + \varepsilon_{i,t} , \tag{12}$$

where MF_t is an 8×1 vector containing the eight global economic tracking portfolios—the high *BM*, low *BM*, high *E/P*, low *E/P*, high *CE/P*, low *CE/P*, high *YD* and low *YD* portfolios. The tradable portfolio (*MVol*) is the global mimicking factor that mimics global market volatility innovation stated in equation (6) in the following equation.

$$MVol_{i,t} \equiv \beta_F^{'} MF_{i,t} , \tag{13}$$

where $\beta_F^{'} MF_{i,t}$ is stated in equation (12). This mimicking factor is the global market volatility risk factor.

5.2. The pricing of global market volatility risk factor

We then test whether the global market volatility risk factor is a systematic pricing factor across the market portfolios of 21 developed countries. To estimate the pricing premium for this global market volatility risk factor, we sort country-specific market portfolios according to their sensitivity to this global market volatility risk factor. We estimate the past volatility beta (β_i^v) for country-specific market portfolio *i* from the following regression for the period from month *t*-60 to month *t*-1:

$$R_{i,\tau} = \alpha_{i,t-1} + \beta_{i,t-1}^{m} MKTXG_{\tau} + \beta_{i,t-1}^{h} HMLG_{\tau} + \beta_{i,t-1}^{s} SMBG_{\tau} + \beta_{i,t-1}^{v} MVol_{\tau} + \varepsilon_{i,\tau},$$

$$\tau = t-60,\ldots,t-1, \qquad (14)$$

where $R_{i,\tau}$ is the excess market return on country *i* in month τ , $MKTXG_{\tau}$ is the global market factor, $HMLG_{\tau}$ is the global value factor, $SMBG_{\tau}$ is the global size factor, and $MVol_{\tau}$ is the global volatility risk factor that mimics the innovation of global market volatility.

We then sort country-specific market portfolios into three groups based on their past volatility betas. Portfolio-H has the highest past volatility beta and portfolio-L has the lowest. The returns on these portfolios are equally weighted. The abnormal return on each global market volatility risk beta-sorted portfolio is the intercept estimated from the following regression:

$$R_{i,t} = \alpha_i + \beta_i^m MKTXG_t + \beta_i^h HMLG_t + \beta_i^s SMBG_t + \varepsilon_{i,t}, \quad i = 1,\ldots 3, \qquad (15)$$

where *MKTXG*, *HMLG*, and *SMBG* are as defined previously.

As reported in Table 5, these abnormal returns (i.e. *alphas*) exhibit a monotonically decreasing trend. The zero-cost hedge portfolio that longs the portfolio having the highest past market volatility betas and shorts the portfolio having the lowest past market volatility betas gives a negative abnormal return of -0.22% per month with a *t*-statistic of -1.06 according to the global two-factor model and -0.20% per month with a *t*-statistic of -0.99 according to the Fama and French's global three-factor model. The results suggest that a market portfolio with a higher exposure to global market volatility risk factor earns a lower expected return, which is consistent with the prediction from the theoretical model proposed by Merton (1973), although the return spreads are not significant.

[Insert Table 5 here]

However, these results do not tell us whether global market volatility risk factor is significantly priced. To find out, we follow Fama and Macbeth (1973) and use a two-pass regression approach. In the first pass, we estimate betas from equation (14). In the second pass, we use the following Fama and MacBeth (1973) regression to estimate the pricing premiums (i.e., λ_m, λ_h, λ_s, and λ_v) for the global market, value, size, and market volatility risk factors:

$$R_i = \alpha + \beta_i^m \lambda_m + \beta_i^h \lambda_h + \beta_i^s \lambda_s + \beta_i^v \lambda_v, \tag{16}$$

where R_i is the excess return on country-specific market portfolio *i*; β_i^m, β_i^h, β_i^s, and β_i^v are the estimated global market, value, size, and market volatility risk betas for market portfolio *i*; and λ_m, λ_h, λ_s, and λ_v are the corresponding estimated pricing premiums.

As reported in Table 6, we find that the pricing premium of the global market volatility risk factor (λ_v) is -1.30% per month, which is significant at the 10% level, with a *t*-statistic of -1.77. The result suggests that the global market volatility risk factor demands a significantly negative premium for locally diversified market portfolios. To check the robustness, we also use the global size factor constructed from the local market portfolios. As reported in Model 2, we find that the global market volatility risk factor also has a significant pricing premium of -1.42 with a *t*-statistic of -1.95.

[Insert Table 6 here]

In order to conduct a robustness test for the pricing of global market volatility risk factor, we also construct another mimicking tracking portfolio of our global market volatility innovation as follows:

$$\Delta Vol_{i,t} = \beta_0 + \beta_F^{'} MF_{i,t} + \varepsilon_{i,t}. \tag{17}$$

where the *MF* is the 8×1 vector of eight global economic tracking portfolios in 21 markets. $\Delta Vol_{i,t}$ is the global market volatility innovation that is the change in the variance of daily global market portfolio return stated in equation (6). The new tradable portfolio (*MVol*), defined as $MVol_{i,t} \equiv \beta_F^{'} MF_{i,t}$ where $\beta_F^{'} MF_{i,t}$ is stated in equation (17), is also a global market volatility risk factor that mimics our global market volatility innovation.

We then perform the same procedure as before to estimate the pricing premiums of four global risk factors. In Model 3, when we use the global size factor constructed from all stocks in these 21 developed markets, we find that the global market volatility risk factor does not have a significant pricing premium of -1.12 with t-statistic of -1.64. However, we also use the global size factor constructed from 21 market portfolios, and report the results in Model 4. The pricing premium of the global market volatility risk factor is -1.27 with t-statistic of -1.90. In sum, our tests confirm that global market volatility risk factor is a global systematic pricing factor for the expected returns of market portfolios across 21 developed markets after controlling for the Fama and French's global three factors.[12] This also suggests that if a country's market portfolio is more sensitive to the global market volatility risk factor (i.e., the beta of global market volatility risk factor), the expected return of the market portfolio or the countrywide cost of capital is lower in this country. This implies that ceteris paribus this multinational firm may consider locating their new project in a country with a market portfolio having a higher beta of the global market volatility

[12] Our result is also consistent with Bates's (2001) reduced-form factor structure model. We regress the global market portfolio return on the lagged global market volatility to check if global market volatility predicts global market portfolio return. This time-series regression has a positive intercept with t-statistic = 4.35 and a beta of the lagged global market volatility with a value -1.26 (t-statistic = -1.64). This result shows that the global market volatility does not have a strong predicting power on the global market portfolio return and does not meet the time-series restriction of a state variable in ICAPM. However, the global market volatility innovation is still a significant pricing factor across 21 market portfolios in the Arbitrage Pricing Theory (APT) framework because its cross-sectional pricing is significant in our Fama-MacBath (1973) tests. When we regress the global market portfolio return on the global market volatility, the global market volatility has a strong and negative beta with a value -5.71 and a t-statistic = -7.91.

risk factor, if the firm's only concern is to reduce the cost of capital. Furthermore, we also interpret all our empirical tests on the pricing of market volatility risk factor – innovation risk that the global stock market has become more integrated than the sample period in Bekaert and Harvey (1995). This is because the pricing of local market volatility risk factor is not robust across 21 developed markets while the global market volatility risk factor has a significant pricing premium across market portfolios.[13]

6. Market volatility – the level risk as a characteristic risk across 21 developed countries

We have shown that the exposure of the market portfolio of a country to global market volatility risk factor has a negative impact on its expected return and that the global size factor has a significantly positive pricing premium across market portfolios. Global investors are interested in how total or idiosyncratic market volatility, as a country characteristic, competes with the sensitivity of market portfolios to the global risk factors (in particular, the market volatility beta and the size beta) in explaining the cross-country differences in the expected returns of market portfolios. We employ a multiple regression approach to investigate how these two different economic forces affect the expected return of market portfolios.

6.1. Total market volatility versus the global market volatility risk factor

To achieve our objective, we perform the following Fama and Macbeth regression:

$$R_{i,t} = \lambda_0 + \sum_{k=1}^{M} \lambda_k \beta^k_{i,t-1} + \lambda_{TVol} TVol_{i,t-1} + \varepsilon_{i,t} \, , \tag{18}$$

where $\beta^k_{i,t-1}$ is the estimated beta of global factor k for country-specific market portfolio and the global factors are the global market, value, size, and market volatility risk factors. These four betas

[13] This paper will not investigate the integration and segmentation of the global stock market.

are estimated from regression (14). $TVol_{i,t-1}$ is total market volatility in country *i* in month *t*-1 in equation (3). The λs are the estimated pricing premiums.

As reported in Table 7, we find that *total market volatility* as a country characteristic significantly dominates other global risk factors (i.e., betas) in forecasting the expected return of locally diversified market portfolios. In Model 1, the mean of the estimated regression coefficient on total market volatility (i.e., λ_{TVol}) is 0.59% per month and with a *t*-statistic of 2.38. The pricing premiums of the Fama and French's global three factors are all insignificant. In Model 2 where we include the beta of global market volatility risk factor in the regression, the mean of the estimated regression coefficient on λ_{TVol} is slightly smaller, with a value of 0.53% per month but still significant at the 5% level (*t*-statistic = 2.06). The global size factor is the only global factor that demands a significant pricing premium (λ_s). However, other global risk factors' premiums remain insignificant. These findings suggest that total market volatility dominates Fama and French's global three factors and the global market volatility risk factor in explaining the inter-country differences between the expected returns of locally diversified market portfolios.

[Insert Table 7 here]

6.2. *Idiosyncratic market volatility versus the global volatility risk factor*

We then investigate whether *idiosyncratic* market volatility also dominates other global risk factors in forecasting the expected return of locally diversified market portfolios using the following Fama and MacBeth regression:

$$R_{i,t} = \lambda_0 + \sum_{k=1}^{M} \lambda_k \beta^k_{i,t-1} + \lambda_{IVol} IVol_{i,t-1} + \varepsilon_{i,t}, \qquad (19)$$

where $IVol_{i,t-1}$ is the idiosyncratic market volatility in country *i* in month *t*-1 estimated from equation (4), and betas are as defined in equation (14).

As shown in Model 3 of Table 7, we find similarities to total market volatility. The idiosyncratic market volatility estimated from the return for the past 36 months also dominates Fama and French's global three factors, in explaining the expected return of country-specific market portfolios with an estimated pricing premium of 0.11% per month and a *t*-statistic of 1.91. None of their three global factors is significantly priced. When betas of global market volatility risk factor are included in the regression, the result reported in Model 4 shows that the regression coefficient on *idiosyncratic market volatility* remains significant with a risk premium of 0.21% per month and a *t*-statistic of 3.20. All four global risk factors remain insignificantly priced.

We then investigate whether our second measure of *idiosyncratic market volatility*, $IVol_{t-1}^{II}$, as estimated from daily returns on the market portfolios in the past month and described in equation (5), dominates four global risk factors in explaining the expected returns of market portfolios. We perform the above Fama and MacBeth regression by replacing the idiosyncratic market volatility ($IVol_{t-1}$) with our second measure of idiosyncratic market volatility ($IVol_{t-1}^{II}$). The results reported in Model 5 indicate that *idiosyncratic market volatility* significantly predicts the expected return of market portfolio with a risk premium of 0.60% per month and a *t*-statistic of 2.46. When we include the sensitivity (i.e., market volatility betas) of the global market volatility risk factor in the regression (Model 6), *idiosyncratic market volatility* continues to be significantly priced with a risk premium of 1.01% (*t*-statistic = 3.74) per month, while none of the four global factors is significantly priced. Overall, these results reliably suggest that *idiosyncratic market volatility* dominates global market, value, size and market volatility risk factors in predicting the expected return of market portfolio.

In sum, the results in Tables 7 suggest that in general the most important risk to the expected return of diversified market portfolio is the idiosyncratic or country-specific market volatility, as estimated from the daily returns of the previous month. Investors are compensated with higher expected return for bearing a higher country-specific risk that is measured by the idiosyncratic market volatility of a country. This is consistent with the global version of Merton's (1987) incomplete information CAPM.

These results imply that the expected return of local market portfolio is higher in a country whose country-specific market volatility is higher. This expected return is the countrywide cost of capital according to the global CAPM. At the same time, the sensitivities of market portfolios to Fama and French's global three factors and the global market volatility risk factor are not important. In this case, this finding suggests that there will be fewer investment opportunities with positive NPV in a country whose countrywide cost of capital is higher. This result implies that multinational firms may consider investing their projects in a country with low idiosyncratic market volatility if the firms' only concern is to reduce their cost of capital.

On the other hand, our finding on the relationship between idiosyncratic market volatility and the expected return of market portfolio is consistent with and supports the good volatility argument proposed by Bartram, Brown, and Stulz (2012). That is, corporations located in countries with higher market volatility are more willing to invest in projects that are more innovative but have higher risk, to invest more in R&Ds, and to improve shareholder protection. These projects also generate higher returns on investments. All these steps promote economic growth and benefit shareholder wealth. In the next section, we describe the formal tests of the good volatility hypothesis.

7. Country-level Corporate Governance and Market Portfolio's Volatility

In this section, we investigate the relationship between country-level corporate governance and market portfolio's volatility to test whether our previous results in section 6 are consistent with the good volatility argument suggested by Bartram, Brown, and Stulz (2012). We separately regress the total or idiosyncratic market volatility on the various country-level corporate governance indices discussed earlier, because these indices are highly correlated. We therefore do not include all of them in one multi-variate regression.

As shown in Table 8, the anti-director index has a positive and significant relationship with total market volatility in local currency at the 10% level and with idiosyncratic market volatility measured by daily returns at the 5% level. The accounting standards index also has a positive and significant relationship with idiosyncratic market volatility constructed by daily returns at the 5% level. This may seem puzzling, because most economists would expect that better corporate governance would reduce market volatility or market-wide level risk as a characteristic risk. However, this finding further supports the hypothesis discussed in the previous section: that good market volatility is associated with the good country-level corporate governance that encourages managers of corporations to take on risky but innovative projects. Such projects may generate higher market volatility but also produce higher expected returns that benefit shareholders, promote economic growth, and develop financial markets.

[Insert Table 8 here]

As discussed in section 2, idiosyncratic market volatility may reflect information asymmetry among global investors in the context of Merton's (1987) incomplete information CAPM. In this sense, this finding also implies that a country with higher idiosyncratic market volatility will have a higher countrywide cost of capital for corporations located there. Therefore, countries with high idiosyncratic market volatility will have fewer investment projects with positive NPV. This result suggests that multinational firms may consider investing their projects in a country with low idiosyncratic market volatility. However, our tests and results on why the pricing premium of the market volatility – the level risk as a characteristic is more consistent with the good volatility hypothesis proposed by Bartram, Brown, and Stulz (2012).

As shown in table 7, our tests and results show that the level of market volatility as a characteristic risk is the most important economic force or factor in determining the country-level cost of capital for multinational corporations. The economic reason is that the level of market volatility captures and reflects the level and the quality of the corporate governance of corporations in a country. A good accounting standard in a country will help corporations to have better transparence and better corporation management flow so that they can take on higher risk and more rewarding projects. This economic rationale and this interpretation also apply to the high standard of anti-director index because the corporate board can be more independent and better governed so that the corporations can take on more innovative projects with higher risk. The cost of information flow will be reduced while the effectiveness of executions of the management decisions will be higher in these countries with high corporate governance standards. Therefore, managers of corporations located in countries with good corporate governance are encouraged to take higher risk on more innovative projects. Their risk-taking management style in these countries turns out to be beneficial not only for shareholders by earning higher expected returns on investments but also for society by generating higher economic growth. As a result, our empirical results are consistent with and support the good volatility hypothesis proposed by Bartram, Brown, and Stulz (2012).

Furthermore, local market volatility reflects many aspects of fundamental and non-fundamental components of a country and corporations located there. For example, the dark side of market volatility (bad volatility as termed by Bartram et al. (2012)) reflects risk such as political uncertainty, policy uncertainty, corruption, and poor legal systems at the country level, and bad corporate governance and managerial misconduct at the firm level. It also reflects noise trader risk due to their irrational behavior. The bright side of market volatility (good volatility as termed by Bartram et al. (2012)) may come from country-level institutions such as good corporate governance and better legal systems, which encourage managerial risk-taking on innovative projects (e.g., Aghion, Reenen, and Zingales (2013)) and entrepreneurship that create wealth for shareholders and generate higher economic growth for society. Our empirical findings point to the bright side of volatility and suggest that investing in countries with good market volatility can be rewarding, not only for global investors but also for multinational corporations.

8. Conclusion

We discover that the pricing of the local market volatility risk factor is not robust even though it is significant in Belgium, Canada, Spain, Norway, the U.K. and the U.S. in one of our tests. This is because the pricing is not consistent across different methods of estimating the betas and of constructing the testing stock portfolios. However, we find that the global market volatility factor is a negative and systematic pricing factor across 21 locally diversified market portfolios after controlling for global market, value, and size factors. This result suggests that global investors earn lower returns when investing in a locally diversified market portfolio with a higher sensitivity to the global market volatility factor. The evidence is consistent with the prediction of Merton's (1973) ICAPM in a global setting. This finding implies that corporations in a country whose market portfolio has a higher sensitivity to the global market volatility risk factor will have a lower countrywide cost of capital for their investment projects.

We also find that idiosyncratic market volatility – the level risk, as a country-specific characteristic risk, dominates the sensitivities of market portfolios to the global market volatility risk factor and Fama and French's global three factors in predicting the expected returns of locally diversified market portfolios. This finding suggests that idiosyncratic market volatility, as a country-specific characteristic risk, is the most important driving force for the expected returns of market portfolios. We interpret his result to be consistent with the good volatility hypothesis proposed by Bartram, Brown, and Stulz (2012). Our further empirical tests and results show that countries with higher accounting standards and stronger anti-director rights (a proxy for investor protection) have higher idiosyncratic market volatility. These results strongly support the good volatility hypothesis that managers of corporations located in countries with good corporate governance are encouraged to take higher risk on more innovative projects. Their risk-taking management style in these countries do not only reward shareholders by earning higher expected returns on investments but also are provide benefits to the society in a country by generating higher economic growth.

Our findings have important implications for issues in international business studies, in particular for multinational corporations. Our empirical tests and results point to the bright side of market volatility (good volatility as termed by Bartram et al. (2012)) Therefore, managers of multinational corporations should distinguish between good versus bad volatility of country-specific market portfolios when they invest in these countries. Our concluding message is that investing in countries with good market volatility can be rewarding, not only for global investors but also for multinational corporations.

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Table 1. Summary statistics

This table reports the summary statistics for our sample countries. The market capitalization is total market value in billion US dollars in December 2010. The number of traded stocks is the total number of actively traded stocks in December 2010. The monthly return is the time-series average monthly returns on country market portfolios. The sample period is from January 1976 to December 2010.

Country	Market capitalization in December 2010	Number of traded stocks in December 2010	Monthly return
Australia	1,122.0	1,754	1.26%
Austria	109.5	105	0.83%
Belgium	241.3	231	0.98%
Canada	1,691.6	1,464	1.02%
Denmark	190.8	189	1.26%
Finland	184.6	138	1.37%
France	1,656.7	848	1.27%
Germany	1,338.4	1,228	0.76%
Hong Kong	1,551.9	1,326	1.81%
Ireland	58.4	52	1.33%
Italy	541.5	347	1.44%
Japan	3,511.2	3,320	0.26%
The Netherlands	428.0	124	1.02%
New Zealand	45.1	141	0.75%
Norway	220.1	232	1.36%
Singapore	484.6	751	0.88%
Spain	592.6	155	0.98%
Sweden	491.3	552	1.56%
Switzerland	1,077.8	285	0.75%
United Kingdom	2,872.1	1,616	1.33%
United States	13,570.8	6,393	1.02%

Table 2: Summary statistics of market volatility in 21 developed countries

This table reports the summary statistics of the market volatility in each country. The total market volatility in a country is the time-series average monthly volatility, which is the standard deviation of the *daily* returns on the country market portfolio multiplied by $\sqrt{250/12}$. The first measure of idiosyncratic market volatility in country *i* is the standard deviation of the idiosyncratic component (ε_i) from the following regression:

$$R_{i,\tau} = \alpha_{i,t-1} + \beta^{m}_{i,t-1} MKTXG_{\tau} + \beta^{h}_{i,t-1} HMLG_{\tau} + \beta^{s}_{i,t-1} SMBG_{\tau} + \varepsilon_{i,\tau}, \quad \tau = t-36,..,t-1,$$

where $R_{i,\tau}$ is the monthly excess return on the market portfolio in country *i* in month τ, *MKTXG* is the monthly return on the global market portfolio minus the risk free rate, *HMLG* is the global value factor, and *SMBG* is the global size factor. The sample period is from January 1976 to December 2010.

Country	Total market volatility in US dollars	Total market volatility in local currencies	Idiosyncratic market volatility from the three-factor model
Australia	2.45%	2.23%	1.346%
Austria	2.33%	2.64%	2.262%
Belgium	2.28%	2.33%	1.106%
Canada	2.08%	2.29%	0.608%
Denmark	2.04%	2.28%	0.804%
Finland	4.37%	4.14%	2.043%
France	2.47%	2.41%	1.477%
Germany	2.59%	2.50%	0.903%
Hong Kong	3.63%	3.72%	1.882%
Ireland	2.67%	2.70%	1.144%
Italy	2.76%	2.77%	2.174%
Japan	2.67%	2.61%	1.090%
The Netherlands	2.58%	2.60%	0.749%
New Zealand	2.13%	2.20%	1.672%
Norway	3.01%	3.21%	1.533%
Singapore	2.64%	2.76%	1.737%
Spain	2.52%	2.65%	0.959%
Sweden	2.89%	2.94%	1.996%
Switzerland	2.58%	2.37%	0.707%
United Kingdom.	2.00%	2.16%	1.063%
United States	2.50%	2.50%	0.574%
Correlation	0.40	0.46	0.38

Table 3: The premium of the local market volatility risk factor

This table reports the pricing premiums of the local Fama and French three factors and of the mimicking factor of local market volatility innovation estimated from equation (8). These premiums are estimated from the Fama and MacBeth regressions using 20 equally weighted stock portfolios in each country for the period from January 1980 to June 2010. We sort all stocks into 20 portfolios based on their betas of the mimicking factor. This mimicking factor is the local market volatility risk factor. The beta of market volatility risk factor, $\beta^{v}_{i,j,t-1}$, of stock *j* is from the following regression:

$$R_{i,j,\tau} = \alpha_{i,j,t-1} + \beta^{m}_{i,j,t-1} MKTX_{i,\tau} + \beta^{h}_{i,j,t-1} HML_{i,\tau} + \beta^{s}_{i,j,t-1} SMB_{i,\tau} + \beta^{v}_{i,j,t-1} MVol_{i,\tau} + \varepsilon_{i,j,\tau},\ i = 1,...,23,\ \tau = t-60,...,t-1,$$

where $MKTX_i$, HML_i, and SMB_i are respectively the market, value and size factors in country *i*. $MVol_{i,t}$ is the mimicking volatility factor $MVol_{i,t} \equiv \beta^{'}_{F} MF_{i,t}$ estimated from the economic tracking model $\Delta Vol_{i,t} = \beta_0 + \beta^{'}_{F} MF_{i,t} + \theta \Delta Vol_{i,t-1} + \varepsilon_{i,t}$. The *MF* is the 8×1 vector of eight economic tracking portfolios in each country. In Panel A, $\Delta Vol_{i,t}$,the local market volatility innovation, is the change in the variance of daily market portfolio return. In Panel B, $\Delta Vol_{i,t}$, the local market volatility innovation, is the change in the standard deviation of daily market portfolio return. The eight economic tracking portfolios are the value-weighted return on the high (top 30%) book-to-market portfolio, the value-weighted return on the low (bottom 30%) book-to-market portfolio, the value-weighted return on the high (top 30%) earnings-to-price portfolio, the value-weighted return on the low (bottom 30%) earnings-to-price portfolio, the value-weighted return on the high (top 30%) cash earnings-to-price portfolio, the value-weighted return on the low (bottom 30%) cash earnings-to-price portfolio, the value-weighted return on the high (top 30%) dividend yield portfolio, and the value-weighted return on the low (bottom 30%) dividend yield portfolio. The *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 3 – Continued

Panel A: The pricing premium of local market volatility risk factor measured by innovation in return variance

Country	$\lambda_{i,m}$	t-stat	$\lambda_{i,h}$	t-stat	$\lambda_{i,s}$	t-stat	$\lambda_{i,v}$	t-stat
Australia	-0.37	-0.17	0.14	0.18	1.74	1.39	**0.10**	**0.13**
Austria	0.83	0.58	-0.85	-0.28	-0.43	-1.49	**1.20**	**1.17**
Belgium	-4.69	-1.56	1.18	0.77	4.89**	2.03	**0.05**	**0.53**
Canada	-2.74	-0.79	0.63	0.75	2.16	1.40	**-0.02**	**-0.19**
Denmark	-1.57**	-1.98	1.17	1.03	0.78	-0.98	**0.09**	**0.81**
Finland	1.07	0.90	0.89	0.79	0.90	0.81	**0.06**	**0.22**
France	0.53	0.55	-0.64	-0.76	-0.12	-0.23	**-0.06**	**-0.82**
Germany	0.74	1.06	0.69	1.23	-0.37	-0.76	**-0.05**	**-0.75**
Hong Kong	0.72	0.84	0.22	0.36	-0.86	-1.31	**-0.12**	**-0.73**
Ireland	0.19	1.04	-0.17	-0.93	-0.10	-1.10	**-0.01**	**-0.02**
Italy	1.32	1.02	1.01**	2.18	0.23	0.42	**0.01**	**0.60**
Japan	-0.49	-0.58	-0.12	-0.25	0.70	1.33	**-0.02**	**-0.38**
Netherlands	0.08	0.10	-1.84*	-1.86	-0.76	-1.32	**-0.09**	**-1.28**
New Zealand	0.22	0.20	-0.85	-0.71	-0.17	-0.22	**0.16**	**0.18**
Norway	1.45	1.46	-1.45	-1.18	0.13	0.17	**0.07**	**0.36**
Singapore	-0.52	-0.83	-0.79	-1.16	0.39	1.03	**0.99**	**0.90**
Spain	-1.14	-1.23	-0.07	-0.12	-0.15	-0.32	**-0.86****	**-1.96**
Sweden	0.24	0.13	-1.35	-0.90	0.66	0.90	**0.29**	**1.00**
Swiss	-0.57	-0.31	-2.95	-1.08	-0.98	-1.17	**0.37**	**0.79**
The U.K.	1.65	1.45	0.94	1.74	0.26	0.48	**-0.15***	**-1.85**
The U.S.	-0.17	-0.27	0.77**	2.24	-0.22	-0.65	**-0.01**	**-0.11**

Table 3 – Continued

Panel B: The pricing premium of local market volatility risk factor measured by innovation in return standard deviation

Country	$\lambda_{i,m}$	t-stat	$\lambda_{i,h}$	t-stat	$\lambda_{i,s}$	t-stat	$\lambda_{i,v}$	t-stat
Australia	-1.19	-1.06	-0.25	-0.32	3.60*	1.94	**0.10**	**1.23**
Austria	4.74	1.55	2.68	1.04	-3.39	-1.49	**-0.14**	**-1.19**
Belgium	-5.74**	-2.35	3.06	1.38	1.28	0.84	**0.11**	**1.54**
Canada	-2.90	-0.66	0.88	1.33	2.85	1.18	**0.07**	**0.65**
Denmark	-0.21	-0.20	0.76	0.69	-0.09	-0.13	**-0.00**	**-0.17**
Finland	-2.05	-1.49	0.89	0.30	0.53	0.55	**-12.70**	**-1.16**
France	0.12	0.12	-1.08	-0.94	-0.28	-0.55	**0.00**	**0.07**
Germany	-0.26	-0.35	-0.05	-0.08	0.37	0.76	**0.01**	**-0.61**
Hong Kong	-0.02	-0.02	0.67	1.09	0.93	1.20	**0.04**	**1.07**
Ireland	0.38	-0.34	-1.83	-1.00	3.26	0.69	**1.00**	**0.95**
Italy	1.32	0.88	0.82	1.48	-0.11	-0.21	**0.00**	**0.07**
Japan	0.90	1.23	-0.13	-0.28	0.55	0.96	**0.01**	**0.72**
Netherlands	-0.80	-0.97	0.29	0.32	0.46	0.74	**0.01**	**0.50**
New Zealand	-0.37	-0.36	0.21	0.17	1.47	1.29	**0.02**	**0.94**
Norway	0.63	0.64	-0.90	-0.83	1.22	1.56	**0.02**	**0.49**
Singapore	4.78	0.18	-1.07	-0.79	2.98	0.16	**-0.16**	**-0.30**
Spain	0.76	0.78	-0.72	-0.83	-0.39	-0.63	**0.47**	**1.25**
Sweden	0.92	0.71	-1.69	-1.31	0.78	1.16	**0.02**	**-0.24**
Swiss	0.05	0.07	-2.85	-0.86	0.29	0.38	**0.18**	**1.19**
The U.K.	-0.14	-0.19	0.57	1.06	0.43	0.83	**-0.04***	**-1.86**
The U.S.	-0.02	-0.02	0.68*	1.95	-0.18	-0.49	**-0.04***	**-1.73**

Table 4: The premium of local market volatility risk factor: Robustness checks

This table reports the pricing premiums for the Fama and French three factors and for the mimicking factor of local market volatility innovation $MVol_{i,t}$ estimated from equation (8). This mimicking factor is the local market volatility risk factor. We sort all stocks in each country into 20 portfolios based on their betas of local market volatility innovation constructed from variance of market portfolios' returns stated in equation (6). The market volatility beta, $\beta^{v}_{i,j,t-1} = \beta^{v}_{1,i,j,t-1} + \beta^{v}_{2,i,j,t-1}$, of stock *j* is from the following regression for month t-60 to t-1.

$$R_{i,j,\tau} = \alpha_{i,t-1} + \beta^{m}_{i,j,t-1} MKTX_{i,\tau} + \beta^{v}_{1,i,j,t-1} \Delta VOL_{i,\tau} + \beta^{v}_{2,i,j,t-1} \Delta VOL_{i,\tau-1} + \varepsilon_{i,j,\tau} ,$$

where $MKTX_{i,}$ *is* the market factors in country *i*. In Panel A, the pricing premiums are estimated from the Fama and MacBeth regressions using 20 equally weighted stock portfolios in each country for the period from January 1980 to June 2010. In Panel B, the pricing premiums are estimated using 20 value-weighted portfolios in each country. The *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: The pricing premium of local market volatility risk factor using 20 equal-weighted portfolios

Country	$\lambda_{i,m}$	t-stat	$\lambda_{i,h}$	t-stat	$\lambda_{i,s}$	t-stat	$\lambda_{i,v}$	t-stat
Australia	-0.37	-0.17	0.14	0.18	1.74	1.39	**-0.01**	**-0.18**
Austria	0.83	0.58	-0.85	-0.28	-0.43	-1.49	**-0.30**	**-0.99**
Belgium	-4.69	-1.56	1.18	0.77	4.89**	2.03	**-0.01**	**-0.13**
Canada	-2.74	-0.79	0.63	0.75	2.16	1.40	**-0.06***	**-1.90**
Denmark	-1.57**	-1.98	1.17	1.03	0.78	-0.98	**-0.04**	**-1.11**
Finland	1.07	0.90	0.89	0.79	0.90	0.81	**0.02**	**0.14**
France	0.53	0.55	-0.64	-0.76	-0.12	-0.23	**0.00**	**0.20**
Germany	0.74	1.06	0.69	1.23	-0.37	-0.76	**0.02**	**1.06**
Hong Kong	0.72	0.84	0.22	0.36	-0.86	-1.31	**0.02**	**0.54**
Ireland	0.19	1.04	-0.17	-0.93	-0.10	-1.10	**0.03**	**0.23**
Italy	1.32	1.02	1.01**	2.18	0.23	0.42	**-0.00**	**-0.00**
Japan	-0.49	-0.58	-0.12	-0.25	0.70	1.33	**0.00**	**0.20**
Netherlands	0.08	0.10	-1.84*	-1.86	-0.76	-1.32	**-0.02**	**-0.23**
New Zealand	0.22	0.20	-0.85	-0.71	-0.17	-0.22	**-0.07**	**-0.24**
Norway	1.45	1.46	-1.45	-1.18	0.13	0.17	**-0.08**	**-0.89**
Singapore	-0.52	-0.83	-0.79	-1.16	0.39	1.03	**0.02**	**0.23**
Spain	-1.14	-1.23	-0.07	-0.12	-0.15	-0.32	**-0.43**	**-1.01**
Sweden	0.24	0.13	-1.35	-0.90	0.66	0.90	**-0.10**	**-1.41**
Swiss	-0.57	-0.31	-2.95	-1.08	-0.98	-1.17	**0.17**	**1.08**
The U.K.	1.65	1.45	0.94	1.74	0.26	0.48	**0.01**	**0.52**
The U.S.	-0.17	-0.27	0.77**	2.24	-0.22	-0.65	**-0.00**	**-0.09**

Table 4 – Continued

Panel B: The pricing premium of local market volatility risk factor using 20 value-weighted portfolios

Country	$\lambda_{i,m}$	t-stat	$\lambda_{i,h}$	t-stat	$\lambda_{i,s}$	t-stat	$\lambda_{i,v}$	t-stat
Australia	-1.60**	-2.10	0.72	1.25	2.13*	1.83	**0.11***	**1.89**
Austria	1.81	1.45	2.00	1.33	-0.04	-0.04	**-0.12**	**-1.57**
Belgium	0.25	0.39	0.92*	1.68	-0.16	-0.36	**0.04***	**-1.89**
Canada	-0.17	-0.24	0.93**	2.22	1.46	0.48	**0.02**	**0.68**
Denmark	-0.19	-0.25	0.49	0.76	-0.11	-0.18	**0.03**	**0.77**
Finland	-0.15	-0.13	1.36	1.38	-0.65	-0.82	**12.81**	**1.10**
France	0.92	1.34	-0.34	-0.67	-0.87*	-2.04	**-0.04**	**-1.27**
Germany	0.12	0.19	1.19**	2.25	-0.14	-0.34	**0.02**	**1.34**
Hong Kong	-1.19	-1.41	-0.16	-0.34	-1.26*	-1.97	**0.05**	**1.07**
Ireland	-0.39	-1.00	0.68	0.37	-1.26	-0.97	**0.03**	**0.98**
Italy	2.50	1.48	-0.10	-0.17	0.90	1.47	**-0.00**	**-0.59**
Japan	-0.16	-0.24	0.79**	2.09	0.26	0.38	**0.02**	**-0.52**
Netherlands	0.25	0.49	-0.38	-0.67	-0.53	-1.16	**-0.02**	**-0.89**
New Zealand	0.08	0.12	1.15	1..05	-0.66	-0.93	**-0.04**	**-1.57**
Norway	0.80	0.90	-1.00	-1.06	0.75	0.81	**-0.20****	**-2.61**
Singapore	1.30	1.59	0.86	1.41	0.10	0.15	**-0.02**	**-0.72**
Spain	-0.55	-0.72	-4.86	-1.35	1.57	0.88	**-0.20**	**-0.45**
Sweden	-0.11	-0.13	0.30	0.55	0.10	0.17	**0.00**	**0.02**
Swiss	0.05	0.73	1.05	-0.60	-0.60	-1.39	**-0.02**	**-0.86**
The U.K.	-0.29	-0.46	-0.27	-0.80	-0.10	-0.24	**0.00**	**0.20**
The U.S.	-0.67	-0.98	0.68	0.09	0.27	-0.86	**0.00**	**0.58**

Table 5. Abnormal returns on country market portfolios sorted by their betas of global market volatility risk factor (β_i^v)

This table reports abnormal returns on the equal-weighted country market portfolios sorted by their betas of global market volatility risk factor for the period from January 1976 to December 2010. $\beta_{i,t-1}^v$ is country *i*'s global market volatility beta in month *t*-1, which is calculated from the following regression using monthly returns from *t*-60 to *t*-1:

$$R_{i,\tau} = \alpha_{i,t-1} + \beta_{i,t-1}^m MKTXG_\tau + \beta_{i,t-1}^v MVol_\tau + \varepsilon_{i,\tau} \quad \tau = t-60,..,t-1,$$

where $R_{i,\tau}$ is the excess return on country market portfolio *i* in month *τ*, *MKTX* is the global market factor. $MVol_t$ is the global volatility factor $\beta_F^{'} MF_{i,t}$ estimated from the economic tracking model.

$\Delta Vol_{i,t} = \beta_0 + \beta_F^{'} MF_{i,t} + \theta \Delta Vol_{i,t-1} + \varepsilon_{i,t}$, where *MF* is the 8×1 vector of the eight global economic tracking portfolios. All stocks in our sample are sorted into three groups—the top 30% (high), the middle 40% (medium), and the bottom 30% (low)—based on their market characteristics measured by the book-to-market (BM) ratio, earnings-to-price (EP) ratio, cash earnings-to-price (CP) ratio, and dividend yield (YLD). The eight global economic tracking portfolios are the value-weighted returns on the high BM, the low BM, the high EP, the low EP, the high CP, the low CP, the high YLD, and the low YLD portfolios. We sort all 21 country market portfolios into three portfolios (Low, Middle, and High) according to their betas of global market volatility risk factor. Portfolio-L (Portfolio-H) has the lowest (highest) beta of the global market volatility risk factor. The zero-cost H-L portfolio longs portfolio-H and shorts portfolio-L. The market capitalization is in billion U.S. dollars. The *t*-statistics are in parentheses. [*], [**], and [***] indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 5 - Continued

Rank	Low (L)	Middle (M)	High (H)	(H-L)
Raw return	1.03***	1.35***	0.97***	-0.06
	(4.70)	(4.98)	(3.65)	(-0.29)
Panel A: The global CAPM				
Alpha	0.28**	0.49***	0.12	-0.16
	(2.05)	(3.74)	(0.88)	(-0.81)
MKTXG	0.76	1.05	1.02	0.25
	(26.03)	(37.54)	(35.19)	(5.90)
R-squared	0.62	0.77	0.75	0.08
Panel B: The Fama and French global two-factor model (*MKTXG* and *HMLG*)				
Alpha	0.28**	0.46***	0.07	-0.22
	(2.04)	(3.49)	(0.50)	(-1.06)
MKTXG	0.76	1.05	1.01	0.25
	(25.87)	(37.24)	(34.92)	(5.73)
HMLG	-0.01	0.05	0.10	0.11
	(0.15)	(1.08)	(2.06)	(5.73)
R-squared	0.62	0.77	0.75	0.08
Panel C: The Fama and French global three-factor model				
Alpha	0.24*	0.43***	0.04	-0.20
	(1.76)	(3.27)	(0.29)	(-0.99)
MKTXG	0.79	1.07	1.03	0.24
	(25.93)	(36.54)	(34.25)	(5.31)
HMLG	-0.04	0.03	0.08	0.12
	(0.82)	(0.56)	(1.55)	(1.59)
SMBG	0.08	0.06	0.06	-0.03
	(3.03)	(2.22)	(2.09)	(0.65)
R-squared	0.62	0.77	0.75	0.08
Market capitalization	1411	386	279	

Table 6. The pricing premium of global market volatility risk factor

This table reports the pricing premium of the global Fama and French three factors and of the global market volatility risk factor. We estimate the pricing premiums (i.e., λ_m, λ_h, λ_s, and λ_v) from the following Fama and MacBeth regressions using 21 locally diversified market portfolios for the period from January 1980 to June 2005.

$$R_i = \alpha + \beta_i^m \lambda_m + \beta_i^h \lambda_h + \beta_i^s \lambda_s + \beta_i^v \lambda_v, \quad (16)$$

where R_i is the excess return on country market portfolio *i*; β_i^m, β_i^h, β_i^s, and β_i^v are the estimated betas of the global market, value, size, and market volatility risk factors for market portfolio *i*; and λ_m, λ_h, λ_s, and λ_v are the corresponding estimated pricing premiums. The beta of global market volatility risk factor, $\beta_{i,j,t-1}^v$, of country *j* is from the following regression.

$$R_{i,j,\tau} = \alpha_{i,j,t-1} + \beta_{i,j,t-1}^m MKTX_{i,\tau} + \beta_{i,j,t-1}^h HML_{i,\tau} + \beta_{i,j,t-1}^s SMB_{i,\tau} + \beta_{i,j,t-1}^v MVol_{i,\tau} + \varepsilon_{i,j,\tau},\ i = 1,\ldots,23,\ \tau = t-60,\ldots,t-1,$$

where $MKTX_i$, HML_i, and SMB_i are respectively the global market, value and size factors. In Model 1 and 3, we construct the global size factor using all stocks in 21 developed markets. In Model 2 and 4, we construct global size factor using 21 market portfolios. In Models 1 and 2, $MVol_{i,t}$ is the global market volatility risk factor. $MVol_{i,t} \equiv \beta_F^{'} MF_{i,t}$ is estimated from the economic tracking model $\Delta Vol_{i,t} = \beta_0 + \beta_F^{'} MF_{i,t} + \theta \Delta Vol_{i,t-1} + \varepsilon_{i,t}$. In Models 3 and 4, $MVol_{i,t}$ is the global market volatility risk factor $MVol_{i,t} \equiv \beta_F^{'} MF_{i,t}$ is estimated from the economic tracking model $\Delta Vol_{i,t} = \beta_0 + \beta_F^{'} MF_{i,t} + \varepsilon_{i,t}$. The *MF* is the 8x1 vector of eight global economic tracking portfolios in these 21 markets. $\Delta Vol_{i,t}$ is the global market volatility innovation that is the change in the variance of daily global market portfolio's returns. The eight global economic tracking portfolios are the value-weighted return on the high (top 30%) book-to-market portfolio, the value-weighted return on the low (bottom 30%) book-to-market portfolio, the value-weighted return on the high (top 30%) earnings-to-price portfolio, the value-weighted return on the low (bottom 30%) earnings-to-price portfolio, the value-weighted return on the high (top 30%) cash earnings-to-price portfolio, the value-weighted return on the low (bottom 30%) cash earnings-to-price portfolio, the value-weighted return on the high (top 30%) dividend yield portfolio, and the value-weighted return on the low (bottom 30%) dividend yield portfolio. The coefficient on the global market volatility risk factor is multiplied by 10,000. The sample period is from January 1976 to December 2010. The *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Model 1	Model 2	Model 3	Model 4
λ_m	0.24	0.03	0.22	0.03
	(0.89)	(0.09)	(0.79)	(0.11)
λ_h	0.05	-0.09	0.05	-0.10
	(0.26)	(-0.45)	(0.27)	(-0.51)
λ_s	-0.07	0.88***	-0.07	0.86***
	(-0.17)	(3.50)	(-0.12)	(3.43)
λ_v	-1.30*	-1.42*	-1.12	-1.27*
	(-1.77)	(-1.95)	(-1.64)	(-1.90)

Table 7. Country market volatility as a characteristic versus global market volatility risk factor

This table reports the test results explaining the expected return of country market portfolio using the following Fama-MacBeth (1973) regression:

$$R_{i,t} = \lambda_0 + \sum_{j=1}^{M} \lambda_k \beta^k_{i,t-1} + \lambda_{TVol} Vol_{i,t-1} + \varepsilon_{i,t} \ ,$$

where $\beta^k_{i,t-1}$ is the sensitivity of market portfolio in country *i* to global factor *k*, with the global factor being the global market (*MKTXG*), value (*HMLG*), size (*SMBG*), or market volatility risk factor (*MVol*) factor and is estimated from regression (14). The λs are the estimated pricing premiums. $Vol_{i,t-1}$ can be either $TVol_{i,t-1}$ or $IVol_{i,t-1}$. $TVol_{i,t-1}$ is the total market volatility of country *i* in the previous month and is calculated as the standard deviation of daily returns in U.S. dollars on market portfolios in month *t*-1. $IVol_{i,t-1}$ is our first measure of idiosyncratic market volatility in the previous period and is calculated as the standard deviation of the idiosyncratic component ($\varepsilon_{i,t}$) from the following regression from month *t*-36 to *t*-1:

$$R_{i,\tau} = \alpha_{i,t-1} + \beta^m_{i,t-1} MKTXG_\tau + \beta^h_{i,t-1} HMLG_\tau + \beta^s_{i,t-1} SMBG_\tau + \varepsilon_{i,\tau}, \ \tau = t-36,..,t-1.$$

We also use $IVol^{II}_{t-1}$ as our second measure of idiosyncratic market volatility of country *i* in the previous month. It is calculated as the standard deviation of the idiosyncratic component ($\varepsilon_{i,t-1}$) from the following regression after adjusting for the global market factor ($MKTX_\tau$) based on daily returns in month *t*-1:

$$R_{i,\tau} = \alpha_{i,t-1} + \beta^m_{i,t-1} MKTXG_\tau + \varepsilon_{i,\tau}, \quad \tau = 1,.., D_{t-1}.$$

β^m_i , β^h_i , and β^s_i in Models 1, 3, and 5 are obtained from the following regression:

$$R_{i,\tau} = \alpha_{i,t-1} + \beta^m_{i,t-1} MKTXG_\tau + \beta^h_{i,t-1} HMLG_\tau + \beta^s_{i,t-1} SMBG_\tau + \varepsilon_{i,\tau}, \ \tau = t-60,..,t-1.$$

β^m_i , β^h_i , β^s_i , and β^v_i in Models 2, 4, and 6 are obtained from the following regression:

$$R_{i,\tau} = \alpha_{i,t-1} + \beta^m_{i,t-1} MKTXG_\tau + \beta^h_{i,t-1} HMLG_\tau + \beta^s_{i,t-1} SMBG_\tau + \beta^v_{i,t-1} MVolG_\tau + \varepsilon_{i,\tau} \ \ \tau = t-60,..,t-1,$$

where $MVol_t$ is the factor that mimics the innovation in global market volatility and the global market volatility risk factor. It is $\beta^{'}_F MF_{i,t}$ estimated from the economic tracking model: $\Delta Vol_{i,t} = \beta_0 + \beta^{'}_F MF_{i,t} + \theta \Delta Vol_{i,t-1} + \varepsilon_{i,t}$, where *MF* is the 8×1 vector of the eight global economic tracking portfolios. All stocks in our sample are sorted into three groups—the top 30% (high), the middle 40% (medium), and the bottom 30% (low)—based on their market characteristics measured by the book-to-market (BM) ratio, earnings-to-price (EP) ratio, cash earnings-to-price (CP) ratio, and dividend yield (YLD). The eight global economic tracking portfolios are the value-weighted returns on the high BM, the low BM, the high EP, the low EP, the high CP, the low CP, the high YLD, and the low YLD portfolios. The coefficient on the global market volatility risk factor is multiplied by 10,000. The sample period is from January 1976 to December 2010. The *t*-statistics are in parentheses. [*], [**], and [***] indicate significance at the 10%, 5%, and 1% levels, respectively.

	$TVol_{i,t-1}$		$IVol_{i,t-1}$		$IVol^{II}_{t-1}$	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
λ_{vol}	0.59** (2.38)	0.53*** (2.06)	0.11* (1.91)	0.21*** (3.20)	0.60*** (2.46)	1.01*** (3.74)
λ^m	-0.06 (-0.23)	-0.12 (-0.43)	0.00 (0.5)	0.29 (1.00)	0.00 (0.16)	0.13 (0.45)
λ^h	-0.06 (-0.30)	-0.16 (-0.77)	-0.16 (-0.91)	0.26 (1.23)	-0.10 (-0.58)	0.10 (0.52)
λ^s	0.31 (1.17)	0.58*** (2.30)	-0.35 (-0.75)	-0.51 (-0.97)	-0.11 (-0.28)	-0.47 (-0.99)
λ^v		-0.78 (-0.98)		-0.08 (-0.10)		-0.44 (-0.57)

Table 8. Country corporate governance and country market volatility: Univariate regressions

This table reports the relationship between country-level corporate governance indices and market portfolio's volatility. The six corporate governance indices are the independent variables while the country market volatility is the dependent variable in the cross-country regression. The earnings management index is the aggregate earnings management score reported by Leuz et al. (2003). Spamann (2010) reports the anti-director rights index for 2005, which is a significant revision of the data reported by La Porta et al. (1998). The accounting standards index is also from La Porta et al. (1998) who examine the annual reports of a country's companies in 1990. The Institution for Management Development International (IMD) compiles the corporate board index and the insider-trading index. We take the values of these indices for 2004. $TVol_{i,t-1}$ is the total market volatility of country *i* in the previous month and is the standard deviation of daily returns in U.S. dollars on market portfolios in month *t*-1. $TVol_{i,t-1(\text{local})}$ is the total market volatility of country *i* in the previous month and is the standard deviation of daily returns in local currency on market portfolios in month *t*-1. $IVol_{i,t-1}$ is our first measure of idiosyncratic market volatility in the previous period and is the standard deviation of the idiosyncratic component ($\varepsilon_{i,t}$) from the following regression from month *t*-36 to *t*-1.

$$R_{i,\tau} = \alpha_{i,t-1} + \beta^m_{i,t-1} MKTXG_\tau + \beta^h_{i,t-1} HMLG_\tau + \beta^s_{i,t-1} SMBG_\tau + \varepsilon_{i,\tau},\ \tau = t-36,..,t-1 .$$

We also use $IVol^{II}_{t-1}$ as our second measure of idiosyncratic market volatility of country *i* in the previous month. It is the standard deviation of the idiosyncratic component ($\varepsilon_{i,t-1}$) from the following regression after adjusting for the global market factor ($MKTX_\tau$) based on daily returns in month *t*-1.

$$R_{i,\tau} = \alpha_{i,t-1} + \beta^m_{i,t-1} MKTXG_\tau + \varepsilon_{i,\tau}, \quad \tau = 1,..,D_{t-1} .$$

The *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	$TVol_{i,t-1}$	$TVol_{i,t-1(\text{Local})}$	$IVol_{i,t-1}$	$IVol^{II}_{t-1}$
Earnings management	-0.00	-0.00	0.02	-0.01
	(-0.01)	(-0.08)	(1.37)	(-0.49)
Accounting Standard	0.02	0.02	0.00	0.45**
	(1.25)	(1.21)	(0.41)	(2.11)
Anti-Director	0.20	0.20*	0.07	0.44**
	(1.53)	(1.77)	(0.51)	(2.06)
Corporate Board	0.08	0.11	0.03	0.16
	(0.45)	(0.69)	(0.17)	(0.55)
Insider Trading	0.00	-0.02	-0.20	-0.15
	(0.04)	(-0.18)	(-1.55)	(-0.62)

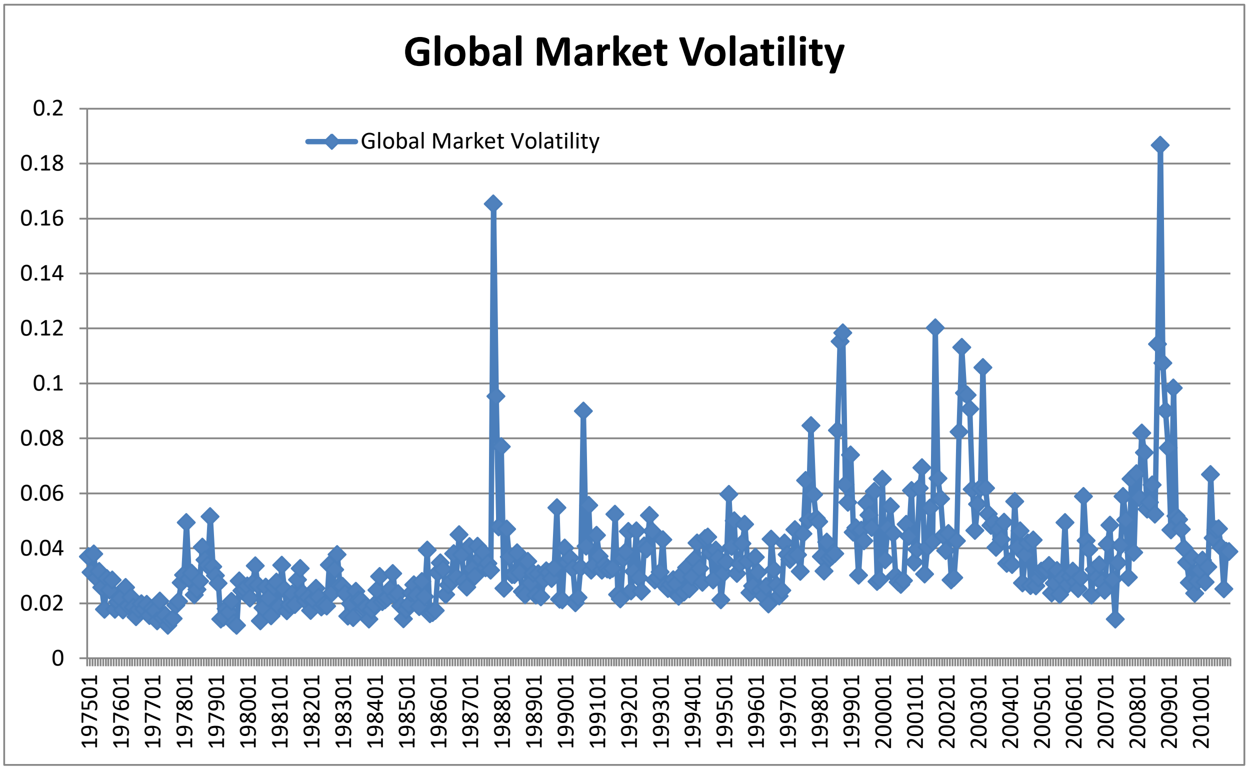

Figure 1: The global market volatility plot. The global market volatility is calculated as the standard deviation of daily value-weighted returns on the global market portfolio multiplied by $\sqrt{250/12}$. The x-axis is the month and the y-axis is the monthly volatility of the global market. The time period is from January 1975 to December 2010.