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Are Strategies for International Diversification by Country, Industry and Region Equivalent?

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ABSTRACT

In this study, we examine whether international portfolio diversification still matters despite an increase in the cross-country correlations of assets returns. More specifically, we explain why an increase in global return correlations does not necessarily imply a reduction in the benefits of international portfolio diversification. We also propose to compare empirically two traditional strategies of international diversification (by country and industry) in addition to a new strategy (by region) using two different methodological approaches, namely the mean variance spanning and multivariate cointegration analysis. Over the full sample period (1994-2008), our results suggest that the three strategies of international diversification remain effective despite the secular increase in the cross-country return correlations. When we divide the sample into two different sub-periods (1994-2000 and 2000-2008), the findings indicate that the strategy based on regional diversification proved to be a new competing strategy during the second period in comparison to the other two traditional strategies.

Introduction

Grubel (1968) and Solnik (1974) show that the inclusion of securities of foreign firms in a portfolio of local assets reduces the portfolio risk without affecting its performance. For many years, international diversification has been advocated as an effective investment strategy that maximizes portfolios' risk-adjusted returns. These benefits are explained by the imperfect integration or segmentation of financial markets due to differences in monetary/fiscal policies and institutional/regulatory regimes between countries. On the other hand, in recent decades, trade and financial globalization have significantly increased the cross-country return correlations raising the question of whether the benefits of international diversification have declined (Bekaert and Hodrick, 2017; Davis and Van Wincoop, 2017; Viceira and Wang, 2018).

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In this paper, we propose to investigate theoretically and empirically whether such benefits remain relevant from the point of view of an American investor. Following Campbell & Shiller (1988) Campbell (1991), Campbell et al. (2017), and Viceira & Wang (2018), we consider that unexpected portfolio returns are a function of cash-flow innovations (fundamentals) and discount rate innovations. Our theoretical framework assumes that cross-country return correlations are linked to cross-country cash-flow correlations and cross-country discount rate correlations. The main source of the secular increase in global return correlations for the 1986-2016 period could be linked to either an increase in cross-country cash-flow correlations, cross-country discount rate correlations or both (Viceira and Wang, 2018). The distinction between these two sources can explain why an increase in global return correlations does not diminish the benefits of international portfolio diversification. Empirically, as suggested by many studies (e.g., Campbell, 1991; Viceira and Wang, 2018), cash-flow shocks can be highly persistent while discount rate shocks can be transitory. In addition, Viceira & Wang (2018) have found that increased correlations of transitory discount rate shocks are the main driver of the secular increase in cross-country correlations for the 1986-2016 period. In contrast, cash-flow correlations across countries have been low suggesting that international equity diversification is still a good option to reduce equity cash-flow risk (Viceira and Wang, 2018). In this paper, we argue that only a significant increase in cross-country cash-flow correlations should have an impact on long-term returns because cash-flow shocks are permanent. In the same line of reasoning, a key implication of the presence of transitory discount rate shocks as the main driver of the secular increase in the cross-country correlations is that international diversification benefits should decline only for short-term investors since discount rates shocks have a temporary negative impact (Viceira and Wang, 2018). Long-term investors can still benefit from global portfolio diversification because permanent cash-flow shocks still exhibit low cross-country correlations. In other words, optimal international portfolio diversification should be a function of investment horizons and approaches (e.g., country-based investment approaches). If the benefits of international portfolio diversification still matter despite an increase in the cross-country correlations of assets returns, we argue that it is important to determine the optimal international diversification strategy that may offer the best risk reduction for a given level of performance. Hence, one important question raised in this paper is: which investment approach maximizes international portfolios' risk-adjusted returns?

Even though many papers findings suggest that country-based approaches to portfolio investment can capture higher expected returns while reducing risk, some authors (e.g., Roll, 1992) consider that industrial factors can also play an important role in explaining cross-country differences in volatilities and correlation structure. To date, most of the literature in the area addresses the question of whether country (geographical) diversification provides more benefits over industry diversification. With the international trend toward regional economic integrations, we propose to investigate whether international diversification strategies at the regional level (in addition to the traditional strategies by country and industry) can also maximize portfolios' risk-adjusted returns. To date, there is no clear consensus on the primacy of one strategy versus another. One contribution of this paper is to explore the merits of the diversification strategy by region both theoretically and empirically. Another contribution of our work is to propose more robust methodological approaches. In this respect, our first approach examines whether the movement of the efficient frontier is significant after the addition of financial assets to a reference portfolio (mean-variance spanning methodology). The second approach investigates the long-term relationship between the U.S. market and the three strategies of international diversification using the multivariate cointegration analysis proposed by Johansen (1988) and developed by Johansen & Juselius (1990).

Our empirical tests will be based on the comparison of performances of investable indexes that are used as an underlying for exchange traded funds (ETFs). Ideally, the direct use of ETFs would have been better. However, data on ETFs are not available for all countries, sectors, and regions. On the other hand, some studies have shown that ETFs sufficiently replicate their underlying indexes and do not suffer from the permanent premium or discount unlike conventional mutual funds (Harper et al. 2003, Ackert and Tian 2000; Delcoure and Zhong, 2003 2007). Thus, we consider that it is appropriate to use investable indexes in our analysis. The remainder of this paper is organized as follows. In section 2, we present our theoretical arguments. Section 3 describes the data and the methodological framework. We discuss our main findings in section 4 before concluding in section 5.

Portfolio Return Decomposition and International Diversification Strategies

Our theoretical approach builds on the work developed by Campbell & Shiller (1988) Campbell (1991), and Viceira & Wang (2018). The starting point of our analysis is to propose the following return decomposition: Unexpected Portfolio Returns = f (Cash-flow shocks + Discount rate shocks). We also consider that globalization is the result of capital markets (financial) integration and real markets (trade) integration. Following Ammer & Mei (1996) and Viceira & Wang (2018), we argue that capital markets integration should increase cross-country discount rate correlations because strong financial integration reduces the differentials in the cost of equity capital across countries. A full financial integration suggests a complete convergence of equity premiums across countries. In the same line of reasoning, high trade integration could also increase cross-country cash-flow correlations because a strong synchronization of trade flows and economic activities should lead to common cash-flow shocks.

Our return decomposition suggests that correlated cash-flows and correlated discount rates are two potential sources of the secular increase in cross-country return correlations. There is also the possibility that cash-flows and discount rates can be cross-correlated. However, in the literature, many studies (e.g., Viceira and Wang, 2018) have shown that these cross correlations are empirically small. To better understand the impact of the secular increase in the cross-country return correlations, we should examine the contribution of each source to portfolio valuations and returns. One key element is whether the potential increased cross-country correlations of each source are permanent or transitory. Another key element is whether the secular increase in the cross-country return correlations over the 1986-2016 period is driven by a transitory or a permanent source of risk. We argue that a transitory increase in cross-country correlations should impact mostly short-term portfolio returns and have less effect on long-term returns. Long-term positions in risky global assets can help investors hedge against a transitory fall in the expected global diversification effects. Therefore, long-term investors can still find that holding globally equity portfolios is an effective investment strategy that maximizes portfolios' risk adjusted returns. On the other hand, persistent shocks should raise the risk of globally diversified portfolios at all horizons (for short-term and long-term investors). Empirically many authors (e.g., Viceira and Wang, 2018) have found that discount rate shocks have only a temporary impact on stock returns. In addition, increased correlations of transitory discount rate shocks represent the main source of the increase in cross-country return correlations over the 1986-2016 period. By contrast, there is no empirical evidence of an increase in cross-country cash-flow correlations during the same period (Viceira and Wang, 2018). This imply that long-term investors still have the possibility to reduce the risk of persistent cash-flow shocks through international portfolio diversification. Such investors should care about their ability to diversify cash-flow shocks since the impact of transitory discount rate shocks should dissipate at long horizons (Viceira and Wang, 2018). In other word, investors should focus on answering the following question: which investment approach can maximize international portfolios' risk-adjusted returns?

Even though many papers results suggest that country-based approaches can maximize portfolios' risk-adjusted returns, some authors (e.g., Roll, 1992) argue that industry-based approaches to portfolio investment can also capture higher expected returns while reducing risk. To date, most of the literature addresses the question of whether country diversification provides more benefits over industry diversification. In addition to the two traditional strategies of international portfolio diversification, we argue that a third strategy (diversification by region) can also offer substantial benefits to international investors. In this respect, regional trade agreements can have significant impacts on the growth of trade both with member countries and non-member countries (Clausing, 2001). The benefits of investment strategies based on regionalism should depend on whether member countries (much less the rest of the word) will gain from the increased trade caused by the regional free trade agreement. In other word, such benefits should be linked to the extent of trade creation relative to trade diversion. As suggested by Clausing, 2001: "Trade creation occurs when the lowering of tariffs allows partner country imports to replace high-cost domestic production. Trade diversion, on the other hand, occurs when the removal of tariffs causes trade to be diverted from a third country to the partner country despite the fact that, were the countries treated equally, the third country would be the low-cost source of imports" (P. 679). When the gains from the regional trade agreement are at the expense of non-member countries (strong trade diversions), we should expect a reduction in cash-flow correlations between member countries and non-member countries and therefore more benefits linked to diversification strategies based on regionalism. In addition, regional integration should also impact member and non-member countries financial integration. We argue that if financial integration progresses more significantly within member countries, we should expect a more pronounced reduction in the dispersion of discount rates among member countries in comparison to the same trend worldwide. The potential deviation from convergence across different economic regions could occur because of differences in information environments, investment opportunities, saving rates, corporate governance, and the quality of regional institutions. As a result, a strong (weak) convergence in the cost of equity within (outside) regions should allow investors to benefit from investment strategies based on regionalism. In the next section, we propose two empirical approaches that will help us examine the merits of the three strategies.

Data and Methodology

Our data consists of monthly returns of the S&P500 index, U.S. 10 years Treasury bonds, and market indexes of MSCI and S&P denominated in U.S. dollars. Our tests cover the period between 31 December 1994 and 31 January 2008. Unfortunately, we do not have access to additional data beyond 2008. The sample consists of 22 developed countries, 19 emerging countries, and 6 regions. The sample also contains 10 global industries proposed by S&P. All types of selected indexes are actively used in passive investment strategies (e.g., iShares). The latter is the name given to the range of ETFs from Barclays Global Investors in the U.S and Canada which are designed to replicate the performance of investable indices constructed by MSCI and S&P.

MSCI, a global financial firm owned by Morgan Stanley, manages many indexes ranging from major global indices (such as the MSCI World Index) to regional indexes (such as the MSCI Europe) and country indexes. MCSI has reorganized its indexes in 2002. Rebalancing and reconstitution are quarterly, one region at a time. All indexes are reviewed every 18 months. The revision considers, as they happen, special events affecting weights and the representation of industries. Changes are announced two weeks in advance. S&P is another major index provider. The S&P 1200 Index is the first global index to be calculated in real time. It covers 31 countries in 6 different regional groupings: S&P 500, S&P TSX 60, S&P Latin America 40 Index, S&P TOPIX 150, S&P Asia Pacific 100 and the S&P Europe 350. Each of these indexes is made under the same rules as the S&P500, with the addition of a free float factor. The proportion of each component depends on the size of its market value adjusted in the global equity market. Changes of 5% are updated immediately, those of less than 5% are reflected on a quarterly basis. Changes to the index are announced 10 days in advance. The index is divided into 10 sectors according to the Global Industry Classification Standards.

Mean-Variance Spanning Test

In this section, we present the mean-variance spanning methodology that examines the benefits of international diversification for a U.S. investor whose portfolio includes the S&P 500 index and U.S. treasury bonds with 10 years maturity. We assume that the U.S. investor plans to invest in 22 developed countries, 19 emerging countries, 10 global industries and 6 regions. The mean-variance spanning analysis will let us know if there are significant additional diversification gains when an investor holding a portfolio of local (reference) assets decides to invest in foreign countries, sectors, and regions. For instance, when one test shows that adding country indexes to the portfolio improves its performance (significantly moves the efficient frontier), we can conclude that country diversification is an effective strategy. If we also include global industry indexes and we get significant additional benefits, then industry motivated diversification strategies are also effective and can be considered as not equivalent to country diversification strategies. Otherwise, the potential of international diversification achieved by both countries and industries is, at best, equivalent to the potential of international diversification by country. The same logic will apply to regional diversification strategies.

In analyzing the performance of a portfolio, the question of whether a set of risky assets can improve the investment opportunity of another set of risky assets has received considerable attention. Assuming that investors are only concerned with the mean and variance of the assets, the question of whether an investor can improve the efficiency of the mean-variance frontier by including other assets in the portfolio was originally proposed by Huberman and Kandel (1987). These authors offer a test based on a regression and examine whether the mean-variance frontier of a set of K reference assets is the same as the mean-variance frontier of the K reference assets increased by N additional assets (test or trial assets). Following the study of Huberman and Kandel (1987), Ferson, Foerster and Keim (1993) have developed the mean-variance spanning analysis under the assumption of non-normality and conditional heteroscedasticity. De Santis (1993) and Bekaert and Urias (1996) also developed the mean-variance spanning test under the approach of the stochastic discount factor (SDF). Other studies have focused on the same issue, including DeRoon, Nijman and Werker (2001); Korkie and Turtle (2002); Ahn, Conrad, and Dittmar (2003); Jagannathan, Skoulakis, and Wang (2003). When the set of *K* risky assets spans a wider set of *K+N* risky assets, we consider the mean-variance frontier of the K assets to be identical to the frontier of *K+N* assets.

Huberman and Kandel (1987) formalized the spanning test as follows: Let $R_t = \left[R_{1t}^{'}, R_{2t}^{'} \right]^{'}$ be the row vector of the returns of the *N+K* risky assets at moment t, with R_{1t} the vector with returns fo the K risky reference assets at moment t, and R_{2t} the vector of N risky test assets at moment t. Let μ be the expected return of N+K risky assets:

$$\mu = E\left[R_t\right] = \begin{bmatrix} \mu_1 \\ \mu_2 \end{bmatrix}$$

And the variance-covariance matrix of the N + K assets is:

$$V = Var\left[R_t\right] = \begin{bmatrix} V_{11} & V_{12} \\ V_{21} & V_{22} \end{bmatrix}$$

Making a regression of R_{2t} with respect to R_{1t}, we obtain the following equation:

$$\mathrm{R}_{2t} = \alpha + \beta.\mathrm{R}_{1t} + \varepsilon_t \qquad (1)$$

R_2 , α and ε are vectors with dimension N × 1, R_1 is a vector with dimension K× 1 and β is a matrix with dimension N × K.

R_1 is the vector of returns of the reference assets and R_2 is the vector of returns of the test assets. Vectors R_1, R_2 and ε are random vectors. The random vector ε is not correlated with the random vector R, and the expected value of each element in ε is equal to 0: $E\left[\varepsilon_t\right] = 0_N$ and $E\left[\varepsilon_t R_{1t}^{'}\right] = 0_{N\times K}$

0_N and $0_{N\times K}$ are two vectors where all elements are null elements. α and β are estimated respectively by the two following equations: $\alpha = \mu_2 - \beta\mu_1$ and $\beta = V_{21}V_{11}^{-1}$.

Let $\delta = 1_N - \beta 1_K$. Huberman et Kandel (1987) formulate the necessary and sufficient conditions for the spanning in terms of restrictions of α and δ . In fact, to determine whether the mean-variance frontier derived by R is the same as the mean-variance frontier generated by R_1, we need to test the following two relationships:

$$H_0 : \alpha = 0_N \ , \ \delta = 0_N .$$

The intuition behind this assumption is that the returns of *N* (new) test assets can be perfectly replicated (spanned) by the returns of the *K* reference assets. Indeed, returns of added assets can be written as a linear combination of the returns of the reference assets plus an error term with mean zero. In addition, the variance of the test assets is higher than that of the reference assets since R_t and ε_t are not correlated and $\mathrm{Var}(\varepsilon_t)$ positive definite. In the case of spanning, no investor may improve his mean-variance frontier by including new assets in his investment universe. Huberman and Kandel test these hypotheses using the likelihood ratio test on the OLS estimations of equation (1).

To get a better understanding of what the two conditions $\alpha = 0_N$ and $\delta = 0_N$ represent, we consider two portfolios on the efficient frontier generated by K + N assets whose weights are given by the following two equations:

$$w_1 = \frac{V^{-1}\mu}{1'_{N+K}V^{-1}\mu}$$

$$w_2 = \frac{V^{-1}1_{N+K}}{1'_{N+K}V^{-1}1_{N+K}}$$

We know, according to Merton (1972) and Roll (1977), that the first portfolio is the tangency portfolio of the origin and the second is the minimum variance portfolio.

Let $\Sigma = V_{22} - V_{21}V_{11}^{-1}V_{12}$ and let $Q = \left[0_{N\times K}, I_N\right]$. The weights of the *N* test assets in the two portfolios are given respectively by the following formula:

$$Q_{w1} = \frac{QV^{-1}\mu}{1'_{N+K}V^{-1}\mu} = \frac{\left[-\Sigma\beta, \Sigma^{-1}\right]\mu}{1'_{N+K}V^{-1}\mu} = \frac{\Sigma^{-1}\left(\mu_2 - \beta\mu_1\right)}{1'_{N+K}V^{-1}\mu} = \frac{\Sigma^{-1}\alpha}{1'_{N+K}V^{-1}\mu}$$

$$Q_{w2} = \frac{QV^{-1}1_{N+K}}{1'_{N+K}V^{-1}1_{N+K}} = \frac{\left[-\Sigma\beta, \Sigma^{-1}\right]1_{N+K}}{1'_{N+K}V^{-1}1_{N+K}} = \frac{\Sigma^{-1}\left(1_N - \beta 1_N\right)}{1'_{N+K}V^{-1}1_{N+K}} = \frac{\Sigma^{-1}\delta}{1'_{N+K}V^{-1}1_{N+K}}$$

From these two expressions, we can deduce that the test $\alpha=0_N$ is equivalent to whether the weights of the *N* test assets are zero in the tangency portfolio at the origin, and the test $\delta = 0_N$ is a test to examine if the weights of the N test assets are zero in the minimum variance portfolio. Based on the separation theorem, we know that when there are two portfolios on the efficient frontier generated by N + K assets such that the weights of the N test assets are zero, then the weights of the N assets in any portfolio on the efficient frontier generated by N + K assets are zero. Finally, a crucial hypothesis of the test of Huberman and Kandel (1987) is that (conditional to R_t) the errors ε_t are independent and identically distributed according to a multivariate normal distribution with mean zero and variance σ. However, if the distribution of R_t is not normal and conditional heteroscedastic, the likelihood ratio test will no longer be asymptotically distributed as a χ^2_{2N} under the null hypothesis. In this case, an alternative is the Bekaert and Urias (1996) GMM model based on a likelihood ratio that corrects for autocorrelation. In this study, we will use the Huberman and Kandel (1987) approach and the Bekaert and Urias (1996) model as a robustness test. In sum, the main question addressed by our first methodology is whether a U.S. investor who holds a well diversified local portfolio (the reference portfolio) can improve its performance by successively adding new series of assets representing countries, sectors, or regions. The inclusion of each assets class across the reference portfolio should significantly move the efficient frontier to the left only if the new assets are not "mean variance spanned (replicated)" by the reference portfolio.

Test of The Multivariate Cointegration

Our second methodology should allow us to perform a detailed analysis of the dynamics of the long-term interdependence between price series of three portfolios representing the three international diversification strategies. More specifically, we propose to test for cointegration using Johansen and Juselius (1990) analysis. We also examine the temporal dynamics of this relationship by the recursive cointegration procedure proposed by Hansen and Johansen (1999). The main objective is to verify the potential existence of a long-term relationship between the three strategies. In the presence of cointegration, we can conclude that these three strategies are linked by a linear relationship in the long term. Therefore, the strategies proposed in this study should not be different. In the absence of cointegration, we can infer that these strategies are different. Each strategy should then allow investors to obtain substantial benefits from international diversification. The multivariate cointegration tests have been widely used in the empirical analysis of co-movements between capital markets. These tests determine the cointegration rank (the number of common stochastic trends) in a system with multiple non-stationary variables. Two tests have been proposed: the trace test and the maximum eigenvalue test. Due to the extreme popularity of these tests, we limit ourselves to a brief description. The trace test, which verifies the null hypothesis of r cointegration relationships against the hypothesis of no cointegration relationships, is based on the following statistic:

$$\lambda_{trace} = -T \sum_{i=r+1}^{n} \log(1-\widehat{\lambda}_i)$$

with *r=0, 1, 2,…., n-2, n-1,* and $\widehat{\lambda}_i$ representing the estimation of the *ith* eigenvalue of the following problem:

$$\left| \lambda S_{kk} - S_{k0} S_{00}{}^{-1} S_{0k} \right| = 0$$

The test of the maximum eigenvalue, which tests the null hypothesis *H(r)* of *r* cointegration vectors against the hypothesis *H(r+1)* of *r*+1 cointegration vectors is based on the following formula:

$$\lambda_{\max} = -T \log(1-\widehat{\lambda}_{r+1})$$

The critical values for both tests were classified by Osterwald-Lenum (1992). Cheung and Lai (1995) conduct Monte Carlo tests and suggest that the trace statistic is more robust for testing the asymmetry and excess kurtosis (in residues) compared to the maximum eigenvalue test. Therefore, when interpreting the results, we give more weight to the findings of the trace test. We first use the cointegration tests of Johansen and Juselius (1990) to obtain preliminary evidence for the presence or absence of cointegration relationships (long-term linear relationship) in the system of three portfolios representing our strategies of international diversification. We present the results for the specification of a VAR with three different models regarding the intercept, the trend in the data and in the cointegrating relationship. The number of lags is equal to two.

Empirical Results

For the mean-variance spanning tests, the results of including separately countries (developed and emerging countries), industries, and regions are presented in Table 1, 2, 3 and 4. In each table, Panel A presents the findings of the Huberman and Kandel test, while Panel B the results of the Bekaert and Urias GMM estimation. Each of the two panels also presents the findings for the entire sample period (1994 -2008) and for two sub-periods: December 1994-December 1999 and January 2000-January 2008. We report essentially p-values associated with the mean-variance spanning analysis. In all 4 Tables, the reference portfolio is composed of the S&P500 index and U.S. 10 years Treasury bonds. The tests (Table 1 to Table 4) are performed for each strategy. In Table 5, the analysis is performed for the three strategies all together. We interpret the value of p-values as the threshold at which we can reject the null hypothesis (the mean-variance spanning). The greater the p-value, the greater we are confident that a given index or portfolio is "mean-variance spanned" and therefore has no positive diversification effect. For analytical purposes, we choose the 5% threshold for rejecting the null hypothesis

Table1. Mean-variance-spanning tests for developed countries

		Panel A: Huberman-Kandel (OLS)			**Panel B: Bekaert-Urias (GMM)**		
		1994-2000	**2000-2008**	**1994-2008**	**1994-2000**	**2000-2008**	**1994-2008**
Developed markets							
Europe	Austria	0.000	0.045	0.000	0.005	0.358	0.005
	Belgium	0.000	0.444	0.004	0.000	0.606	0.008
	Denmark	0.002	0.294	0.175	0.036	0.300	0.176
	Finland	0.135	0.053	0.007	0.085	0.082	0.009
	France	0.054	0.410	0.520	0.085	0.639	0.659
	Germany	0.051	0.004	0.482	0.111	0.136	0.601
	Greece	0.749	0.028	0.363	0.772	0.462	0.452
	Ireland	0.003	0.326	0.014	0.029	0.426	0.009
	Italy	0.284	0.893	0.177	0.320	0.920	0.351
	Holland	0.007	0.295	0.524	0.116	0.642	0.550
	Norway	0.037	0.054	0.305	0.305	0.097	0.397
	Portugal	0.042	0.467	0.037	0.133	0.690	0.092
	Spain	0.798	0.102	0.426	0.862	0.450	0.523
	Sweden	0.369	0.003	0.082	0.734	0.173	0.264
	Switzerland	0.026	0.096	0.004	0.212	0.162	0.014
	UK	0.000	0.057	0.000	0.000	0.145	0.000
Pacific	Australia	0.003	0.358	0.000	0.019	0.520	0.101
	Hong Kong	0.714	0.786	0.287	0.849	0.836	0.336
	Japon	0.009	0.003	0.000	0.135	0.109	0.011
	New Zeland	0.006	0.022	0.000	0.095	0.443	0.025
	Singapour	0.283	0.645	0.023	0.700	0.750	0.150
	Canada	0.619	0.029	0.113	0.734	0.047	0.174
	All the countries	**0.005**	**0.000**	**0.000**	**0.000**	**0.000**	**0.004**

For Table 1, which represents the diversification strategy by country (developed countries), the results for both tests and for the entire period reject spanning at 5% for the following countries: Austria, Belgium, Finland, Ireland, Switzerland, UK, New Zealand, and Japan. These countries have provided throughout the entire period of the study significant positive benefits. The rest of the countries offer fewer diversification benefits. Both tests also reject spanning when all developed countries are included together. Our findings are consistent with Errunza et al. (1999) but are contradictory to DeSantis (1994) results. On the other hand, the findings of the two sub-periods are not stable. The second period results suggest more spanning and therefore less benefits linked to international diversification by country. This could be interpreted as evidence that global equity markets are increasingly integrated in the second sub-period 2000-2008, reducing some benefits linked to international diversification.

Table 2. Mean-variance-spanning test for emerging countries

		Panel A: Huberman-Kandel (OLS)			**Panel B: Bekaert-Urias (GMM)**		
		1994-2000	**2000-2008**	**1994-2008**	**1994-2000**	**2000-2008**	**1994-2008**
Emerging markets							
Europe	Czech Republic	0.030	0.174	0.001	0.065	0.540	0.099
	Hungary	0.333	0.256	0.120	0.272	0.426	0.063
	Poland	0.979	0.191	0.231	0.986	0.162	0.296
	Russia	0.165	0.002	0.007	0.456	0.003	0.030
Asia	China	0.996	0.232	0.189	0.996	0.259	0.287
	India	0.013	0.247	0.008	0.033	0.590	0.143
	Indonesia	0.588	0.187	0.044	0.779	0.510	0.132
	Korea	0.234	0.012	0.028	0.707	0.034	0.164
	Malaysia	0.899	0.078	0.110	0.865	0.080	0.330
	Pakistan	0.086	0.376	0.005	0.210	0.685	0.110
	Philippines	0.323	0.123	0.003	0.726	0.431	0.151
	Taiwan	0.593	0.978	0.485	0.580	0.984	0.588
	Thailand	0.131	0.128	0.001	0.707	0.336	0.106
Latin America	Argentina	0.926	0.151	0.121	0.933	0.572	0.272
	Brazil	0.529	0.000	0.004	0.861	0.000	0.020
	Chile	0.124	0.176	0.009	0.244	0.509	0.157
	Colombia	0.018	0.019	0.002	0.199	0.513	0.116
	Mexico	0.650	0.008	0.010	0.609	0.009	0.032
	Peru	0.085	0.421	0.062	0.494	0.609	0.318
	All the countries	**0.043**	**0.000**	**0.000**	**0.000**	**0.199**	**0.004**

For emerging countries presented in Table 2, we find that 12 out of 19 countries have a positive contribution for the entire sample period based on Huberman and Kandel test. These results contrast with the findings of DeSantis (1994) and Bekaert and Urias (1996) but are consistent with of Errunza et al. (1999). The Huberman and Kandel test also rejects spanning when all emerging countries are included together. On the other hand, when we rely on Bekaert and Urias (1996) test, most emerging countries do not significantly move the efficient frontier. Furthermore, the findings suggest that all emerging countries do not offer significant diversifications benefits for the second sub-period (2000-2008).

Table 3. Mean-variance-spanning tests by industry

	Panel A: Huberman-Kandel (OLS)			**Panel B: Bekaert-Urias (GMM)**		
	1994-2000	**2000-2008**	**1994-2008**	**1994-2000**	**2000-2008**	**1994-2008**
Global sectors						
Basic Comsumption	0.000	0.000	0.000	0.064	0.000	0.000
Discretionary Comsumption	0.004	0.414	0.089	0.044	0.447	0.304
Energy	0.030	0.667	0.034	0.160	0.711	0.043
Finance	0.596	0.871	0.798	0.866	0.926	0.755
Healthcare	0.330	0.000	0.000	0.419	0.000	0.000
Information technologies	0.038	0.000	0.000	0.049	0.002	0.000
Materials	0.003	0.200	0.005	0.177	0.232	0.095
Industrial products	0.000	0.359	0.033	0.002	0.599	0.083
Telecommunications	0.018	0.077	0.296	0.624	0.532	0.339
Utilities	0.000	0.002	0.000	0.000	0.007	0.000
All sectors	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

The results of the sector diversification strategy are presented in Table 3. Based on both tests, we find that all global industries offer significant advantages over the full sample period and the two sub-periods. On the other hand, when we run both tests for each sector separately, only 5 sectors (among the 10 sectors included in the study) have a lesser than 5% p-value and thus offer significant diversifications gains over the entire period. Based on the second sub-period findings, only four sectors offered significant diversification gains. These additional results confirm once again that the benefits from international diversification have declined during the period 2000-2008.

Table 4 presents the results of the strategy of diversification by region. Based on both tests, we show that including all egions to a local portfolio offers significant positive gains for all periods. However, when we run both tests for each region separately, only 3 regions (among the 6 included in study) have a lesser than 5% p-value and thus offer significant diversifications gains over the entire period. Furthermore, the most important result from table 4 is that the benefits of international diversification by region are more pronounced during the second period (2000-2008). This result means that when the two strategies by country and by industry have lost ground during the second period, the strategy of international diversification by region have gained in importance.

Table 4. Mean-variance-spanning tests by region

	Panel A: Huberman-Kandel (OLS)			Panel B: Bekaert-Urias (GMM)		
	1994-2000	**2000-2008**	**1994-2008**	**1994-2000**	**2000-2008**	**1994-2008**
Regions						
Developed Europe	0.000	0.836	0.035	0.005	0.843	0.072
Developed Pacifique	0.009	0.006	0.000	0.135	0.165	0.024
North America	0.491	0.040	0.032	0.687	0.039	0.037
Emerging Europe	0.682	0.007	0.055	0.791	0.077	0.120
Emerging Asia	0.326	0.185	0.004	0.500	0.346	0.181
Latin America	0.768	0.000	0.003	0.910	0.001	0.036
All the regions	**0.013**	**0.000**	**0.000**	**0.005**	**0.000**	**0.000**

Table 5 presents the results of the combined three diversification strategies. In each of the nine experiments, a reference portfolio is composed of a local portfolio plus one or two international diversification strategies. The test portfolio is always composed of one of the three international diversification strategies. We find that, for the entire period, the strategy of diversification by country improves both the sector and region strategies. However, the same strategy was less effective for the period 1994-1999 when the sectors are included in the reference portfolio (reference 1). In the same line of reasoning, the sector diversification strategy also improves the other two strategies for the entire period but was less effective between 1994 and 1999 when country indexes are added in the reference portfolio (reference 3). This result means that both sector and country strategies were equivalent during the period 1994-1999 and each of them captures the same potential of international diversification.

Over the full sample period, the strategy of diversification by region has only improved the performance of a portfolio diversified by sectors. On the other hand, such strategy was effective in all cases (reference 5 and 6) during the period 2000-2008. This result confirms again that the strategy of diversification by region has increased in value during the period 2000-2008.

Finally, when we include two strategies in the reference portfolio (7, 8 and 9) and we increase it including a third competitive strategy, we note that none of the three strategies has improved the risk-return characteristics of the portfolio during the first reference period. However, all three strategies were effective in the second period and the entire study period, with the supremacy of the country diversification strategy followed by the sector and regional strategies. These findings indicate that the three strategies are not equivalent, especially for the second sub-period. Indeed, each of these strategies provides additional gains, and none of them captures all the expected potential benefits of international diversification.

Table 5. Mean-variance-spanning tests for the three strategies

	Panel A: Huberman-Kandel (OLS)			Panel B: Bekaert-Urias (GMM)		
	1994-2000	**2000-2008**	**1994-2008**	**1994-2000**	**2000-2008**	**1994-2008**
Reference 1: Local+sectors **Test 1:** Country	0.2870	0.0040	0.0000	0.0000	0.0000	0.0000
Reference 2: Local+regions **Test 2:** Country	0.0110	0.0010	0.0000	0.0000	0.0000	0.0000
Reference 3: Local+Country **Test 3:** Sectors	0.3250	0.0010	0.0030	0.0060	0.0900	0.0060
Reference 4: Local+ regions **Test 4:** Sectors	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000
Reference 5: Local+Country **Test 5:** Regions	0.1410	0.0290	0.1470	0.0050	0.3080	0.3900
Reference 6: Local+sectors **Test 6:** Regions	0.2260	0.0050	0.0000	0.5500	0.0670	0.0360
Reference7: Local+sectors+regions **Test 7:** Country	0.7610	0.0020	0.0000	1.0000	0.0000	0.0000
Reference8: Local+Country+regions **Test 8:** Sectors	0.6620	0.0290	0.0040	0.0020	0.0000	0.0000
Reference9: Local+Country+sectors **Test 9:** Regions	0.6200	0.0430	0.0380	0.0960	0.0000	0.0000

In sum, the main results of the mean-variance spanning tests suggest that the three strategies of international diversification are independent and effective. Furthermore, the diversification strategy by region has gained in importance during the second sub-period while the other two strategies (by country and industry) have lost ground during the same period. Thus, an American investor with a portfolio of local S&P 500 index and government bonds can improve the performance of his portfolio by relying on these three strategies.

Table 6 and 7 present respectively the results for the tests of the multivariate cointegration (the trace and the maximum eigenvalue). These tests provide no evidence of the existence of a cointegration relationship between the price series of the three strategies over the full sample period and during the period between 2000 and 2008. However, for Model 1 (trace test), which is appropriate for the series of mean zero, there is a cointegration relationship for the period between 1994 and 2000 (at 10%). Such finding suggests that there is a linear relationship between the three strategies for the period 1994-2000 which is not present during the second period of the study.

Table 6. Test for the trace for three different periods and models

H0	H1	1994-2000 Trace	1994-2000 p-value	2000-2008 Trace	2000-2008 p-value	1994-2008 Trace	1994-2008 p-value
Model 1 : (AB'Yt-1): no intercepts or trends							
r=0	$r \geq 1$	22.2598	*0.0879*	17.688	*0.2963*	14.4972	*0.5292*
$r \leq 1$	$r \geq 2$	8.8762	*0.1765*	3.2668	*0.8131*	5.1051	*0.597*
$R \leq 2$	$r \geq 3$	3.0665	*0.0946*	0.0274	*0.8928*	0.6469	*0.6149*
Model 2 : (B'Yt-1 + C0) : intercepts but no trends in the data							
r=0	$r \geq 1$	26.8734	*0.324*	23.756	*0.507*	22.655	*0.5716*
$r \leq 1$	$r \geq 2$	11.5016	*0.5321*	7.1857	*0.8848*	9.4189	*0.7059*
$r \leq 2$	$r \geq 3$	3.9099	*0.4962*	2.9222	*0.6446*	0.6469	*0.9865*
Model 3 : A(B'Yt-1 + C0 + D0t) + C1 : intercepts and linear trends							
r=0	$r \geq 1$	33.8718	*0.3214*	35.154	*0.2538*	32.0686	*0.4164*
$r \leq 1$	$r \geq 2$	12.9308	*0.7455*	17.0497	*0.4501*	14.5964	*0.6261*
$r \leq 2$	$r \geq 3$	3.9577	*0.757*	3.9905	*0.7531*	3.9487	*0.758*

Table 7. Test for the maximum eigenvalue and for three different periods and models

H0	H1	1994-2000 $\lambda_{\max}$	1994-2000 p-value	2000-2008 $\lambda_{\max}$	2000-2008 p-value	1994-2008 $\lambda_{\max}$	1994-2008 p-value
Model 1 : (AB'Yt-1) no intercepts or trends							
r=0	*r=1*	13.3836	*0.2067*	14.4213	*0.15*	9.3921	*0.5841*
r=1	*r=2*	5.8097	*0.4314*	3.2393	*0.7592*	4.4582	*0.6038*
r=2	*r=3*	3.0665	*0.0946*	0.0274	*0.8928*	0.6469	*0.6149*
Model 2 : (B'Yt-1 + C0) intercepts but no trends in the data							
r=0	*r=1*	15.3718	*0.3858*	16.5703	*0.2854*	13.2361	*0.5649*
r=1	*r=2*	7.5917	*0.6263*	4.2635	*0.9426*	8.772	*0.5058*
r=2	*r=3*	3.9099	*0.4962*	2.9222	*0.6446*	0.6469	*0.9865*
Model 3 : A(B'Yt-1 + C0 + D0t) + C1 intercepts and linear trends							
r=0	*r=1*	20.941	*0.1939*	18.1042	*0.4091*	17.4722	*0.458*
r=1	*r=2*	8.9731	*0.7334*	13.0592	*0.3646*	10.6476	*0.5822*
r=2	*r=3*	3.9577	*0.757*	3.9905	*0.7531*	3.9487	*0.758*

Furthermore, to explore the temporal dynamics of the equilibrium relationship, we use the methodology of recursive multivariate cointegration proposed by Hansen and Johansen (1999). Figure 1 shows this relationship over time and for the entire period 1994-2008. Hansen and Johansen (1999) provide a method to analyze not only the magnitude but also the dynamics of long-term relationships. Their approach of recursive cointegration is based on the cointegration test of Johansen and Juselius (1990). The analysis is performed for an initial period and gradually updated when new data is added to the initial sample. The statistical test, here the trace, is calculated for the sample between t_0 and t_n . This sample is then increased by *j* periods and the statistics are re-estimated for the period between t_0 and t_{n+j} . Finally, when the estimation procedure reaches the last observation, the results are plotted for their interpretation. Figure 1 shows the temporal relationship of cointegration among the three strategies. A value greater than 1 indicates the existence of a cointegrating relationship. The recursive multivariate cointegration results suggest that there is great instability in the group dynamics, reflected in great variations in the cointegrating relationship.

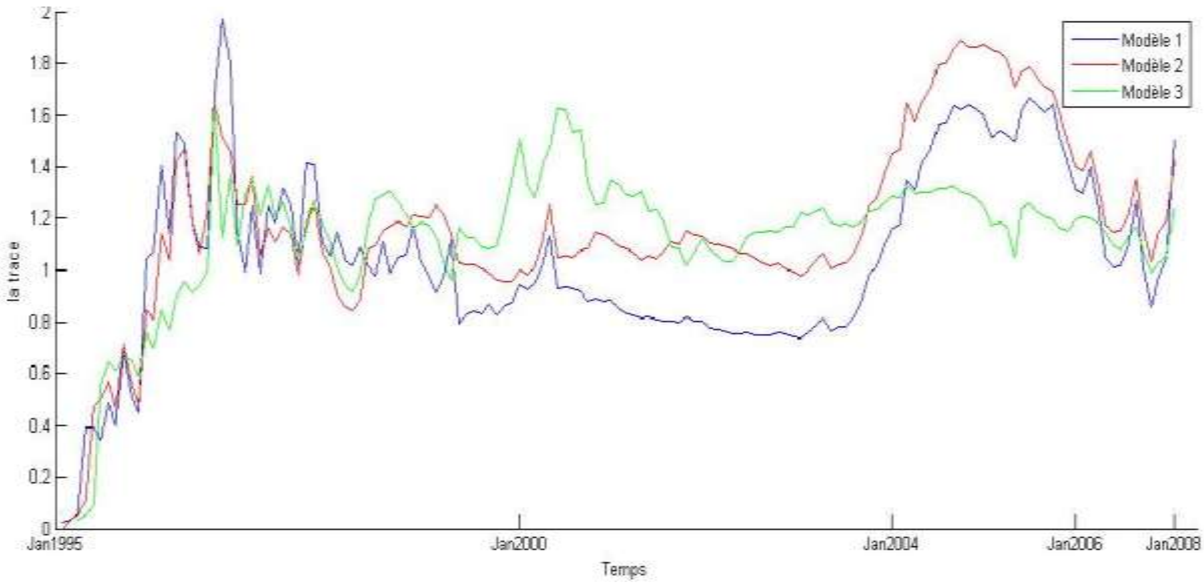

Figure 1. Measure of the statistic standarized trace of the cointegration relation among the three strategies

Conclusion

International portfolio diversification has been the subject of a large body of research. To date, most of the literature in the area examines whether country diversification provides more benefits over industry diversification. On the other hand, with the growing interdependence of world economies and comovements of financial markets (especially in times of higher volatility), the question of whether the benefits of global portfolio diversification have declined becomes important. In this paper, we propose theoretical arguments that explain why an increase in cross-country return correlations does not necessarily imply a reduction in the benefits of international portfolio diversification. We also propose to investigate empirically whether the benefits linked to the two traditional strategies of international diversification (by country and industry) remain relevant despite the secular increase in cross-country correlations. Furthermore, with the international trend toward regional economic integrations, the question of whether other international investment approaches (e.g., regional approaches) can also maximize portfolios risk-adjusted returns becomes important too. Hence, one contribution of this paper is to investigate theoretically and empirically the merits of the regional investment approach.

To examine and compare our three strategies of international diversification (by country, industry, and region), we use two different methodological approaches, namely the mean variance spanning and multivariate cointegration analysis. Our results indicate the following conclusions: First, the three strategies of international diversification are independent and effective strategies. Thus, an American investor, with a local portfolio composed of investments in the S&P500 Index and government bonds, can improve the performance of its portfolio by including the three strategies over the sample period. Second, during the second sub-period of our study (2000-2008), the traditional strategies, by countries and sectors, have lost ground while the benefits linked to regional diversification have been more pronounced. Therefore, future research should focus more on exploring the potential benefits of the third strategy both theoretically and empirically.

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