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Diversification Strikes Again: Evidence from Global Equity Factors

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Diversification is among the most fundamental, well-accepted concepts within our industry: investors can mitigate their portfolio risk by diversifying across different sectors, asset classes, countries, and investment strategies. The simplicity and robustness of this property makes it an ubiquitous goal across investment funds, asset managers, and advisors. Accordingly, a voluminous literature focuses on quantifying the degree of markets' integration and the potential for portfolio diversification. In particular, these studies concentrate on one or more major asset classes, such as equity indices, foreign currencies, or bonds.¹

Key Points

1. *International diversification has historically improved equity factor portfolio performance.*
2. *Diversification benefits do not appear to be equivalent across geographies. Geographically distant regions appear to offer superior diversification compared to neighboring regions.*
3. *Like major asset classes, international equity factors' returns tend to be more correlated during recessions and bear stock markets.*
4. *Unlike asset classes, the correlations of international equity factors' returns have not been rising over the last two decades, making the latter a desirable addition to a portfolio.*

Motivated by the recent rise and popularity of factor-based investing, our recent paper (Binstock, Kose, and Mazzoleni, 2017) extends the insights of geographic diversification to cross-sectional equity strategies. We explore whether long-standing benefits of geographical diversification also apply across six well-established equity factors: market, value, size, momentum, investment, and profitability. In particular, our focus centers on the portfolio implications of international factor investing across a set of major developed markets.

Our work offers four main insights. First, the potential benefits of global diversification apply to equity factor strategies. By diversifying an equity strategy across developed markets, investors can significantly reduce the volatility of their factor portfolio. Even for a US investor, who has access to a large domestic market, the volatility reduction across the equity factors is estimated up to 30%. Second, diversification gains do not tend to be equivalent across different regions. The returns of neighboring countries are more likely to co-move than geographically distant nations; that is, investors should be brave and look beyond their continents.

We also examine whether geographical diversification exhibits time-varying properties. Our third insight is that factor strategies tend to exhibit higher correlations across regions during economic downturns. As is the case within major asset classes, the benefits of diversification weaken when most needed. Unlike asset classes, however, the correlations of factor portfolios across regions have not been increasing over the last two decades, making global equity factors a particularly desirable addition to a portfolio. All in all, diversification is alive and well.

Performance of Regional Factor Portfolios

Before we delve into our findings, we offer a brief overview of our methodology and data. Our analysis builds on the Fama and French (2016) five-factor model and complements it with the momentum factor of Carhart (1997). The

“Global equity factors tend to explain regional factor average excess returns.”

investment factors are defined as follows. Value is book equity scaled by market capitalization. Size is market capitalization. Momentum is determined by the cumulative return over the past 12 months, excluding the immediately previous month. Investment is given by growth in total assets. Lastly, operating profitability is defined as total sales minus cost of goods sold, minus selling, general and administrative expenses, minus interest, all divided by total assets.

Our study focuses exclusively on the developed world, specifically, eight macro regions: United States, Japan, Germany, United Kingdom, France, Canada, Europe excluding the aforementioned three major economies, and Asia Pacific excluding Japan.² Within each macro region, we construct long-short factor portfolios. For instance, our value factor portfolio holds high book-to-market stocks and shorts low book-to-market stocks. More detail is available in Binstock, Kose, and Mazzoleni (2017).

In **Table 1**, we report the summary statistics for the six factors across all regions, and the evidence appears mixed: no single investment strategy displays excess returns that are uniformly significant across the eight regions. In particular, momentum is statistically weak in the United States and Japan, the two largest markets in terms of capitalization. Value lacks statistical significance in the United States, United Kingdom, and France; investment and profitability show statistical significance only in three regions; and lastly, the size factor is uniformly insignificant.³

The findings presented in Table 1 may appear discouraging. One could conclude that the international evidence in favor of these investment factors is poor. Yet **Table 2** suggests a different perspective: consistently high regional correlations indicate that these factors are unlikely the byproduct of chance.

Table 1. Excess Returns of Factor Portfolios, Nov 1990–Feb 2016

| | Asia ex Japan | Other Europe | France | Germany | United Kingdom | Japan | Canada | United States |
|--|------------------|-----------------|---------------|---------------|-------------------|--------------|---------------|------------------|
| <i>Panel A. Market Factor (MKT)</i> | | | | | | | | |
| Mean | 7.32% | 7.01% | 6.51% | 5.48% | 5.38% | 1.31% | 6.57% | 8.31% |
| Volatility | 17.55% | 15.85% | 16.85% | 17.33% | 13.92% | 18.52% | 13.79% | 14.60% |
| Sharpe Ratio | 0.42 | 0.44 | 0.39 | 0.32 | 0.39 | 0.07 | 0.48 | 0.57 |
| <i>Panel B. Value Factor (HML)</i> | | | | | | | | |
| Mean | 7.79% | 4.32% | 3.45% | 9.16% | 2.34% | 5.21% | 4.16% | 3.46% |
| Volatility | 10.28% | 9.01% | 12.84% | 11.16% | 10.17% | 9.93% | 14.30% | 12.45% |
| Sharpe Ratio | 0.76 | 0.48 | 0.27 | 0.82 | 0.23 | 0.52 | 0.29 | 0.28 |
| <i>Panel C. Size Factor (SMB)</i> | | | | | | | | |
| Mean | 0.74% | -1.01% | 0.64% | -1.86% | 1.58% | 0.18% | 2.58% | 1.80% |
| Volatility | 10.08% | 8.02% | 9.79% | 10.85% | 10.95% | 11.58% | 8.94% | 9.39% |
| Sharpe Ratio | 0.07 | -0.13 | 0.07 | -0.17 | 0.14 | 0.02 | 0.29 | 0.19 |
| <i>Panel D. Momentum Factor (WML)</i> | | | | | | | | |
| Mean | 9.44% | 11.00% | 7.09% | 10.70% | 12.46% | 1.50% | 17.39% | 5.80% |
| Volatility | 16.06% | 15.31% | 16.71% | 17.06% | 15.66% | 15.68% | 17.53% | 17.06% |
| Sharpe Ratio | 0.59 | 0.72 | 0.42 | 0.63 | 0.80 | 0.10 | 0.99 | 0.34 |
| <i>Panel E. Investment Factor (CMA)</i> | | | | | | | | |
| Mean | 2.64% | 2.28% | 3.28% | 4.44% | 3.81% | 1.23% | 3.33% | 3.44% |
| Volatility | 9.78% | 8.02% | 8.56% | 11.32% | 7.54% | 8.04% | 10.87% | 8.44% |
| Sharpe Ratio | 0.27 | 0.28 | 0.38 | 0.39 | 0.51 | 0.15 | 0.31 | 0.41 |
| <i>Panel F. Profitability Factor (RMW)</i> | | | | | | | | |
| Mean | 1.30% | 3.36% | 1.25% | 2.58% | 2.92% | 0.27% | 7.18% | 3.78% |
| Volatility | 10.20% | 5.69% | 7.43% | 7.83% | 6.33% | 6.05% | 13.47% | 11.24% |
| Sharpe Ratio | 0.13 | 0.59 | 0.17 | 0.33 | 0.46 | 0.04 | 0.53 | 0.34 |

Source: Research Affiliates, LLC, using monthly returns from Datastream and annual financials from Worldscope. Figures are based on monthly excess returns.

Note: Significance at the 5% level is indicated by boldface type.

Table 2. Average Cross-Region Correlations, Nov 1990–Feb 2016

| | Market | Value | Size | Momentum | Investment | Profitability |
|----------------------|--------|-------|------|----------|------------|---------------|
| <i>Eight Regions</i> | | | | | | |
| Across Eight Regions | 68% | 41% | 32% | 56% | 32% | 13% |
| <i>Seven Regions</i> | | | | | | |
| With the US Factor | 71% | 49% | 22% | 62% | 38% | 20% |

Source: Research Affiliates, LLC, using monthly returns from Datastream and annual financials from Worldscope. Figures are based on monthly excess returns.

“Investors should look beyond their continents when diversifying their portfolios.”

Table 2 shows that the regions’ portfolios tend to be significantly correlated. For instance, across the eight regions, the value portfolios display an average correlation of 41%, whereas the momentum portfolios’ average is 56%. The magnitude of these correlations is similar if computed between the excess returns of the US portfolios and the average excess returns of the remaining seven regions. In particular, all international factor portfolios display a statistically significant correlation with the US portfolios.

How should one interpret this international evidence? We argue that regional factor portfolios reflect both common variation, which we define as the global factor, and region-specific variation. As explained in the next section, a global factor has a simple interpretation: the average excess return across regions. This explains the high cross-region correlations in Table 2. The region-specific component reflects potentially uncompensated risk, which can be diversified away by simply investing across national markets.

Performance of Global Factor Portfolios

In **Table 3**, we evaluate the performance of the global components of the market, value, size, momentum, investment, and profitability factors. Because of a strong correlation with the first principal component of each equity factor, we conclude that a simple average of the excess returns across the eight regions offers an accurate measure of a global factor. Except for size, the global factor portfolios are all statistically significant, and the *t*-statistics of the value, momentum, and profitability factors are above 3.⁴

The significance of these global equity factors raises at least two questions. First, can the global factors explain the average excess returns associated with the regional portfolios of Table 1? Answering this question should reveal the sources of the risk premia that characterize these investment styles, which could be region-specific or global in nature. Second, what are the diversification benefits from implementing an equity strategy at the international level? The answer to this question will depend on the region-specific volatility, which could be diversified away by investing across different regions.

As for the first question, we find that global equity factors do tend to explain regional factor average excess returns. With the exception of value in Asia ex Japan and Germany, and momentum in Canada, no individual factor portfolio

Table 3. Statistics of Global (Mean) Factor Portfolio, Nov 1990–Feb 2016

| | Market | Value | Size | Momentum | Investment | Profitability |
|-------------------------------------|---------------|--------------|-------|---------------|--------------|---------------|
| Mean | 5.99% | 4.99% | 0.58% | 9.42% | 3.06% | 2.83% |
| Volatility | 13.56% | 7.97% | 6.27% | 12.84% | 5.76% | 4.40% |
| Sharpe Ratio | 0.44 | 0.63 | 0.09 | 0.73 | 0.53 | 0.64 |
| Correlation with 1 st PC | 100% | 99% | 100% | 100% | 99% | 88% |

Source: Research Affiliates, LLC, using monthly returns from Datastream and annual financials from Worldscope. Figures are based on monthly excess returns. This table reports the performance of each global factor portfolio expressed as the equally weighted average of the eight regional factor portfolios. The bottom row reports the correlation between these factors and the first principal components of the eight factors as estimated in Binstock, Kose, and Mazzoleni (2017).

Note: Significance at the 5% level is indicated by boldface type.

offers a statistically positive excess return, or alpha, after controlling for its exposure to the global portfolio. In particular, this conclusion holds across the six factor portfolios in the United States, the nation having the most liquid stock market. Overall, the evidence is supportive of equity strategies' risk premia being explained by their exposure to global components.

We dedicate the next section to investigating the second question on the benefits of diversifying factor exposure internationally.

Diversification in Action

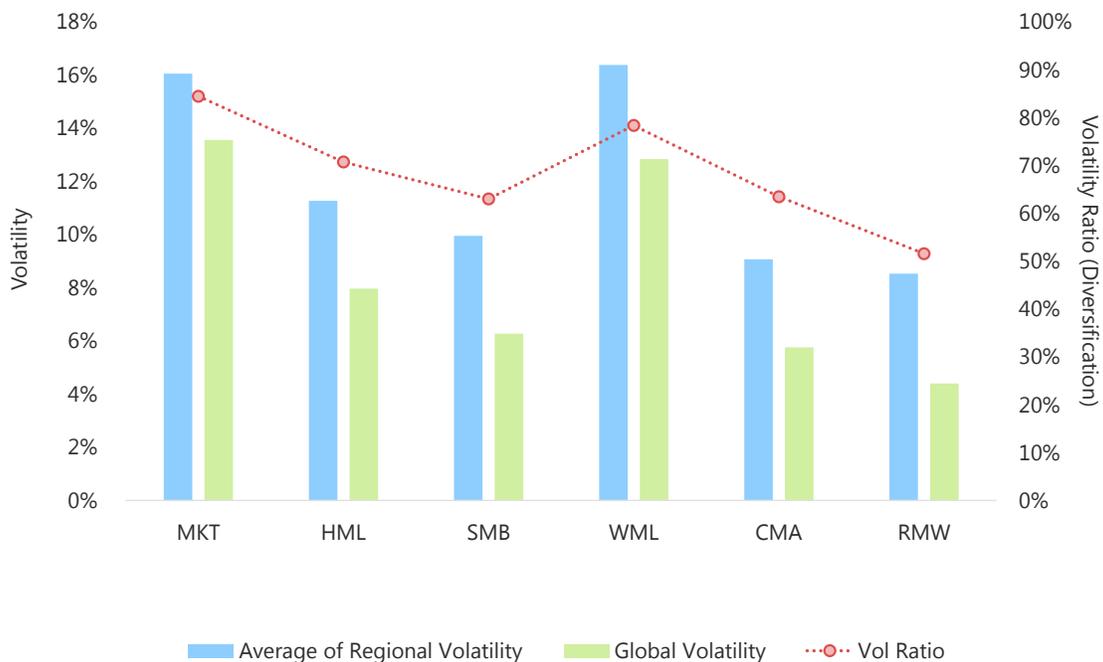
Our next step consists of quantifying the diversification benefits associated with the six global factors. For each investment style, we compare the volatility of the average

(global) factor portfolio's returns to the average return volatility across the eight regions. The ratio of these volatilities informs how much of the region-specific variation—the volatility uncorrelated to the global component—can be diversified by simply averaging an equity strategy across countries. Hence,

$$\text{Diversification Ratio} = \frac{\text{Volatility of Global Portfolio}}{\text{Average Volatility across Regions}}$$

Figure 1 illustrates the benefits of international diversification. By construction, the global portfolios' returns are identical to the average returns across the eight regions. Yet, the global portfolios' volatilities are markedly lower than the average of the regions. In general, the volatility of a global portfolio is about 30% lower than the average volatility (i.e., the diversification ratio is 70%).

Figure 1. Global (Average) Portfolio and Diversification Benefits, Nov 1990–Feb 2016



Source: Research Affiliates, LLC, using monthly returns from Datastream and annual financials from Worldscope. Figures are based on monthly excess returns.

Note: Blue bars are the average of regional factor volatilities. Green bars are the volatilities of the global factor portfolios (constructed as the average of the regional factor returns). The average portfolio returns and the average (global) portfolios are, by construction, identical. As highlighted by the red dots, however, the volatility of the average portfolio is typically 30% lower than the average volatility across the eight regions.

The diversification gains are, intuitively, the greatest for those factors whose average correlations in Table 2 are the lowest (investment and profitability). Individual regional factor portfolios may offer noisy exposures to an underlying systematic source of excess returns, and low correlations could indicate particularly noisy signals and portfolios. Averaging across countries is a way to minimize the noise of the investment signal and access a more robust source of excess returns.

Diversification benefits should not be expected to be uniform across regions. Neighboring regions are likely to co-move more than those that are geographically distant. For instance, Germany and France have tight economic and financial links, and Canada directs 70% of its exports to the United States. Therefore, investors should look beyond their continents when diversifying their portfolios.

To appreciate the diversity of the relationships between various region-pair portfolios, we look at the average

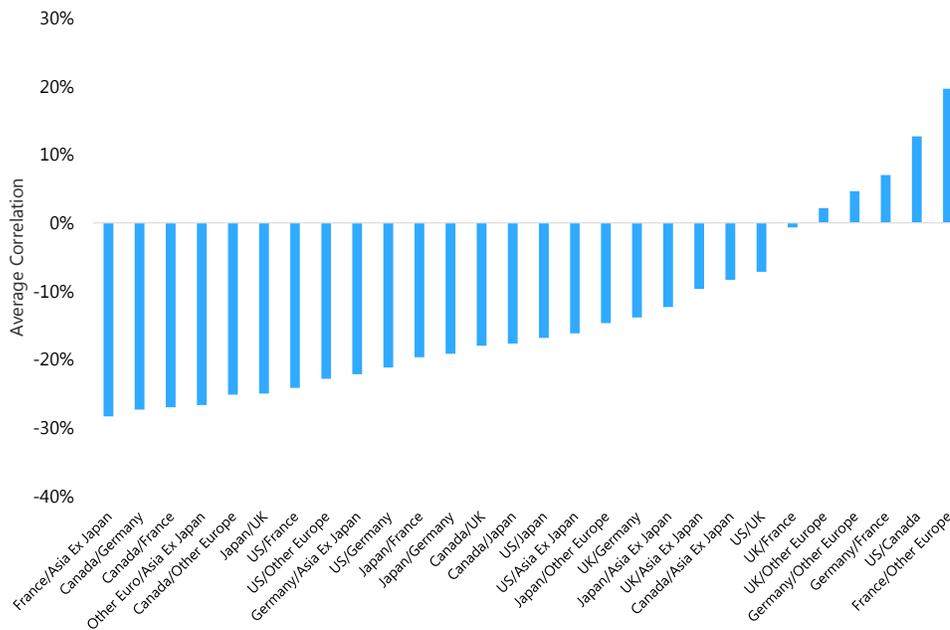
“Time-series trends observed across global markets do not extend to long-short equity factor portfolios.”

correlation between the region-specific returns of all region pairs. The region-specific returns for a certain investment strategy are defined as follows:

$$\text{Region-Specific Returns} = \text{Excess Return} - \beta \times \text{Global Returns}$$

In **Figure 2**, we plot the average correlation between the region-specific returns across the six factors. For instance, the average correlation between France and Other Europe is almost 20%, and it is computed across the market, value,

Figure 2. Average Factor Correlation of Region-Specific Returns (Residuals), Nov 1990–Feb 2016



Source: Research Affiliates, LLC, using monthly returns from Datastream and annual financials from Worldscope. Figures are based on monthly excess returns.

Note: This figure reports the average correlation between the region-specific returns estimated as the residuals of a regression of the region factor excess returns onto the respective global factor. In general, we see higher co-movement of the residuals between region pairs that are geographically close.

size, momentum, investment, and profitability factors. On the other side of the spectrum, the average correlation between France and Asia ex Japan is almost -30% . From this perspective, Asia ex Japan is an excellent diversifier for a French investor, but Other Europe is not.

Diversification over Time

Over the full sample, the potential for portfolio diversification applied to equity factors is compelling. But are these benefits largely stable or do they vary over time?

“Cross-regional correlations within individual factors tend to rise during economic or market turbulence.”

Previous research has shown that the correlations of major asset classes vary over time. Such changes may be temporary and associated with business-cycle fluctuations, or they may be permanent and explained by greater economic and financial integration. Such changes in the correlations are not innocuous. A higher degree of co-movement between portfolios of different countries implies lower diversification opportunities for international investors.

Panel A of Figure 3 depicts the three-year trailing average correlation of the value, size, momentum, investment, and profitability factors across the eight regions of our sample. Just like within asset classes, we find that the correlation between equity factor portfolios of different regions tends to increase during turbulent times.⁵ In particular, around the two NBER recessions of the last 20 years, in 2001 and 2008–2009, the value, momentum, and investment portfolios clearly saw a higher degree of co-movement across developed markets. In Binstock, Kose, and Mazzoleni (2017), we also show that the correlations between the regions' profitability portfolio are sensitive to fluctuations in the S&P 500 Index, whereas the size portfolios are generally insensitive to macro or market conditions. On the whole, diversification benefits tend to diminish during downturns, exactly when most needed.

When we examine the cross-regional correlations between factor strategies over the two halves of our sample (1990–2002 and 2003–2016), we find they tend to be more stable relative to what is observed within four major asset classes.⁶ For comparison purposes, **Panel B of Figure 3** displays the three-year trailing average across equity market indices, sovereign bonds, foreign currencies, and commodity futures. These asset classes display an evident upward trend in their average correlation. For instance, the developed equity markets' correlation has increased from 60% during the period 1990–2002 to 79% during the period 2003–2016. In contrast, when comparing the two halves of the sample, equity factor strategies have generally remained stable.

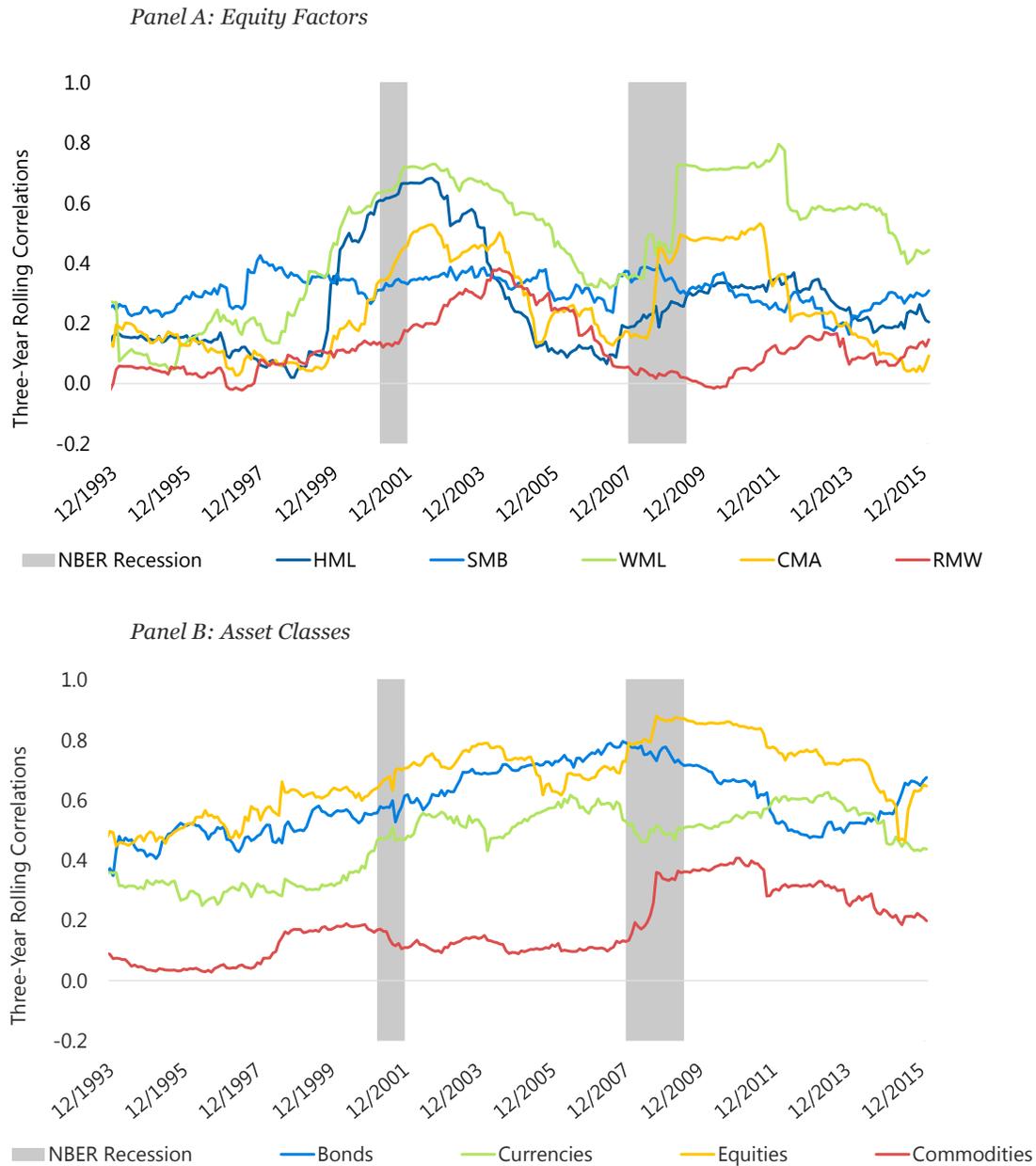
The stability of the correlations among equity strategies over the last 26 years is somewhat surprising. More integrated capital markets should lead to more correlated investment strategies across countries, however, this section shows that the time-series trends observed across global markets do not extend to long-short equity factor portfolios. This is an unexpected result that bodes well for international investors.

Conclusion

The concept of diversification is one of the pillars of academic finance and the investment management industry. In Binstock, Kose, and Mazzoleni (2017), we apply it to equity factors and study the performance of value, size, momentum, investment, and profitability portfolios across a set of developed markets.

Our evidence offers the following insights. First, investors can reduce their factor portfolio volatility by about 30% simply by extending their investment universe to foreign geographies. Indeed, regional portfolios reflect common variation, which we define as the global factor, and local volatility. This latter volatility is generally not compensated and can be diversified away by investing across national markets. Moreover, we show that diversification benefits should not be expected to be uniform across regions. The returns of neighboring regions are likely to co-move more

Figure 3. Three-Year Rolling Correlations for Equity Factors and Asset Classes, Nov 1990–Feb 2016



Source: Research Affiliates, LLC, using monthly data from Datastream, Worldscope, Bloomberg, Global Financial Data, and the Commodity Research Bureau. Figures are based on monthly excess returns.

Note: In Panel A, the plot lines reflect trailing three-year correlations of monthly excess returns across the eight regions for each equity factor. Panel B reports the equivalent statistic across the four major asset classes. NBER recessions are highlighted. Equities, bonds, and currencies are limited to developed countries. The commodities universe is composed of 24 commodity futures: Aluminum, Brent Crude, Cocoa, Coffee, Copper, Corn, Cotton, Feeder Cattle, Gasoil, Gasoline, Gold, Heating Oil, Kansas Wheat, Lead, Lean Hogs, Live Cattle, Natural Gas, Nickel, Silver, Soybeans, Sugar, Wheat, WTI Crude, and Zinc.

than those that are more geographically distant. Investors should look beyond their continents when diversifying their portfolios.

Consistent with major asset classes, the cross-regional correlations within individual factors tend to rise during economic or market turbulence. Volatilities of the global equity factors rise during these periods and, portfolio diversification tends to weaken exactly when most needed. That said, long-term investors have reason to celebrate: in contrast to the upward trend in correlations documented for major asset classes, we find a more stable correlation structure among regional factor portfolios before and after the start of the millennium. All in all, in the factor space, diversification is alive and well.

Endnotes

1. Recent contributions include Cotter, Gabriel, and Roll (2017) and Bekaert et al. (2011), who document the increasing co-movement of major international markets since the early 2000s. Bekaert and Harvey (2017) argue that developing economies still offer diversification opportunities due to their incomplete integration with mature markets, which according to Bekaert et al. (2011), is also explained by the limited development of their stock markets. We refer to these papers for an in-depth review of the literature.
2. The Other Europe region includes Austria, Belgium, Denmark, Finland, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland. The Asia ex Japan region includes Australia, Hong Kong, Singapore, and New Zealand.
3. Our empirical evidence regarding the United States may appear at odds with the existing literature. For example, Fama and French (1993, 2016) find that a US value portfolio offers significant average excess returns. These discrepancies are explained by the use of different sample periods. The US time series in this paper is shorter than in other studies in order to have consistent sample periods across regions. Comparing the overlapping periods, despite some differences in the data sources and methodologies, the factors estimated in this paper are consistent with the returns published on Kenneth French's website.
4. Of course, this evidence does not rule out the size factor as potentially useful in asset pricing models.
5. See Longin and Solnik (2001), Ang and Bekaert (2002), and Campbell, Koedijk, and Kofman (2002) for evidence regarding asset classes.
6. See Viciara, Wang, and Zhou (2017), Bekaert and Harvey (2017), and Cotter, Gabriel, and Roll (2017) for evidence regarding asset classes.

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