NOWHERE TO RUN, NOWHERE TO HIDE: ASSET DIVERSIFICATION IN A FLAT WORLD

John Cotter[1], Stuart Gabriel[2] and Richard Roll[3]

ABSTRACT

This paper presents new indexes of investment diversification potential within and among equity, sovereign debt, and real estate asset classes and countries. The diversification indexes derive from estimates of asset return integration based on common global factors. The indexes reveal a marked and near ubiquitous decline in diversification potential across asset classes and markets for the post-2000 period. Analysis of panel data suggests that the decline is related to higher levels of market credit risk and volatility as well as to technological and communications innovation as proxied by internet diffusion. The decline in diversification opportunity is associated with sharply higher levels of investment risk.

This draft: August 2017

Keywords: asset return integration and diversification, equities, fixed income, real estate

JEL Classification: G01, G10, G11, G12, G14, G15

[1]UCD School of Business, University College Dublin, Blackrock, Co. Dublin, Ireland. Email: john.cotter@ucd.ie and Research Fellow, UCLA Ziman Center for Real Estate
[2]UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, California 90095, stuart.gabriel@anderson.ucla.edu
[3]California Institute of Technology, Pasadena, CA 91125, rroll@caltech.edu

The authors gratefully acknowledge research support from the UCLA Rosalinde and Arthur Gilbert Program in Real Estate, Finance and Urban Economics at the UCLA Ziman Center for Real Estate. Cotter also acknowledges the support of Science Foundation Ireland under Grant Number 16/SPP/3347. The authors thank participants at the Luxembourg Asset Management Summit, AREUEA International Meetings, UCLA, University College Dublin, University of Georgia, Monash University, University of Reading, Leibniz University, Western Finance Association Annual Conference, FMA European Conference, 2017 Accounting and Finance Forum at University of Queensland, European Securities and Markets Authority, World Investment Forum 2017, and the Financial Management Association Annual Conference as well as Abhinav Anand, Michael Brennan, Chris Brooks, Paul Calem, Mike Clements, Thomas Conlon, Hans Degryse, Richard Evans, Larry Harris, Andreas Hoepner, Bige Kahraman, Aneel Keswani, Hugues Langlois, Christian Lundblad, Niall McGeever, Gary Painter, Neil Pearson, Ronan Powell, Marcel Prokopczuk , Bill Sharpe, Matt Spiegel, Rene Stulz, and Gary Williams.

I. Introduction

Diversification is fundamental to risk mitigation. An early adage to diversify is found in the Book of Ecclesiastes (935 B.C.), which advises, "But divide your investments among many places, for you do not know what risks might lie ahead." In 1710, S. Palmer (Moral Essays on Proverbs, 344) similarly admonished "not to venture all your eggs in one basket". More recently, the California Public Employees Retirement System (CalPERS) undertakes to diversify pension investments among stocks, bonds, and real estate to maximize returns at a prudent level of risk. Similar strategies are proclaimed by virtually all major pension and investment advisory firms. [1]

During the late-2000s meltdown, anecdotal evidence suggested that diversification was not all that effective. Individual and institutional investors incurred substantial losses because of unforeseen and unprecedented contemporaneous price declines across asset classes and markets. But even prior to that crisis, limitations to diversification were becoming apparent. In the popular media, Thomas Friedman, in his bestseller titled "The World is Flat" (2007), depicted a globalized marketplace where, in the wake of innovations in technology, extension of global supply chains, and widespread accretions to household wealth, geographical divisions were becoming less relevant. In a more connected global economy, investment diversification opportunities should be less readily available. Diversification provides fewer benefits when returns across assets and geographies are highly integrated. Limitations on diversification have major implications for investment strategies, fund composition, and macroeconomic and asset management.

Despite the overwhelming prevalence of asset diversification strategies, few studies have sought to investigate the implications of a more integrated world for diversification potential and related risk mitigation. There have been a number of studies of correlations within a single asset class, sometimes with emphasis on developed versus emerging markets (see, for example, Bekaert, Hodrick, and Zhang (2009), Bekaert and Harvey (2014)). Correlations are commonly connected (inversely) with diversification. Further, international evidence on cross-country correlation is mixed;

[1] Morningstar Investment Advisory Services advocates diversification to provide exposure across sectors and geographies and to reduce portfolio risk.

it is typically lower for emerging equity markets (Berger, Pukthuanthong and Yang, 2011; and Goetzmann, Li and Rouwenhorst, 2005). In contrast, relatively large and rising correlations have been found for tail return dependence (Christofferson, Errunza, Jacobs and Langlois, 2012; and You and Daigler, 2010). The profile of correlations and associated diversification differs for emerging (relatively low) and developed markets (relatively high) (Christofersson, Errunza, Jacobs and Langlois, 2012; Bekaert and Harvey, 2014; Eiling and Gerard, 2014). More generally, Roll (2013) has questioned the link between correlation and diversification potential.

Little is known about return integration trends across geographically diverse asset classes (such as real estate, sovereign debt and equities) over the period of the financial crisis and beyond. Studies have usually concentrated on a single asset class such as sovereign debt (see Chaieb, Errunza and Gibson Brandon (2014)). Nor have prior studies developed indexes to explicitly measure diversification potential. Few studies have explicitly evaluated factors associated with diversification trends or estimated temporal variation in risk associated with diversified global investment portfolios.

This study presents new indexes of diversification potential that are relevant for all market participants, be they individual investors, pension funds, or institutional private equity firms. These indexes also provide useful information to policymakers about the asset class and geographic diffusion of macroeconomic shocks and policy. Such measures also are vital to macroprudential policymakers that seek to enact regulatory and economic measures to mitigate catastrophic risk associated with economic and financial crises.

Our study commences with estimation of return integration within and among asset classes and markets and over time. Our measure of integration is based on the proportion of asset returns that can be explained by an identical set of global factors (see Pukthuanthong-Le and Roll (2009)). The level of integration is indicated by the magnitude of R-square, with higher values representing higher levels of integration. Two assets are viewed as perfectly integrated if the same global factors fully explain asset returns in both markets. In that case, the R-square would be 1.0, implying no

diversification potential between the assets. We provide detailed methodological review of our diversification measure below.

We then estimate models of return integration within and among equity, fixed income, and real estate asset classes and countries. We define our diversification index as [100 –the level of integration (adjusted R-square)]. The index takes on values between 0 and 100, where 0 indicates no diversification potential whereas 100 implies maximal diversification benefits. The diversification indexes are computed over time among cohorts of nations and across developed and emerging nations. We assess implications of a trending up in return integration for portfolio investment diversification. We also evaluate robustness of findings across market cycle, volatility, and credit risk regimes. We then employ panel data methods to identify factors associated with diversification potential and assess the relations between our computed diversification indexes and investment risks.

We find a pronounced uptrend in integration within and among asset classes and countries over the period of the financial crisis and beyond and hence a substantial decline in our diversification indexes. The decline in diversification potential is widespread among country cohorts and has been precipitous in the post-2000 period. Diversification indexes for equity, sovereign debt, and REIT asset classes decline from a maximum level of 100 in the late-1990s to roughly *half* that level by 2012! A similar result is observed for a global index comprised of all three asset classes. The trend is downward with little evidence of differences in bull and bear markets or during periods of high and low VIX (market volatility).

Older and more established markets display a larger downtrend in the diversification indexes. Further, the generalized downtrend in diversification potential is shown to be associated with higher levels of investment risk. Some countries, however, notably including many Middle Eastern and African nations, persistently display only weak integration with the global economy. While those areas may provide increments to portfolio diversification, they are often subject to substantial security, political, and economic risks along with higher transaction costs and lower liquidity.

We further examine factors associated with trends in diversification potential. Using balanced and unbalanced panel regressions, we assess the role of both macro-finance and development factors. These results suggest that credit risk, as proxied by the TED spread, is associated with diminished diversification opportunity for all three asset classes. Equity market Implied volatility (VIX) is negatively associated with diversification in equity markets, but positively associated with diversification in bond markets. Global events including the 1992 ERM and 2009-2010 Eurozone crises are associated with sizable reductions in diversification indexes for all asset classes. Finally, consistent with the "world is flat" hypothesis, we also find that technology and communications innovation, as proxied by global diffusion in internet usage, is associated with declines in diversification indexes among all asset classes. Taken together, our findings offer a cautionary note about geographic and asset class diversification as a mechanism to mitigate investment risk.

II. Indexes of Global Diversification

Below we discuss literature and methodological derivation of our diversification indexes. From there, we proceed to index estimation and analysis.

a. Literature and Methodological Approach

The starting point is estimation of integration of assets within and among nations and asset classes over time. A review of existing literature suggests substantial variation in methods and geographic focus of related integration research (for a comprehensive review of this topic and related research see Gagnon and Karolyi (2006)). The dynamics of equity market integration have been investigated by Harvey (1991), Chan, Karolyi, and Stulz (1992), Engle and Susmel (1993), Bekaert and Harvey (1995), Longin and Solnik (1995), Errunza, Hogan, and Hung (2007), Eun, Huang and Lai (2008), and Eiling and Gerard (2014). Cotter, Gabriel, and Roll (2014) investigate integration of US housing market returns.

Papers have varied in geographic focus, as some address integration in the European community (see, for example, Hardouvelis, Malliaropoulos, and Priestley (2006), and Schotman and Zalewska (2006)), in developed markets over long a period (Rangvid, Santa-Clara, and Schmeling (2016)),

whereas others investigate emerging markets (see, for example, Bekaert and Harvey (1995), Chambet and Gibson (2008), Bekaert, Harvey, Lundblad and Siegel (2011)). Some employ the US as a benchmark market (Ammer and Mei (1995) and Karolyi and Stulz (1996)).

There is also considerable variation in methods. For instance, Carrieri, Errunza and Hogan (2007) use GARCH-in-mean to assess correlation in returns and volatility among markets, Cappiello, Engle and Sheppard also use GARCH models to report high correlation between international bond markets, as do Christoffersen, Errunza, Jacobs, and Xisong (2014) for equity markets. In examining correlation of international equity markets Conlon, Cotter and Gencay (2015) use wavelet methods, while Longin and Solnik (1995) use cointegration. Bekaert, Harvey and Ng (2005) use multiple economic fundamental factors. Integration is often described in terms of cross-country correlations in stock returns (for an early study see King and Wadhwani (1990)); however, correlation may be a misleading measure.

Below we adopt the return integration measure proposed in Pukthuanthong-Le and Roll (2009). In that paper, the authors provide a simple intuitive measure of equity market integration based on the proportion of a country's returns that can be explained by an identical set of global factors. This measure of integration implicitly regards country-specific residual variance in a factor model as an indicator of imperfect integration.[2] Clearly, to the extent global factors explain only a small proportion of variance in a country's returns, the country would be viewed as less integrated (see, for example, Stulz (1981) and Errunza and Losq (1985)).[3] In contrast, markets would be viewed as highly integrated to the extent that their returns, as indicated by a high R-square, are well explained.

[2] When multiple factors drive returns, markets may be imperfectly correlated but perfectly integrated. As shown by Pukthuanthong and Roll (2009), while perfect integration implies that identical global factors fully explain index returns across countries, some countries may differ in their sensitivities to those factors and accordingly not exhibit perfect correlation. In the presence of multiple factors, the simple correlation between index returns could be a flawed measure of integration unless the estimated coefficient vectors from factor regressions are exactly proportional.

[3] According to this definition, a country is perfectly integrated if the country-specific variance is zero after controlling for global factors. In the case of two perfectly integrated countries, market indexes would have zero residual variance. See Pukthuanthong and Roll (2009) for discussion and details.

We define our diversification index as 100 – level of integration (adjusted R-square in percent). Hence the index takes on values between 0 and 100, where the former indicates no diversification potential and the latter implies full potential. Diversification potential should be high to the extent asset returns are not well integrated.

b. Rationale for our Diversification Measure

In this section, we provide detailed discussion of our diversification measure. As a starting point, a time-honored (inverse) measure of diversification potential is the correlation between two assets. All standard investment textbooks illustrate the Markowitz principle that the volatility of a portfolio formed by combining two assets is a monotonically negative function of the assets' correlation; e.g., if the correlation is +1, there is no diversification benefit while there exists a portfolio with zero volatility if the correlation is -1.

The Markowitz principle is correct when dealing with individual assets. However, correlation can be a misleading indicator of diversification when considering a combination of two portfolios, such as large indexes, each of which already contains many individual assets, provided that there are two or more underlying common factors that drive all returns. The correlation between the two portfolios can conceivably vary over the entire range of possibilities, -1 to +1, without implying anything about the true benefits of diversification.

The basic reason for this seemingly perverse result is implied by the possibility that large portfolios can be re-weighted to mimic one another. If the mimicking is good enough, then one portfolio contains a re-weighted image of the other, so combining the two original portfolios has little benefit relative to simply combining one of them with its re-weighted self.

To illustrate, consider a multi-factor world wherein all asset returns are driven by K common factors; i.e., every asset's return at time t conforms to the return generating model:

$$R_{i,t} = E_i + \beta_{i,1} f_{1,t} + \beta_{i,2} f_{2,t} + \ldots + \beta_{i,K} f_{K,t} + \varepsilon_{i,t}$$

where the f's denote common factors that influence the return R on asset i through its "sensitivity coefficients," the βs. By assumption and without loss of generality, the factors have zero means, as does the idiosyncratic risk, ε, while the expected return on asset i is E_i. Note that everything is specific to asset i (and thus carries an i subscript), except the common factors. Also, in this elementary multi-factor model, the asset's expected return and its sensitivities (β's) are assumed to be time invariant constants.

Within this world, now consider the relations among well-diversified portfolios. For example, suppose that two asset classes, A and B, have broad, widely-followed, well-diversified market indexes. Let's suppose initially that the indexes are so well-diversified that both have negligible remaining idiosyncratic volatility; i.e., for A and B respectively,

$$R_{A,t} = E_A + \beta_{A,1} f_{1,t} + \beta_{A,2} f_{2,t} + ... + \beta_{A,K} f_{K,t},$$

$$R_{B,t} = E_B + \beta_{B,1} f_{1,t} + \beta_{B,2} f_{2,t} + ... + \beta_{B,K} f_{K,t}.$$

The returns of both indexes are explained entirely by the same underlying systematic factors. Does this mean they are perfectly correlated? In general, that answer is no. Their correlation will be perfect if and only if for some constant of proportionality, k≠0, $\beta_{A,j} = k\beta_{B,j}$ for each and every j=1,…K.. For any other set of sensitivity coefficients (β's), the correlation will be imperfect.[4] Conceivably, the correlation can be quite low even though both indexes A and B are driven by the same common influences.

Within an asset class such as, e.g., U.S. equities, portfolios have similar sensitivities to the underlying factors, so correlations are relatively high. But across asset classes, this is not necessarily the case. Consider the example of equities and bonds. Suppose one factor is related to shocks in real output and another factor is related to shocks in expected inflation. Then a positive shock in the first factor would increase equity returns but not affect bonds all that much. Conversely, a reduction

[4]The formal proof is delivered by the Cauchy inequality. The correlation is +1 (-1) when k is the same for all pairs of β's and k > (<) 0.

(a positive shock) in expected inflation would drive up nominal bond prices but have a more attenuated impact on equities. The result over many periods, when there are shocks in both real output and expected inflation, is a relatively low correlation between stocks and bonds. Of course, this is just an illustrative example and is not meant to imply that equities and bonds are so divergent in sensitivity to the true underlying factors. There could be other systematic factors, such as investor confidence, that drive them in the same direction.

Another example is suggested by the frequently-observed low correlations across some country equity indexes. For example, Hong Kong and Saudi Arabia are undoubtedly driven differentially by global energy shocks. Saudi stocks are driven upward by energy price increases but the opposite is true for Hong Kong, an energy importer. These two countries could be very well integrated in the sense that they both depend on the same global factors, yet their simple correlation could be small or even negative depending on the volatility of energy shocks relative to other common factors.

In other words, low correlation between bundles of assets fails to properly measure the potential benefits of diversification. To see the extent of this issue, consider again two diversified portfolio indexes A and B, perhaps in different asset classes or countries, whose returns are driven by the same underlying systematic factors but with diverse sensitivities (β's). Assume that their simple correlation is relatively low, for the reasons previously mentioned. Diversification into the two indexes might seem powerful because various allocations between them (such as 50-50) appear to substantially reduce volatility. But this overstates the true diversification benefit because the respective index compositions are held constant when making such allocations.

Instead of allocating a fraction of investment funds to index A and the complementary fraction to index B, consider structuring a different investment portfolio from the individual assets within index A that matches the factor sensitivities of index B. This is feasible when there is a large enough menu of available derivatives or when short positions are inexpensive. The resulting

returns, index B and the re-structured version of index A, denoted A*, would then conform to the following return generating multi-factor models:

$$R_{A^*,t} = E_{A^*} + \beta_{B,1} f_{1,t} + \beta_{B,2} f_{2,t} + \ldots + \beta_{B,K} f_{K,t} + \varepsilon_{A^*,t},$$

$$R_{B,t} = E_B + \beta_{B,1} f_{1,t} + \beta_{B,2} f_{2,t} + \ldots + \beta_{B,K} f_{K,t} + \varepsilon_{B,t}.$$

Notice that the sensitivity coefficients (β's) from the restructured portfolio A* of A assets now match the original sensitivity coefficients of index B. To allow for generality, there is still some remaining idiosyncratic risk, as represented by the ε's.

What, then, is the actual diversification benefit available from combining A and B? We can gain some insight about this question by considering as an example the minimum variance portfolio from combining index B with the β_B re-structured portfolio A* composed of assets in A. It is straightforward to show[5] that this portfolio has a weighting w in index B (and 1-w in the re-structured portfolio A*) equal to

$$w = \mathrm{Var}(\varepsilon_{A^*,t}) / [\mathrm{Var}(\varepsilon_{A^*,t}) + \mathrm{Var}(\varepsilon_{B,t})]$$ [6]

In words, if the re-structured portfolio A* from the class A assets has no idiosyncratic component, diversifying with B brings absolutely no benefit in terms of risk reduction; w is zero. This is true even when, as we assumed initially, the correlation is weak between the original indexes of classes A and B. Any benefit from combining B with A would have to be in terms of enhanced return, not reduced risk.

If the re-structured A-asset-only portfolio A* retains some idiosyncratic risk, there is a diversification benefit. But that benefit has nothing to do with the correlation between the original indexes A and B. This result leads directly to our proposed measure of diversification potential

[5] Assuming, as usual, that the idiosyncratic terms are uncorrelated with the factors and with each other.

[6] Proof: Because the β's are identical for every factor in B and A*, weighting w in B with 1-w in A* gives the portfolio return $R_p = (1-w)R_{A^*} + wR_B = (1-w)\varepsilon_{A^*} + w\varepsilon_B$. Assuming that the idiosyncratic terms are unrelated, the portfolio's variance is $\mathrm{Var}(R_P) = (1-w)^2 \mathrm{Var}(\varepsilon_{A^*,t}) + w^2 \mathrm{Var}(\varepsilon_{B,t})$. Minimizing the portfolio's variance with respect to w and solving yields the equation in the text, QED.

If the β_B-structured B-mimicking portfolio A* composed of A assets has an r-square on the underlying factors close to 1.0, then $\mathrm{Var}(\varepsilon_{A^*,t})$ will be very small, so there will be negligible diversification benefits from combining B and A. (The same would be true going the other direction; i.e., restructuring B to match the factor sensitivities of the A index.) Hence, we compute the r-square (denoted R^2) from multi-factor regressions for each asset class and country and then measure the benefit of diversifying with that class or country by 1-R^2. If R^2 = 1.0, there is no benefit while if R^2 is close to zero, the benefit is large. Given the above methodology, we turn now to computation of the new diversification indices.

III. Data and Model Specification

For each available country, our diversification index is computed from the average R-square in a multi-factor asset return model fitted using daily data within each year between 1986 and 2012 inclusive. The global factors are 16 principal components obtained from existing markets pre-1986 but updated each calendar year.

a. Data

The analysis below employs index return data for equity, bond, and real estate markets from Thompson Reuters DataStream. Datastream provides the most comprehensive set of country-specific indexes available for the three asset classes. [7] The daily data are US dollar denominated and collected for equity, five-year sovereign bonds, and REIT indexes.[8] We choose the index in each market/asset class that is the most comprehensive in terms of coverage. We include both active and inactive assets to avoid survivorship bias.

Returns are defined as differences in log index levels. Index levels are removed from the dataset if they are identical to the previous day (Datastream records an index value on holidays

[7] Although Datastream gives us the greatest coverage it is not without its faults. That dataset is biased towards large capitalization stocks but we argue that investors would create their diversified portfolio using these assets as those assets are more likely to well known to them, have less political risk and are relatively liquid. This would certainly be true for international investors.

[8] 5-year sovereign bond indices are chosen as there are more of these than their 10-year counterpart.

when markets are closed) or in those cases where index values are not 1 day apart from Monday through Thursday and 3 days apart from Friday through Monday. Some markets and asset classes are more liquid than others. To foster estimation, we require at least 50 valid returns per year. This sometimes affects the estimation of the diversification index, especially for small markets. For example, a diversification index in a year with at least fifty returns might be followed by a year with no index calculated because of insufficient (<50) daily returns.

b. Estimating Global Factors with Principal Components

The principal components analysis employs data from Datastream markets that had availability prior to 1986. The use of pre-1986 existing markets enables estimation of common factors from three asset classes, equity, debt, and real estate and 23 countries, a total of 40 dollar-denominated global market indexes,[9] (Bond and real estate indexes are not available for all 23 countries.) For each calendar year from 1986 – 2012, a covariance matrix is computed using returns from the 40 equity, bond, and REIT indexes. Because of time zone differences, the covariance matrix is augmented to include the one-day lagged returns from the North American markets (Canada and the US).[10] As an additional precaution, for each pre-1986 cohort of countries, separate principal components are estimated after that country was excluded from the calculation.[11]

From the yearly covariance matrices, sorted eigenvalues (low to high) are used to produce the orthogonal out-of-sample principal components that are used in the factor model in each subsequent year. This is repeated for each year from 1986 through the end of sample to yield 27

[9] The pre-1986 markets include Equity: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; Bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and REIT: Australia, Netherlands, UK, and US.

[10] This is because North America is the last region to trade on a given calendar day. If a globally-significant event occurs after the Asian or European markets close but while the North American markets are still open, there could be a co-movement between North America returns and returns in other regions the next day. Including the lagged North American markets yields a 45x45 covariance matrix including lags for 3 asset classes in the US and in Canada.

[11] This is to avoid any possible bias in the regression of a pre-1986 country's returns on the global factors associated with that country being heavily weighted in the principal components. Since we exclude a pre-1986 country from the PCs when that country is the dependent variable, the potential bias is obviated.

years of principal components. (Principal components are obtained each calendar year using the daily data.) We retain 16 principal components, which explain roughly 90 percent of the volatility in the covariance matrix. Appendix Figure 1 shows the average (over 1886-2012) cumulative percentage of variance explained by the sorted (low to high) eigenvalues from the pre-1986 country cohort covariance matrices. Appendix Figure 2 provides a time series plot, by calendar year, of the average percentage of variance explained by the sorted eigenvalues.

c. Return Regressions on Global Factors

The estimated 16 out-of-sample principal components serve as the common global factors in the country-specific regressions. Those regressions are estimated for each country and for each calendar year 1986 – 2012. The adjusted R-square from each regression is a measure of market integration for that country and time period. We take a simple average of R-squares by country for each asset class and time period to provide the corresponding trend in global asset class integration. As explained above, [100 – average asset class integration] is our index of asset-specific diversification potential.

Figure 1 shows the diversification index for each asset class between 1986 and 2012. Figure 2 plots the same for the assets classes as a whole (100-average of R-squares across asset classes.) The included countries by asset class are indicated in Notes to the figures. In each case, there is a time-series plot of the diversification index and a fitted linear trend line. The results reveal a substantial downtrend in the global asset diversification indexes. The declines across the global indexes would have been more pronounced for country weighted indexes given the importance of the large countries and their respective reduction in diversification potential.

As recently as the late 1990s, the indexes signal nearly full diversification opportunity, with index values approaching 100. Since that time, however, diversification potential has declined markedly to levels of roughly 50-60 for each of asset class by 2012. The diversification index decline is strongest for sovereign debt plummeting during the mid-2000s boom period and then rebounding somewhat during the early years of the financial crisis. Figure 2 displays the world diversification

index for the (average) of the three asset classes. Overall, there is a substantial downtrend in diversification opportunity among countries and asset classes over the post-1996 period. Given the harmony of the trends for the three asset classes, a world weighted average based on asset allocation across the three assets would have resulted in similar limiting diversification potential.

It is apparent from Figure 1 that trends in diversification are shared by asset classes; further quantitative evidence of common diminished diversification opportunity is given in Appendix Table 1. Appendix Table 1 reports simple contemporaneous correlations in diversification indexes for raw returns by asset class and for the full period and for the pre- and post-2000 period. The contemporaneous correlations for the full sample period are elevated and in the range of .66 for equities and bonds and in excess of .83 for equities and real estate and for bonds and real estate. For equities, these correlations are higher in the post-2000 period; for example, the correlation for equities and real estate reaches a full .98! Appendix Table 1 displays similar and substantially elevated lead correlations among asset classes for the post-2000 period relative to those estimated for pre-2000.

Figure 3 displays the asset-specific diversification indexes by cohort. We go back to pre-1986 to illustrate long term trends in diversification, and to show how robust these trends are to the timing of when a country became part of the analysis. Countries are assigned to cohorts depending upon when their data became available. Countries joining the dataset typically start out with lower integration R-squares, so averaging of all countries together (absent cohort assignments) could reduce R-squares early on for the sample and thus spuriously depress any trend in the average. The assigned cohorts for equities include pre-1974, 1974-1983, 1984-1993 and post-1993. In the case of bonds, the assigned cohorts include: pre-1986, 1986-1999 and post-1999. We assign countries to pre-2000 and post-2000 cohorts for REITs. Table 1 displays cohort members by asset class.

As shown in Figure 3, the cohorts indicate a downtrend in diversification indexes from the late 1990s onward. Equities and REITs display more substantial downtrends in older and more

established markets.[12] For example, the index value for REITs falls from roughly 100 in the early 2000s to about 40 in 2011 for the pre-2000 cohort versus about 80 for the post-2000 group. In the case of sovereign debt, the declines in diversification potential are largely robust to cohort stratification.[13]

IV. Portfolio Diversification and Risk

Next, we assess the relation between portfolio diversification and risk for global investors. As noted in the introduction, diversification across asset classes and geographies long has been fundamental to risk mitigation. Figure 4 shows global diversification indexes for each asset class (equity, fixed income, real estate) alongside asset-specific risk as proxied by the annual standard deviation of asset returns.

Figure 4 provides evidence of an inverse relationship between diversification opportunity and risk in each of the asset classes. Specifically, as opportunities to diversify decline, investment risks move up sharply. Reduction in the diversification indexes is particularly apparent among all asset classes post-2000. Among global equities, diversification potential fell markedly from an index level of roughly 80 in 2000 to about 60 in 2012. During the same period, equity investment risk moved up sharply, but then fell back some post-crisis.

Among other global assets, including sovereign debt and real estate, the fall-off in diversification opportunity was similarly marked, from index levels in the high 90s in 2000 to close to 55 and 60, respectively, in bonds and real estate, in 2012. For the composite of the three asset classes, the diversification index (average of the asset classes) fell from over 90 in 2000 to roughly 60 in 2012 (see Figure 5). Overall, volatility in returns moved up as diversification opportunities abated. Indeed, when global returns to an asset class are well integrated, potential benefits of geographic diversification are meagre. Diversification index levels and risk are strongly negatively correlated for

[12] The pre-1974 equity market cohort includes the major advanced modern economies of Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Japan, Netherlands, Singapore, South Africa, Switzerland, the UK and the USA.

[13] The post-1999 bond cohort includes China, the Czech Republic, Mexico, Poland, and South Africa.

each of the three asset classes, with correlation coefficients over the full sample period of -0.648 for equities, -0.462 for bonds, and -0.735 for REITs. The correlation is -0.653 for the three asset class average.

V. Where to Run and Hide

Table 2 provides further details on diversification trends by asset class and country. It provides insight into systematic differences among highly integrated markets and others. For each estimated country/asset class diversification index, Table 2 reports the coefficient and t-statistic from fitting a linear time trend. Trends are given for the full sample and for the pre- and post-2000 periods.

Table 2 also reports those findings for a global index (labelled world index) for each asset class. Each asset class-specific global index has a significant downward trend. For the entire sample, the strongest downtrend is for real estate followed closely by equities, where the t-statistics are highly significant. Consistent with results cited above, the estimated global index time trends for each of the three asset classes switch from positive in the pre-2000 period to negative and highly statistically significant post-2000.

At the country level, the estimated time trends further reveal striking turnarounds in diversification potential between the pre- and post-2000 periods. Pre-2000, negative and statistically significant trend coefficients, indicating reduced diversification potential, were estimated only for a few country-specific equity indexes. In fact, for sovereign debt, *positive* and significant time trends were estimated for many developed nations pre-2000, notably including Austria, Denmark, France, Germany, Ireland, Japan, and the Netherlands, signifying enhanced opportunities for diversification in early years. In the case of REITs pre-2000, a negative and significant time trend coefficient was estimated only for the U.S.

However, as suggested above, by the more recent post-2000 period, country- and asset class-specific opportunities for diversification have turned largely and significantly negative. But there are some notable exceptions. A number of Middle Eastern nations, including Egypt, Jordan, Lebanon, Oman, Saudi Arabia, and the UAE, do not exhibit a significant decline in their index of equity

diversification. This is similarly the case for several developing Asian and African nations, including Ghana, Kazakhstan, Kenya, Nigeria, Pakistan, and Zambia. In the market for sovereign debt, the only exceptions to significant country-specific declines in the diversification index are China and Japan. Also, among REIT diversification indexes, Greece and Japan fail to show significant declines in diversification potential. Note, however, that while the above-identified Middle Eastern and African and Asian nations offer higher levels of diversification potential, some are subject to other country-specific risks, including political instability, inadequate legal infrastructure, civil unrest and sectarian violence, and the like. [14]

Table 3 shows results of estimation of a linear time trend for portfolios comprised of all 3 assets for individual nations and for the different sample timeframes. Only a limited number of advanced western nations allow estimation of those trends for a 3 asset class portfolio. Among the 12 country indexes, the single outlier to an estimated negative and significant diversification trend coefficient is Japan. For Japan, the estimated coefficient switched from positive and significant in the pre-2000 period to negative and insignificant in the post-2000 period.

We further investigate the estimated trend in diversification opportunity among developed and emerging economies. We allocate countries across these categories based on the United Nations Human Development Index. In accordance with the UN Index, we coded those countries identified as "very high human development" as developed nations, whereas the others were included in the "emerging" category. The UN categorization is based on a large number of country-level economic and human capital characteristics.

Figure 6 displays trends in global diversification indexes by asset class and for developed and emerging economies. Overall, diversification potential trends down in the post-2000 period, relative to earlier years, especially among developed economies. Specifically, the diversification indexes plotted in Figure 6 move down markedly post-2000 for developed economy equity and real estate

[14] For a detailed explanation of the United Nations Human Development Index, see: http://hdr.undp.org./en/content/table-1-human-development-index-and-its-components.

markets; in contrast, only limited trending down in diversification opportunity was found for emerging equity markets. In the case of debt markets, the divergence between developed and emerging markets is less apparent, reflecting in part sovereign debt crises in the latter half of the 2000s and beyond in a number of advanced European economies.

Results of fitting of time trends to the developed and emerging country groups are as anticipated. As shown in Table 4, the estimated diversification trends switch from positive and insignificant in the pre-2000s for all asset classes to negative and statistically significant for the post-2000s period. Further, for all asset classes, the estimated trending down in diversification opportunity post-2000 was substantially larger in the case of developed relative to emerging countries.[15]

Finally, Figure 7 displays diversification indexes for equity, bond, and real estate asset classes as well as for the composite (average) of the asset classes for the United States. Broadly speaking, the plots reveal substantial downtrends in the diversification indexes since 2000. Relative to the global indexes, however, diversification opportunity across asset classes moved up during the mid-2000s boom prior to falling back sharply before, during and after the subsequent downturn period. The post-boom downtrend in the diversification indexes was especially pronounced for equity and real estate asset classes.

[15] For equities the developed markets are: Argentina, Australia, Austria, Bahrain, Belgium, Canada, Chile, Croatia, Cyprus, Czech Rep., Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, Kuwait, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Poland, Portugal, Qatar, Saudi Arabia, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, UAE, UK and US. The associated emerging equity markets are: Bangladesh, Botswana, Brazil, Bulgaria, China, Colombia, Cote d'Ivoire, Ecuador, Egypt, Ghana, India, Indonesia, Jamaica, Jordan, Kazakhstan, Kenya, Lebanon, Macedonia, Malaysia, Mauritius, Mexico, Montenegro, Morocco, Namibia, Nigeria, Oman, Pakistan, Panama, Peru, Philippines, Romania, Russia, Serbia, South Africa, South Korea, Sri Lanka, Taiwan, Thailand, Trinidad, Tunisia, Turkey, Ukraine, Venezuela, Vietnam and Zambia. For bonds the developed markets are: Australia, Austria, Belgium, Canada, Czech Rep., Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, UK and US. The associated emerging bond markets are: China, Mexico and South Africa. For REITs the developed markets are: Australia, Belgium, Canada, France, Germany, Greece, Hong Kong, Italy, Japan, Netherlands, New Zealand, Singapore, UK and US. The associated emerging REIT markets are: Bulgaria, Malaysia, Mexico, South Africa and Turkey.

VI. Robustness of Diversification Trends

Prior research has provided evidence of higher correlations among international markets during downturns (bear markets) than during upswings (bull markets); e.g.; see, for example, Longin and Solnik (2001), Pukthuanthong and Roll (2009). Pukthuanthong and Roll (2009), for example, show slight increments to return integration among global equities in bear markets. Appendix Figure 3 distinguishes global equity, bond, and real estate asset class diversification by NBER recession periods (red bars) and non-recession periods. The dating of US recessions by the NBER is similar to the dating of global recessions by the IMF.[16] As is evident, the plots in Appendix Figure 3 do not suggest systematic variation across recession and upswing periods in the global asset class diversification indexes. Instead, as described above, they indicate long-term secular downtrends in diversification potential dating from roughly 2000.

We further assess robustness of diversification results to periods of bear versus bull equity markets, high and low equity market volatility (S&P Index Options VIX Index), and high and low perceived credit risk in the economy (TED Spread).[17] These stratifications elucidate whether diversification opportunity vary according to the state of the financial markets. As shown in Panel A of Appendix Figure 4, we plot average annual returns for each asset class against the difference between asset-specific diversification index annual values for low and high return days. Average annual returns by asset class are computed from daily return observations in each year. The difference between bear and bull asset-specific diversification values is computed as the difference

[16] The dating of NBER and IMF recession periods is almost identical from the 1970s to 2009. The only exception is the Russian crisis of 1998 which is designated as a global recession by the IMF but not as a US recession by the NBER. The IMF changed its recession dating methodology in 2009. In the new methodology, the US dot-com bust of 2001-02 is absent from the IMF list of global recessions. Source: IMF World Economic Outlook: Crisis and Recovery, April 2009 (http://www.imf.org/external/pubs/ft/weo/2009/01/pdf/text.pdf).

[17] The CBOE Volatility Index (VIX Index) is a barometer of equity market volatility. The VIX Index is based on real-time prices of options on the S&P 500 Index and is designed to reflect investors' consensus view of future (30-day) expected stock market volatility. The VIX Index is often referred to as the market's "fear gauge." LIBOR measures the interbank lending rate so as the spread between The TED spread, defined as the basis point differential between the 3-month LIBOR and the 3-month T-bill, measures perceived credit risk in the general economy. A rising TED spread shows an accelerating lack of trust between banks and a corresponding tightening of credit for all other counterparties.

in the diversification index for low and high return periods for a given year, where the low and high groups are based on being below and above the median annual return value.

We employ the same stratification protocol in Panels B and C of the chart, where we plot the average annual VIX and TED spread against the difference between the asset-specific diversification index values for high and low VIX and TED spread days, respectively.[18] We also compute the simple correlations between the diversification indexes for bear minus bull returns and average returns for the three asset classes. We do the same for high and low VIX and TED spread periods. Those correlations are displayed in Appendix Table 2.

Results of the stratification analysis reveal only limited opportunity for enhanced diversification across periods of market downturn, volatility, and credit risk. For example, as depicted in Appendix Figure 4 and Appendix Table 2, the correlations between the bear-bull diversification indexes and asset class returns are very low for both equities and REITs—on order of magnitude of 10 percent or less for both equities and REITs and for the full period of analysis. While those correlations rise somewhat in the post-2000 period, they never exceed .24. Appendix Table 2 displays similarly low correlations between the diversification index for high-low VIX periods and average VIX returns for all asset classes and time periods. In the case of global credit risk, as embodied in the TED spread, Appendix Table 2 reveals somewhat elevated correlations between the diversification index for high-low TED spread and average TED spread—roughly .40--for both equities and REITs for the pre-2000 period. Those correlations fall back in the post-2000 period.

Appendix Table 3 displays the mean difference between diversification indexes stratified by bear minus bull market returns, high minus low VIX, and high minus low TED and related t-statistics.

[18] As shown in Panel B of Appendix Figure 4, we plot the average annual VIX against the difference between the asset-specific diversification index values for high and low VIX days. We do this for each of the three equity, bond, and real estate asset classes. Average annual VIX values are computed from daily VIX observations in each year. The difference between high and low asset-specific diversification values is computed as the difference in average R-square for the diversification index between high and low VIX periods for a given year, where the high and low groups are based on being above and below the median annual VIX value. As is broadly appreciated, the mean VIX runs up sharply and then substantially contracts during the run-up and aftermath to the 2000s crisis period. In a similar manner, in Panel C of the Appendix Figure 4, we plot the average annual TED spread against the difference between the asset-specific diversification index for high and low TED spread days.

These differences are statistically insignificant in all cases exclusive of bear minus bull returns for global equity markets and for high minus low TED spread in the case of sovereign debt.

We hasten to note, however, that the above exercises are essentially univariate. They simply assess diversification potential in periods, respectively, of bull vs. bear markets, high vs. low volatility, and high vs. low credit conditions. They do not simultaneously control for these or other possible influences on diversification. In the next section (VI), we offer a multivariate analysis of diversification trends.

VII. Factors Associated with Diversification Indexes

In this section, we examine possible drivers of the diversification indexes. In so doing, we estimate panel regressions seeking to explain the marked trending down in diversification potential. Table 5 lists possible covariates and Table 6 reports their simple correlations. Modelled factors include both well-established controls for macro-financial risk as well as proxies for secular evolution in communications, technology, and trade associated with the Friedman "world is flat" hypothesis.

As mentioned above, Friedman (2007) hypothesized that technological innovation, extensions in global supply chains, and accretions to household wealth each have served to enhance connectivity and related economic and financial markets outcomes. If Friedman is right, the higher levels of trade and connectivity should result in dampened diversification opportunity in a more economically-integrated world. Table 6 reveals relatively high correlations among the various "world is flat" proxies, notably including the global supply chain, internet diffusion, and household wealth terms. We considered additional proxies of these terms sourced from the World Bank, including exports of goods and services as a % of GDP, mobile cellular and fixed telephone subscriptions, air transport freight, female teachers in secondary education, and scientific and technical journal articles published. All were highly correlated and subsequently not included in the panel regressions.

Table 7 reports on the association between the macro-financial and development factors and the equity, bond, and REIT diversification indexes. The table displays results of panel regressions for balanced (1996-2010) and unbalanced (1986-2012) panels spanning the timeframes

of diversification index availability. Secular trends in the use of telecommunications and related technology are proxied by a country-specific and population-weighted measure of internet diffusion. The regressions included dummy variables for periods of ERM and Eurozone crisis. Further, all models include country-specific fixed effects. In general, results are consistent among the balanced and unbalanced panel regressions.

Results indicate a sizable negative depressive effect of TED spread credit risk on bond and REIT diversification trends but not for equities. These results are especially pronounced for bond markets, indicating dampened diversification opportunity and high levels of integration among global sovereign debt markets during periods of elevated credit risk. Equity market volatility as proxied by the VIX similarly is significantly related to global asset market diversification opportunity. Interestingly, while the VIX is associated with higher levels of return integration and significantly dampened diversification opportunity in global equity markets, the opposite holds true for global bond and REIT markets. Among other salient results, global internet diffusion, as a proxy for ongoing enhancements to global telecommunications and technology, is uniformly associated with dampened diversification opportunity. The estimated internet diffusion coefficients are sizable and highly significant for both balanced and unbalanced panels and for all asset classes. Among equity markets, for example, a 1 percent increase in global internet diffusion is associated with a 1.7 percent decline in diversification potential. Also, the 1992 European exchange rate mechanism (ERM) crisis is associated with lower diversification potential across all asset classes, similar to the outcome for sovereign debt and REIT asset classes for the 2009-2010 Eurozone crisis. Interestingly, the Eurozone crisis is associated with enhanced diversification opportunity among global equity markets.

Finally, we investigate the robustness of findings among stratifications of panels. In Table 8 we report results for stratification of the panel regressions among developing and emerging countries as defined by the United Nations Human Development Index. Results are reported only for equities owing to lack of adequate sample among sovereign debt and REIT asset classes. In the case of both

the balanced and unbalanced panels, findings for the full sample largely are borne out in both emerging and developed markets. Internet usage, for example, is universally associated with a dampening in diversification trends. This relationship is stronger for developed markets where a 1 percent increase in internet usage is associated with a 2.3 percent decline in equity diversification opportunities. For developed markets in the larger unbalanced panel, in addition to the internet factor, the VIX, consumer sentiment, and the ERM dummy are all negative and significant in relation to equity market diversification, whereas the FED Funds is also negative but is insignificant. Overall, as would be expected, model fit is substantially elevated among developed nations.

Table 9 assesses variation in estimation results among temporally stratified balanced and unbalanced panel samples. Specifically, we stratify the balanced panel into 1996-2003 and 2004-2010 sub-samples and the larger unbalanced panel into 1986-1999 and 2000-2012 sub-samples. Here the specification diverges from the full panel models, as the Eurozone dummy is not present in the early panels, whereas the ERM dummy does not appear in the more recent panels. As would be anticipated, model fit as regards the decline in diversification potential is elevated among the more recent panels.

VIII. Conclusion

Diversification has long been fundamental to risk mitigation. Recent anecdotal evidence, however, suggests diminished effectiveness of asset diversification strategies in the context of an increasingly integrated world economy. This paper presents methodology, computation, and test of new indexes of investment diversification potential. The indexes are computed within and among (equity, sovereign debt, and real estate) asset classes and countries. The diversification indexes derive from estimates of asset return integration based on common global factors.

We detect a large decline in diversification indexes over the period of the financial crisis and beyond. This decline is widespread across country cohorts and is precipitous in the post-2000 period. For example, we estimate declines in the diversification indexes for each of the equity, sovereign debt, and REIT asset classes from a maximum level of 100 in the late-1990s to roughly half

that level by 2012! The diversification trends are robust to state of the economy and to other influences.

Panel data analysis further suggests that declines in diversification indexes are associated with numerous macro-financial and development factors, notably including proxies for market credit risk and volatility as well as secular diffusion in communications technology associated with internet usage. Further, the decline in diversification potential is associated with a marked increase in portfolio risk. Our findings offer a cautionary note regarding asset class and geographic diversification of investment risk in an increasingly flat world.

References

Ammer, J. and Mei., J., 1996, Measuring International Economic Linkages with Stock Market Data, *Journal of Finance* 51, 1743–1763.

Baker, M. and J. Wurgler, 2006, Investor Sentiment and the Cross-Section of Stock Returns, *Journal of Finance*, 61, 645-1680.

Bekaert. G. and Harvey, C. , 2014, Emerging Equity Markets in a Globalizing World, working paper.

Bekaert, G., and Harvey, C., 1995, Time-Varying World Market Integration, *Journal of Finance* 50, 403-444.

Bekaert, G., Harvey, C., and Ng, A., Ng, 2005, Market Integration and Contagion, *Journal of Business* 78, 39–69.

Bekaert, G., Hodrick, R., and Zhang, X., 2009, International Stock Return Comovements, Vol. LXIV, No. 6. *Journal of Finance*, 2591 – 2626

Berger, D., Pukthuanthong, K., and Yang, J.J., 2011, International Diversification with Frontier Markets, *Journal of Financial Economics*, 101, 227-242.

Cappiello, L., Engle, R.F., Sheppard, K., 2006, Asymmetric dynamics in the correlations of global equity and bond returns, *Journal of Financial Econometrics*, 4, 537-572.

Carrieri, F., Errunza, V., and Hogan, K., 2007, Characterizing World Market Integration Through Time, *Journal of Financial and Quantitative Analysis*, 42, 915-940.

Chaieb, I, V. R. Errunza, and R. Gibson Brandon, 2014, Integration of Sovereign Bonds Markets: Time Variation and Maturity Effects, Swiss Finance Institute Research Paper 14-47.

Chambet, A., and Gibson, R., 2008, Financial Integration, Economic Instability, and Trade Structure in Emerging Markets, *Journal of International Money and Finance* 27, 654-675.

Chan, K. C., G. A. Karolyi, and R. M. Stulz, 1992, Global Financial Markets and the Risk Premium on U.S. Equity, *Journal of Financial Economics* 32, 137-167.

Christofersen, P., Errunza, V., Jacobs, K., and Langlois, H., 2012, Is the Potential for International Diversification Disappearing? A Dynamic Copula Approach. *Review of Financial Studies*, 25, 3711-3751.

Christoffersen, P. F.; Errunza, V. Jacobs, K., and J. Xisong, 2014, Correlation Dynamics and International Diversification Benefits, International Journal of Forecasting, 30, 807-824.

Conlon, T., Cotter, J., and R. Gencay, 2015, Long-Run International Diversification, Working Paper.

Cotter, J., S. A. Gabriel, and R. Roll, 2014, Can Housing Risk be Diversified? A Cautionary Tale from the Housing Boom and Bust, *Review of Financial Studies* 28, 913-936

Eiling, E and B. Gerard, 2014, Emerging Equity Market Comovements: Trends and Macroeconomic Fundamentals, *Review of Finance*, 19, 1543-1585.

Engle, R. and R. Susmel, 1993, Common Volatility in International Equity Markets, *Journal of Business and Economic Statistics* 11, 167-176.

Errunza, V., and Losq, E., 1985, International asset pricing under mild segmentation: Theory and test, *Journal of Finance* 40, 105-124.

Errunza, V., K. Hogan, and M.-W. Hung, 2007, Characterizing World Market Integration through Time, *Journal of Financial and Quantitative Analysis*, 42, 915-940.

Eun, C. S., Huang, W., and S. Lai, 2008, International Diversification with Large- and Small-Cap Stocks, The Journal of Financial and Quantitative Analysis, 43, 489-523

Friedman, Thomas, "The World is Flat", Picador Publishers, 2007.

Gagnon, L., and Karolyi, A., 2006 Price and Volatility Transmissions Across Borders, New York University Salomon Center Monograph Series Financial Markets, Institutions & Instruments, Volume 15, Number 3, August.

Goetzmann, W.N., Li, L., and Rouwenhorst, K.G., 2005, Long-term Global Market Correlations. *Journal of Business*, 78, 1-38.

Hardouvelis, G., Malliaropoulos, D., and Priestley, R., 2006, EMU and European Stock Market Integrations, *Journal of Business* 79, 369-392.

Harvey, C., 1991, The World Price of Covariance Risk, *Journal of Finance* 46, 111-159.

Hung, Kathy., and Glascock, John, 2010, Volatilities and Momentum Returns in Real Estate Investment Trusts, *Journal of Real Estate Finance and Economics* 41: 126–149.

Jorion, P. and W. Goetzmann, 1999, Global Stock Markets in the Twentieth Century, *Journal of Finance* 54, 953—980.

Karolyi, G. A. and Stulz, R. M., 1996, Why do Markets Move Together? An Investigation of U.S.-Japan Stock Return Comovements, *Journal of Finance* 51,951–986.

Karolyi, G. A., and Sanders, A. B., 1998, The Variation of Economic Risk Premiums in Real Estate Returns, *Journal of Real Estate Finance and Economics*, 17, 245-262.

King, M. A., and S. Wadhwani, 1990, Transmission of Volatility between Stock Markets, *Review of Financial Studies*, 3, 5-33.

Lin, T. C., and Lin, Z-H., 2011, Integration between Securitized Real Estate and Stock Markets: A Global Perspective, *Pacific-Basin Finance Journal*, 19, 571-85

Liow, Kim Hiang, 2010, Are Stock and Real Estate Markets Integrated? An Empirical Study of Six Asian Economies, *Journal of Real Estate Portfolio Management* 16 (3), 249-65.

Longin, F., Solnik,B., 2001, Extreme Correlation of International Equity Markets. *Journal of Finance*, 56, 649–676.

Peterson, James D. and Cheng-Ho Hsieh, 1997. Do Common Risk Factors in the Returns on Stocks and Bonds Explain Returns on REITs?, *Real Estate Economics*, 25, 321-345.

Pukthuanthong-Le, K., and Roll, R., 2009 Global Market Integration: An Alternative Measure and Its Application, *Journal of Financial Economics*, 94, 214-232.

Rangvid, J., P. Santa-Clara, and M. Schmeling, 2016, Capital market integration and consumption risk sharing over the long run, *Journal of International Economics*, 103, 27–43.

Roll, R., 2013, Volatility, Correlation, and Diversification in a Multi-Factor World, *Journal of Portfolio Management,* 38, 2, 11-18.

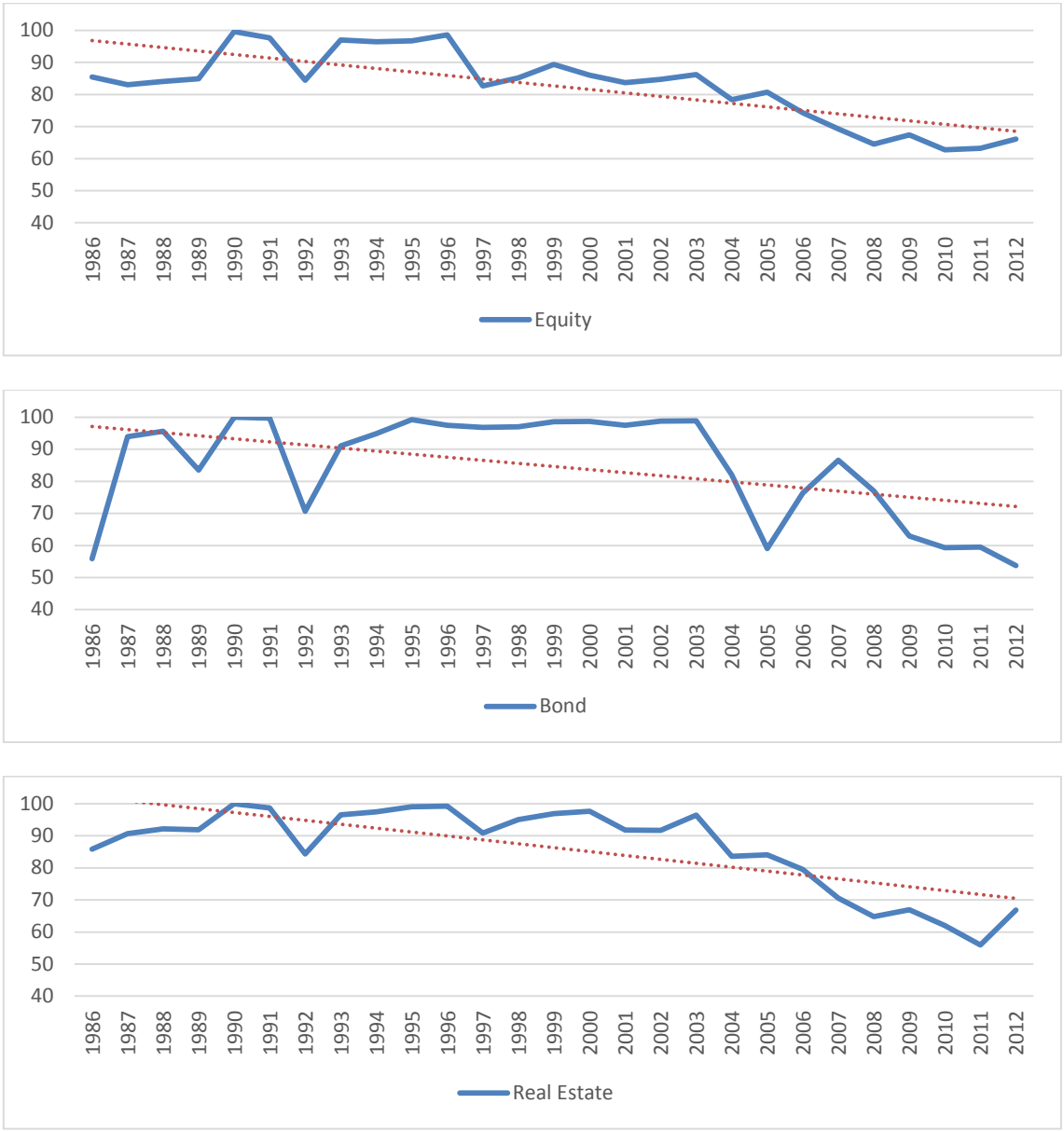
Schotman, P., and Zalewska, A., 2006, Non-synchronous trading and testing for market integration in Central European emerging markets, *Journal of Empirical Finance* 13, 462-494.

Stulz, R. 1981, On the effects of barriers to international investment, *Journal of Finance* 36, 923–934.

You, L., and Daigler, R. T., 2010, Is international Diversification really Beneficial? *Journal of Banking and Finance*, 34, 163-173.

Figure 1

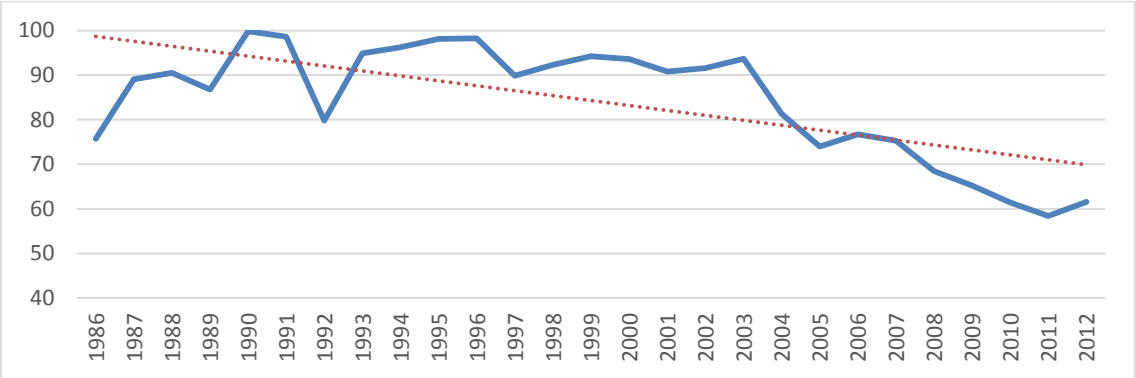
Trends in Global Diversification Indexes by Asset Class



Notes: This figure shows the average diversification indexes for each asset class between 1986 and 2012. There is a time-series plot of the diversification indexes and a fitted linear trend line. The diversification index is 100 minus the average R-square (in percent) from a multi-factor returns model fitted using daily data during every calendar year, 1986-2012. The dependent variable in each regression is a country-specific return on an asset class and the explanatory variables are global factors. The global factors are 16 principal components obtained from the pre-1986 markets. Countries and asset classes in separate regression are for equities: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; for bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and for REITs: Australia, Netherlands, UK, and US). To be included, a country/asset class must have at least 50 valid daily returns during the year.

Figure 2

Trend in World Diversification Index (average of 3 asset classes)



Notes: This figure shows a time series plot of the average diversification index for three asset classes, equities, bonds and REITS along with a fitted linear trend line. The diversification index is 100 minus the average R-square (in percent) from a multi-factor returns model fitted using daily data during every calendar year, 1986-2012. The dependent variable in each regression is a country-specific return on an asset class and the explanatory variables are global factors. The global factors are 16 principal components obtained from the pre-1986 markets. Countries and asset classes in separate regression are for equities: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; for bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and for REITs: Australia, Netherlands, UK, and US). To be included, a country/asset class must have at least 50 valid daily returns during the year.

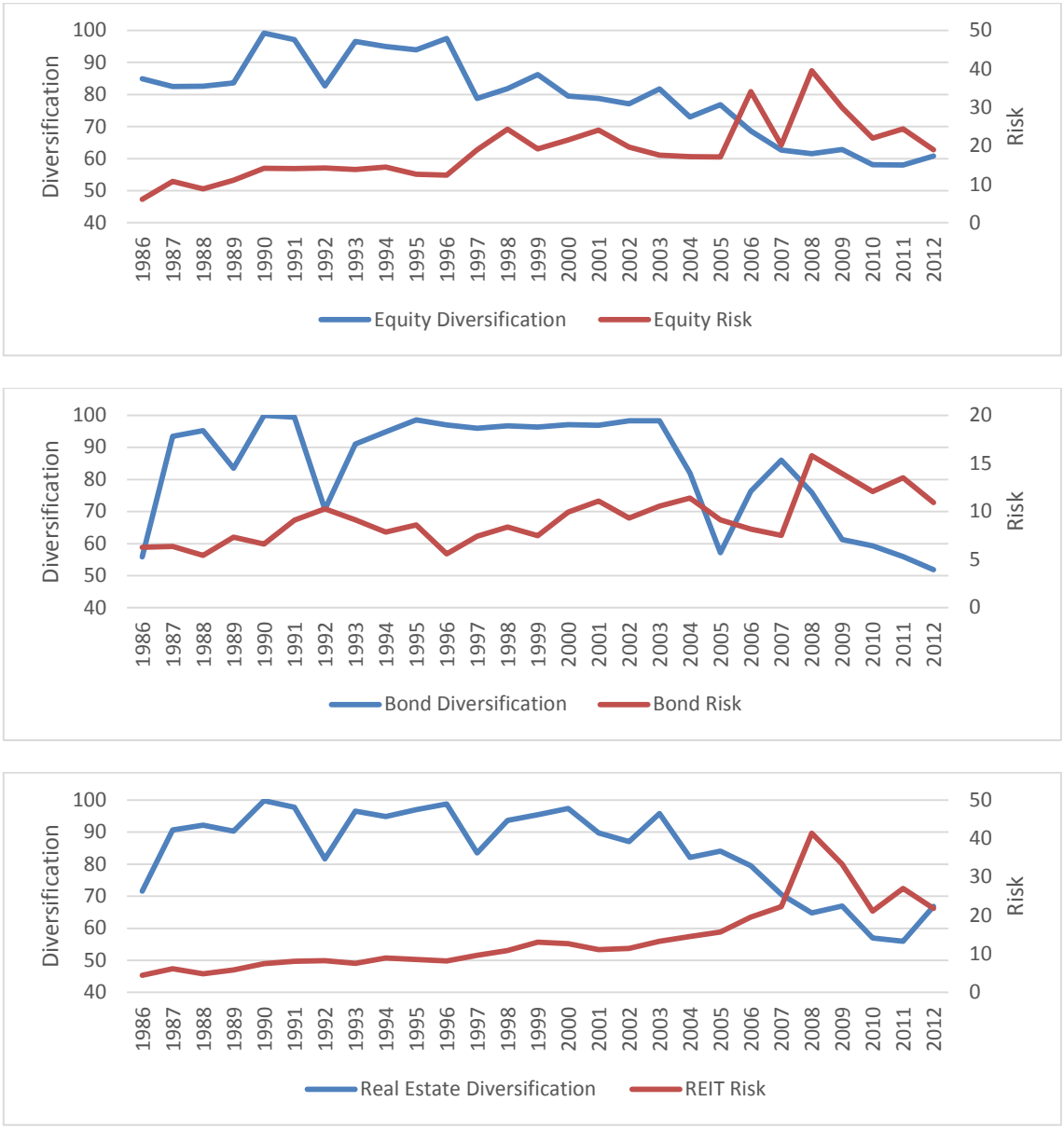
Figure 3

Trends in Global Diversification Indexes by Asset Class and Cohort

Notes: This figure shows the average diversification indexes for each asset class between 1986 and 2012 broken out by cohort years. The diversification index is 100 minus the average R-square (in percent) from a multi-factor returns model fitted using daily data during every calendar year, 1986-2012. on the dependent variable in each regression is a country-specific return on an asset class and the explanatory variables are global factors. The global factors are 16 principal components obtained from the pre-1986 markets. Countries and asset classes in separate regression are for equities: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; for bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and for REITs: Australia, Netherlands, UK, and US). To be included, a country/asset class must have at least 50 valid daily returns during the year. Cohorts for equities are pre-1974, 1974-1983, 1984-1993 and post-1993; for bonds they are: pre-1986, 1986-1999 and post-1999; and for REITs they are pre-2000 and post-2000.

Figure 4

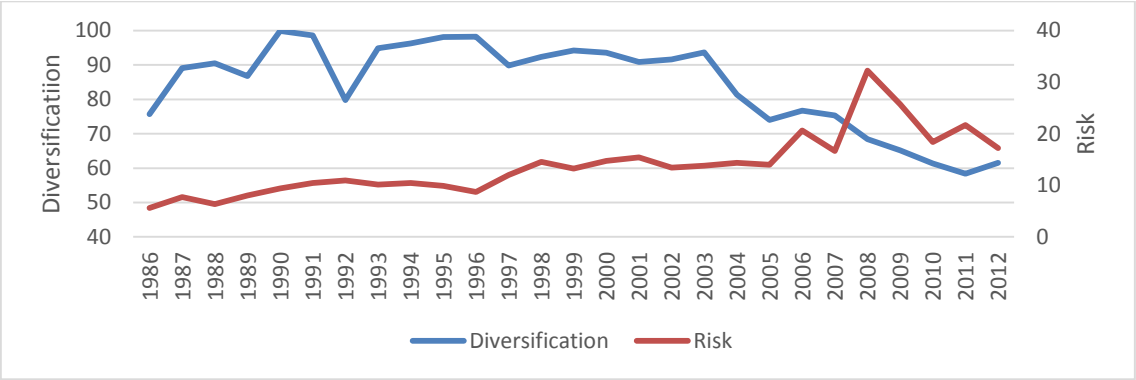
Trends in Global Diversification and Risk by Asset Class



Notes: This figure shows the average diversification indexes for each asset class and associated annual standard deviation of returns. The diversification index is 100 minus the average R-square (in percent) from a multi-factor returns model fitted using daily data during every calendar year, 1986-2012. The dependent variable in each regression is a country-specific return on an asset class and the explanatory variables are global factors. The global factors are 16 principal components obtained from the pre-1986 markets. Countries and asset classes in separate regression are for equities: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; for bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and for REITs: Australia, Netherlands, UK, and US). To be included, a country/asset class must have at least 50 valid daily returns during the year.

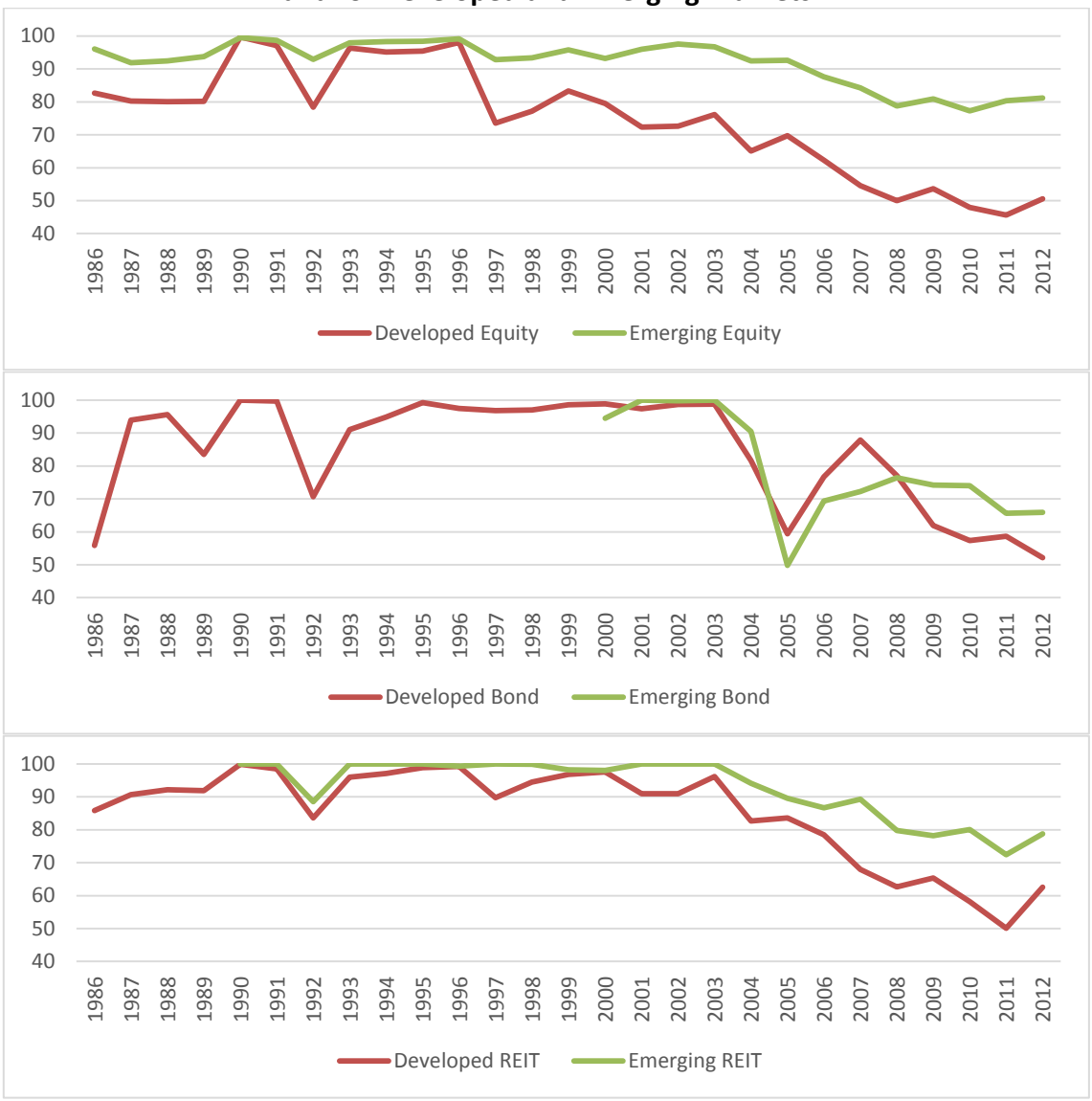
Figure 5

Trends in World Diversification and Risk (average of 3 asset classes)



Notes: This figure shows an average of the diversification indexes and associated risk for the three asset classes, equities, bonds and REITS. There is a time-series plot of the averages of the diversification indexes and risk using the standard deviation of returns. The diversification index is 100 minus the average R-square (in percent) from a multi-factor returns model_fitted using daily data during every calendar year, 1986-2012. The dependent variable in each regression is a country-specific return on an asset class and the explanatory variables are global factors. The global factors are 16 principal components obtained from the pre-1986 markets. Countries and asset classes in separate regression are for equities: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; for bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and for REITs: Australia, Netherlands, UK, and US). To be included, a country/asset class must have at least 50 valid daily returns during the year.

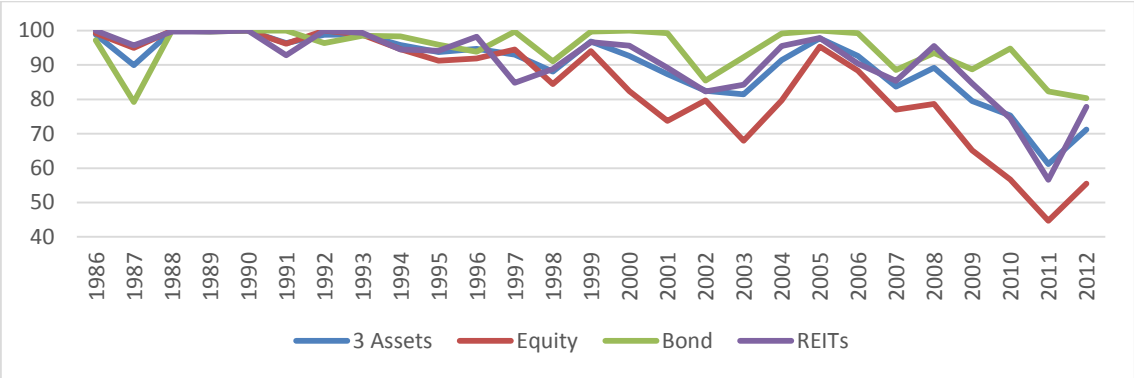
Figure 6
Trends in Global Diversification Indexes by Asset Class and for Developed and Emerging Markets



Notes: This figure shows the average diversification indexes for each asset class between 1986 and 2012 broken out for developed and emerging markets. The diversification index is 100 minus the average R-square (in percent) from a multi-factor returns model fitted using daily data during every calendar year, 1986-2012. The dependent variable in each regression is a country-specific return on an asset class and the explanatory variables are global factors. The global factors are 16 principal components obtained from the pre-1986 markets. Countries and asset classes in separate regression are for equities: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; for bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and for REITs: Australia, Netherlands, UK, and US). To be included, a country/asset class must have at least 50 valid daily returns during the year. The categorization of "developed" and "emerging" economies relies on the United Nations Human Development Index that incorporates a number of distinguishing features such as income and education. The United Nations country category of "very high human development" is taken here as a developed economies; those outside that category are taken here as emerging economies.

Figure 7

Trends in U.S. Diversification Indexes Within and Among Asset classes



Notes: This figure shows an average of the diversification indexes for the three asset classes, equities, bonds and REITS and for a single country, the US. There is a time-series plot of the averages of the diversification indexes across asset classes and the diversification indexes for equities, bonds and REITS for the US. The diversification index is 100 minus the average R-square (in percent) from a multi-factor returns model_fitted using daily data during every calendar year, 1986-2012. The dependent variable in each regression is a country-specific return on an asset class and the explanatory variables are global factors. The global factors are 16 principal components obtained from the pre-1986 markets. Countries and asset classes in separate regression are for equities: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; for bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and for REITs: Australia, Netherlands, UK, and US). To be included, a country/asset class must have at least 50 valid daily returns during the year.

Table 1

Cohort Members for Asset Classes

Equity	Pre 1974	Australia	Austria	Belgium	Canada	Denmark	France
		Germany	Hong Kong	Ireland	Italy	Japan	Netherlands
		Singapore	South Africa	Switzerland	UK	US	
	1974-1983	Brazil	Malaysia	Norway	South Korea	Spain	Sweden
	1984-1993	Argentina	Bangladesh	Chile	Colombia	Czech Rep.	Ecuador
		Finland	Greece	Hungary	Iceland	India	Israel
		Jordan	Kenya	Luxembourg	Mexico	Morocco	New Zealand
		Pakistan	Panama	Peru	Philippines	Poland	Portugal
		Slovakia	Sri Lanka	Taiwan	Thailand	Turkey	Venezuela
	Post 1993	Bahrain	Botswana	Bulgaria	China	Cote d'Ivoire	Croatia
		Cyprus	Egypt	Estonia	Ghana	Iceland	Indonesia
		Jamaica	Kazakhstan	Kuwait	Latvia	Lebanon	Lithuania
		Macedonia	Malta	Mauritius	Montenegro	Namibia	Nigeria
		Oman	Qatar	Romania	Russia	Saudi Arabia	Serbia
		Slovenia	Trinidad	Tunisia	Ukraine	UAE	Vietnam
		Zambia					
Bonds	Pre 1986	Austria	Belgium	Canada	Denmark	France	Germany
		Ireland	Japan	Netherlands	Sweden	Switzerland	UK
		US					
	1986-1999	Australia	Finland	Italy	New Zealand	Norway	Portugal
		Spain					
	Post 1999	China	Czech Rep.	Mexico	Poland	South Africa	
REITs	Pre 2000	Australia	Belgium	Canada	France	Germany	Netherlands
		South Africa	UK	US			
	Post 2000	Bulgaria	Greece	Hong Kong	Italy	Japan	Malaysia
		Mexico	New Zealand	Singapore	Turkey		

Notes: This table lists the markets used in estimating diversification indexes for equities, bond and REITS broken out by cohort years. There are 89 equity indexes, 25 bond indexes and 19 REIT indexes with data obtained from DataStream. Cohorts for equities are pre1974, 1974-1983, 1984-1993 and post1993; for bonds are pre1986, 1986-1999 and post1999; and for REITs are pre2000 and post2000.

Table 2

Time Trends for Diversification Indexes for Equities, Bonds and REITs

Full Sample							
Equity							
World Index	Argentina	Australia	Austria	Bahrain	Bangladesh	Belgium	Botswana
-1.089	-1.355	-1.968	-3.123	-0.105	NA	-3.387	-0.668
(-5.892)	(-3.532)	(-5.573)	(-6.155)	(-1.662)	(NA)	(-7.350)	(-0.303)
Brazil	Bulgaria	Canada	Chile	China	Colombia	Cote d'Ivoire	Croatia
-2.292	-3.960	-2.453	-2.191	-0.290	-2.586	-1.761	-3.974
(-8.952)	(-7.725)	(-9.860)	(-8.674)	(-4.430)	(-5.554)	(-5.598)	(-6.524)
Cyprus	Czech Rep.	Denmark	Ecuador	Egypt	Estonia	Finland	France
-1.998	-3.359	-3.237	NA	-0.740	-2.912	-4.507	-3.812
(-0.890)	(-6.676)	(-7.647)	(NA)	(-2.253)	(-7.394)	(-8.652)	(-9.511)
Germany	Ghana	Greece	Hong Kong	Hungary	Iceland	India	Indonesia
-3.236	-0.007	-2.511	-1.048	-3.164	-1.844	-1.406	-2.282
(-8.210)	(-0.690)	(-6.182)	(-3.725)	(-7.275)	(-4.451)	(-6.890)	(-2.348)
Ireland	Israel	Italy	Jamaica	Japan	Jordan	Kazakhstan	Kenya
-2.672	-2.055	-3.478	-0.091	-0.001	0.105	0.941	-0.166
(-6.806)	(-8.425)	(-8.761)	(-0.674)	(-0.002)	(1.364)	(0.300)	(-1.805)
Kuwait	Latvia	Lebanon	Lithuania	Luxembourg	Macedonia	Malaysia	Malta
-0.140	-3.078	2.071	-5.108	-3.567	-2.439	-0.698	-2.024
(-3.148)	(-7.511)	(1.490)	(-7.753)	(-3.381)	(-1.910)	(-2.317)	(-6.659)
Mauritius	Mexico	Montenegro	Morocco	Namibia	Netherlands	New Zealand	Nigeria
NA	-2.759	-0.012	-0.901	-0.759	-3.368	-2.140	-0.055
(NA)	(-12.889)	(-0.073)	(-3.835)	(-0.507)	(-7.165)	(-5.514)	(-1.756)
Norway	Oman	Pakistan	Panama	Peru	Philippines	Poland	Portugal
-2.882	-0.322	0.077	NA	-1.708	-0.521	-3.944	-2.750
(-8.167)	(-1.826)	(0.626)	(NA)	(-4.920)	(-1.935)	(-9.226)	(-6.104)
Qatar	Romania	Russia	Saudi Arabia	Serbia	Singapore	Slovakia	Slovenia
-0.483	-5.023	-3.571	-0.736	-3.906	-1.559	-0.992	8.476
(-1.052)	(-7.933)	(-4.662)	(-1.885)	(-2.089)	(-4.714)	(-4.335)	(2.843)
South Africa	South Korea	Spain	Sri Lanka	Sweden	Switzerland	Taiwan	Thailand
-2.577	-1.164	-3.228	-0.026	-3.292	-2.738	-0.897	-0.799
(-6.407)	(-6.961)	(-8.588)	(-0.398)	(-8.564)	(-5.787)	(-5.361)	(-3.547)
Trinidad	Tunisia	Turkey	Ukraine	UAE	UK	US	Venezuela
0.038	-1.591	-2.615	-3.463	-1.061	-3.449	-1.644	0.077
(1.574)	(-3.567)	(-7.399)	(-3.704)	(-1.323)	(-10.029)	(-7.783)	(0.623)
Vietnam	Zambia						
-0.259	-0.299						
(-2.231)	(-1.775)						

Bonds							
World Index	Australia	Austria	Belgium	Canada	China	Czech Rep.	Denmark
-0.958	-2.201	-0.939	-1.182	-1.484	0.008	-4.951	-6.190
(-2.623)	(-5.803)	(-2.012)	(-2.579)	(-6.085)	(0.205)	(-4.419)	(-4.150)
Finland	France	Germany	Ireland	Italy	Japan	Mexico	Netherlands
-1.675	-4.871	-0.566	-1.020	-2.064	-0.766	-12.176	-3.454
(-3.084)	(-4.139)	(-1.133)	(-2.899)	(-3.386	(-1.749)	(-1.850)	(-5.115)
New Zealand	Norway	Poland	Portugal	South Africa	Spain	Sweden	Switzerland
-2.555	-1.812	-7.042	-1.670	-5.640	-1.786	-3.298	-0.153
(-6.124)	(-3.923)	(-8.776)	(-3.462)	(-6.381	(-4.082)	(-6.330)	(-0.393)
UK	US						
-0.635	-0.702						
(-2.143)	(-2.509)						
REITs							
World Index	Australia	Belgium	Bulgaria	Canada	France	Germany	Greece
-1.216	-1.491	-4.821	-4.378	-3.178	-3.216	-1.024	-1.216
(-5.374)	(-5.304)	(-9.290)	(-3.124)	(-6.751	(-5.334)	(-3.268)	(-5.374)
Hong Kong	Italy	Japan	Malaysia	Mexico	Netherlands	New Zealand	Singapore
1.435	-4.468	0.521	-2.789	NA	-2.321	-5.011	-4.599
(1.257)	(-6.367)	(0.686)	(-4.992)	(NA)	(-4.666)	(-4.108)	(-3.079)
South Africa	Turkey	UK	US				
-1.781	NA	-2.444	-0.872				
(-6.218)	(NA)	(-6.963)	(-4.843)				

Pre 2000							
Equity							
World Index	Argentina	Australia	Austria	Bahrain	Bangladesh	Belgium	Botswana
0.327	-2.549	-1.045	-0.298	NA	0.322	0.113	NA
(0.715)	(-2.347)	(-0.935)	(-0.279)	(NA)	(0.811)	(0.108)	(NA)
Brazil	Bulgaria	Canada	Chile	China	Colombia	Cote d'Ivoire	Croatia
-0.377	NA	-1.096	-1.883	NA	0.327	0.037	-1.957
(-2.029)	(NA)	(-1.733)	(-2.280)	(NA)	(0.456)	(0.378)	(-0.582)
Cyprus	Czech Rep.	Denmark	Ecuador	Egypt	Estonia	Finland	France
NA	-3.666	0.817	-0.143	0.086	-0.029	-1.158	-1.086
(NA)	(-1.380)	(2.017)	(-0.931)	(0.190)	(-0.205)	(-0.811)	(-0.962)
Germany	Ghana	Greece	Hong Kong	Hungary	Iceland	India	Indonesia
-0.487	NA	0.056	-1.105	-3.675	0.177	-0.094	NA
(-0.402)	(NA)	(0.100)	(-1.240)	(-2.552)	(0.904)	(-0.397)	(NA)
Ireland	Israel	Italy	Jamaica	Japan	Jordan	Kazakhstan	Kenya
0.369	-0.723	0.065	-0.372	0.722	0.460	NA	0.010
(0.417)	(-2.087)	(0.071)	(-1.603)	(1.061)	(1.365)	(NA)	(0.217)
Kuwait	Latvia	Lebanon	Lithuania	Luxembourg	Macedonia	Malaysia	Malta
-0.095	NA	NA	NA	NA	NA	0.741	1.016
(-0.478)	(NA)	(NA)	(NA)	(NA)	(NA)	(1.117)	(1.932)
Mauritius	Mexico	Montenegro	Morocco	Namibia	Netherlands	New Zealand	Nigeria
-0.095	-2.152	NA	0.446	NA	0.201	-1.149	-0.033
(-0.527)	(-4.527)	(NA)	(1.448)	(NA)	(0.149)	(-1.072)	(-1.732)
Norway	Oman	Pakistan	Panama	Peru	Philippines	Poland	Portugal
-0.280	-0.189	-0.380	NA	-1.429	-1.227	-3.803	-3.363
(-0.348)	(-0.849)	(-0.651)	(NA)	(-2.702)	(-1.940)	(-2.433)	(-2.296)
Qatar	Romania	Russia	Saudi Arabia	Serbia	Singapore	Slovakia	Slovenia
NA	NA	-3.371	NA	NA	-0.497	0.182	NA
(NA)	(NA)	(-0.595)	(NA)	(NA)	(-0.481)	(0.983)	(NA)
South Africa	South Korea	Spain	Sri Lanka	Sweden	Switzerland	Taiwan	Thailand
-1.197	-0.011	-0.422	-0.155	-0.616	1.348	-0.053	-0.850
(-1.188)	(-0.046)	(-0.457)	(-1.047)	(-0.534)	(1.162)	(-0.199)	(-1.048)
Trinidad	Tunisia	Turkey	Ukraine	UAE	UK	US	Venezuela
0.551	NA	-0.428	NA	NA	-0.966	-0.750	-1.062
(1.495)	(NA)	(-1.738)	(NA)	(NA)	(-0.950)	(-3.344)	(-2.540)
Vietnam	Zambia						
NA	NA						
(NA)	(NA)						

Bonds							
World Index	Australia	Austria	Belgium	Canada	China	Czech Rep.	Denmark
1.536	0.580	1.910	1.627	-0.431	NA	NA	1.812
(2.006)	(1.456)	(1.937)	(1.812)	(-2.068)	(NA)	(NA)	(1.954)
Finland	France	Germany	Ireland	Italy	Japan	Mexico	Netherlands
2.351	2.047	2.434	1.940	2.384	1.729	NA	2.441
(1.442)	(1.978)	(1.934)	(2.486)	(1.252)	(2.425)	(NA)	(1.976)
New Zealand	Norway	Poland	Portugal	South Africa	Spain	Sweden	Switzerland
0.260	1.480	NA	1.442	NA	0.853	1.497	1.486
(0.482)	(1.464)	(NA)	(1.934)	(NA)	(1.372)	(1.802)	(1.615)
UK	US						
1.004	0.211						
(1.366)	(0.550)						
REITs							
World Index	Australia	Belgium	Bulgaria	Canada	France	Germany	Greece
0.518	-1.300	-0.032	NA	-1.147	0.868	0.637	NA
(1.662)	(-1.641)	(-0.173)	(NA)	(-1.750)	(1.988)	(1.153)	(NA)
Hong Kong	Italy	Japan	Malaysia	Mexico	Netherlands	New Zealand	Singapore
NA	NA	NA	NA	NA	1.866	NA	NA
(NA)	(NA)	(NA)	(NA)	(NA)	(2.505)	(NA)	(NA)
South Africa	Turkey	UK	US				
0.232	NA	0.647	-0.635				
(0.783)	(NA)	(1.293)	(-2.384)				

Post 2000							
Equity							
World Index	Argentina	Australia	Austria	Bahrain	Bangladesh	Belgium	Botswana
-2.228	-2.956	-3.333	-7.679	-0.105	NA	-4.460	-0.668
(-9.009)	(-3.346)	(-4.387)	(-8.098)	(-1.662)	(NA)	(-4.071)	(-0.303)
Brazil	Bulgaria	Canada	Chile	China	Colombia	Cote d'Ivoire	Croatia
-4.417	-3.960	-4.020	-3.498	-0.460	-3.919	-2.407	-5.014
(-6.478)	(-7.725)	(-7.495)	(-6.889)	(-3.585)	(-4.404)	(-5.025)	(-6.179)
Cyprus	Czech Rep.	Denmark	Ecuador	Egypt	Estonia	Finland	France
-1.998	-3.801	-4.721	NA	-1.125	-3.232	-4.641	-2.633
(-0.890)	(-3.899)	(-4.308)	(NA)	(-1.799)	(-4.875)	(-9.565(	(-4.856)
Germany	Ghana	Greece	Hong Kong	Hungary	Iceland	India	Indonesia
-3.955	-0.004	-2.582	-0.362	-4.383	-2.845	-2.722	-2.282
(-9.571)	(-0.254)	(-2.091)	(-0.518)	(-4.287)	(-3.071)	(-4.537)	(-2.348)
Ireland	Israel	Italy	Jamaica	Japan	Jordan	Kazakhstan	Kenya
-4.900	-3.349	-3.319	-0.042	0.427	0.000	0.941	-0.187
(-6.609)	(-4.288)	(-5.584)	(-0.181)	(0.545)	(0.003)	(0.300)	(-0.632)
Kuwait	Latvia	Lebanon	Lithuania	Luxembourg	Macedonia	Malaysia	Malta
-0.265	-3.078	2.071	-5.108	-3.779	-2.439	-2.563	-2.875
(-3.809)	(-7.511)	(1.490)	(-7.753)	(-3.089)	(-1.910)	(-3.051)	(-7.481)
Mauritius	Mexico	Montenegro	Morocco	Namibia	Netherlands	New Zealand	Nigeria
NA	-3.967	-0.012	-2.498	-0.759	-3.033	-4.317	-0.082
(NA)	(-6.657)	(-0.073)	(-4.003)	-0.507)	(-5.889)	(-4.564)	(-1.352)
Norway	Oman	Pakistan	Panama	Peru	Philippines	Poland	Portugal
-4.766	-0.419	-0.004	0.078	-2.677	-0.792	-6.102	-3.158
(-6.469)	(-1.564)	(-0.049)	(2.690)	(-2.823)	(-0.920)	(-8.113)	(-2.662)
Qatar	Romania	Russia	Saudi Arabia	Serbia	Singapore	Slovakia	Slovenia
-0.483	-5.966	-5.296	-0.918	-3.906	-2.685	-1.343	8.476
(-1.052)	(-8.481)	(-4.552)	(-1.779)	(-2.089)	(-3.662)	(-2.823)	(2.843)
South Africa	South Korea	Spain	Sri Lanka	Sweden	Switzerland	Taiwan	Thailand
-4.774	-1.119	-1.999	-0.108	-2.932	-3.367	-1.389	-1.460
(-4.238)	(-1.984)	(-3.187)	(-0.575)	(-6.548)	(-4.578)	(-2.285)	(-3.399)
Trinidad	Tunisia	Turkey	Ukraine	UAE	UK	US	Venezuela
0.007	-1.637	-4.982	-4.423	-1.061	-3.123	-2.344	0.298
(0.367)	(-2.728)	(-5.073)	(-3.807)	(-1.323)	(-8.331)	(-2.790)	(1.410)
Vietnam	Zambia						
-0.259	-0.382						
(-2.231)	(-1.487)						

Bonds							
World Index	Australia	Austria	Belgium	Canada	China	Czech Rep.	Denmark
-3.886	-5.273	-4.612	-4.991	-3.804	0.008	-4.951	-4.063
(-5.858)	(-5.895)	(-4.652)	(-5.033)	(-5.228)	(0.205)	(-4.419)	(-4.976)
Finland	France	Germany	Ireland	Italy	Japan	Mexico	Netherlands
-4.220	-4.644	-3.885	-3.207	-4.962	-0.371	-12.176	-4.367
(-4.354)	(-4.630)	(-4.059)	(-3.280)	(-4.699)	(-0.393)	(-1.850)	(-4.602)
New Zealand	Norway	Poland	Portugal	South Africa	Spain	Sweden	Switzerland
-5.539	-5.124	-7.042	-2.557	-5.640	-4.641	(-4.598	-2.180
(-6.280)	(-6.830)	(-8.776)	(-2.396)	(-6.381)	(-4.483)	-4.606)	(-1.946)
UK	US						
-2.521	-1.095						
(-3.834)	(-2.560)						
REITs							
World Index	Australia	Belgium	Bulgaria	Canada	France	Germany	Greece
-3.421	-3.038	-6.922	-4.378	-4.566	-8.960	-3.489	3.049
(-9.444)	(-4.226)	(-11.956)	(-3.124)	(-5.159)	(-8.998)	(-5.056)	(1.725)
Hong Kong	Italy	Japan	Malaysia	Mexico	Netherlands	New Zealand	Singapore
1.435	-4.468	0.521	-2.789	NA	-6.831	-5.011	-4.599
(1.257)	(-6.367)	(0.686)	(-4.992)	(NA)	(-10.140)	(-4.108)	(-3.079)
South Africa	Turkey	UK	US				
-3.939	NA	-5.634	-1.715				
(-9.014)	(NA)	(-13.955)	(-2.444)				

Notes: This table shows the coefficient from fitting a linear trend to each market's diversification index followed by the associated t-test (in parentheses.) The first panel is for the full period, followed by pre-2000 in the second panel and post-2000 in the final panel. NA refers to cases where no trend statistics can be computed. This may have occurred for markets where there was at least one year of insufficient returns to calculate a diversification index in a year (a minimum of 50 daily observations are required) after the countries joined the database or where there were insufficient annual diversification index values to fit a time-trend. The diversification index is 100 minus the average R-square (in percent) from a multi-factor returns model fitted using daily data during every calendar year, 1986-2012. The dependent variable in each regression is a country-specific return on an asset class and the explanatory variables are global factors. The global factors are 16 principal components obtained from the pre-1986 markets. Countries and asset classes in separate regression are for equities: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; for bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and for REITs: Australia, Netherlands, UK, and US).

Table 3

Time Trends for Diversification Indexes Across Three Asset Classes

Full Sample					
Australia	Belgium	Canada	France	Germany	Italy
-1.858	-2.144	-1.929	-2.371	-1.430	-1.840
(-6.392)	(-5.300)	(-8.240)	(-6.194)	(-4.074)	(-5.125)
Japan	Netherlands	New Zealand	South Africa	UK	US
0.143	-2.125	-2.001	-1.829	-2.176	-0.940
(0.628)	(-5.048)	(-5.654)	(-5.531)	(-7.900)	(-5.991)
Pre 2000					
Australia	Belgium	Canada	France	Germany	Italy
-0.674	1.208	-0.486	0.920	1.261	1.113
(-0.968)	(1.480)	(-1.650)	(1.146)	(1.434)	(1.332)
Japan	Netherlands	New Zealand	South Africa	UK	US
1.226	1.503	-0.320	-0.055	0.228	-0.391
(2.165)	(1.518)	(-0.450)	(-0.087)	(0.353)	(-1.663)
Post 2000					
Australia	Belgium	Canada	France	Germany	Italy
-3.881	-5.458	-4.130	-5.413	-3.776	-4.250
(-5.328)	(-13.906)	(-7.265)	(-31.009)	(-10.473)	(-11.207)
Japan	Netherlands	New Zealand	South Africa	UK	US
0.147	-4.744	-4.574	-4.784	-3.759	-1.718
(0.216)	(-13.820)	(-5.549)	(-6.590)	(-14.203)	(-2.950)

Notes: This table shows the coefficient from fitting a linear trend to the average diversification indexes across asset classes followed by the associated t-test in parentheses. The diversification indexes are created for those countries where the three asset classes, equities, bonds and REITs are available. The indexes represent portfolios containing the three asset classes together. The first panel is for the full period, followed by pre2000 in the second panel and post2000 in the final panel. The diversification index is measured by the average R-squares from the multi-factor asset returns model fitted using daily data every year between 1986 and 2012 for all markets in the database. The model fits asset returns within each year on global factors. The global factors are 16 principal components obtained from the pre1986 markets (Equity: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; Bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and REIT: Australia, Netherlands, UK, and US). A diversification value is obtained for each market assuming there are 50 valid daily returns per year.

Table 4

Time Trends for Diversification Indexes for Developed and Emerging Markets for Equities, Bonds and REITs

Full Sample					
Equities		Bonds		REITs	
Developed	Emerging	Developed	Emerging	Developed	Emerging
-1.720	-0.629	-0.989	-2.908	-1.357	-1.070
(-7.249)	(-5.332)	(-2.664)	(-3.318)	(-5.539)	(-5.914)
Pre 2000					
Equities		Bonds		REITs	
Developed	Emerging	Developed	Emerging	Developed	Emerging
0.068	0.117	1.536	NA	0.475	0.232
(0.105)	(0.606)	(2.006)	(NA)	(1.461)	(0.565)
Post 2000					
Equities		Bonds		REITs	
Developed	Emerging	Developed	Emerging	Developed	Emerging
-2.849	-1.726	-4.017	-2.908	-3.810	-2.349
(-9.493)	(-6.954)	(-5.926)	(-3.318)	(-9.695)	(-9.400)

Notes: This table shows the coefficient from fitting a linear trend to the average diversification indexes for developed and emerging markets followed by the associated t-test in parentheses. The first panel is for the full period, followed by pre2000 in the second panel and post2000 in the final panel. NA refers to cases where no trend statistics are reported. This may have occurred for markets where there was at least one year of insufficient returns to calculate a diversification index in a year (minimum 50 required) after the countries joined the database or where there were insufficient annual diversification index values to fit a time-trend. The diversification index is measured by the average R-squares from the multi-factor asset returns model fitted using daily data every year between 1986 and 2012 for all markets in the database. The model fits asset returns within each year on global factors. The global factors are 16 principal components obtained from the pre1986 markets (Equity: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; Bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and REIT: Australia, Netherlands, UK, and US). The identification of developed and emerging economies uses the United Nations Human Development Index that incorporates a number of distinguishing features such as income and education. The United Nations country title of 'very high human development' is designated as developed economies and those outside this list as emerging economies. For equities the developed markets are: Argentina, Australia, Austria, Bahrain, Belgium, Canada, Chile, Croatia, Cyprus, Czech Rep., Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, Kuwait, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Poland, Portugal, Qatar, Saudi Arabia, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, UAE, UK and US. The associated emerging equity markets are: Bangladesh, Botswana, Brazil, Bulgaria, China, Colombia, Cote d'Ivoire, Ecuador, Egypt, Ghana, India, Indonesia, Jamaica, Jordan, Kazakhstan, Kenya, Lebanon, Macedonia, Malaysia, Mauritius, Mexico, Montenegro, Morocco, Namibia, Nigeria, Oman, Pakistan, Panama, Peru, Philippines, Romania, Russia, Serbia, South Africa, South Korea, Sri Lanka, Taiwan, Thailand, Trinidad, Tunisia, Turkey,

Ukraine, Venezuela, Vietnam and Zambia. For bonds the developed markets are: Australia, Austria, Belgium, Canada, Czech Rep., Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, UK and US. The associated emerging bond markets are: China, Mexico and South Africa. For REITs the developed markets are: Australia, Belgium, Canada, France, Germany, Greece, Hong Kong, Italy, Japan, Netherlands, New Zealand, Singapore, UK and US. The associated emerging REIT markets are: Bulgaria, Malaysia, Mexico, South Africa and Turkey.

Table 5

Variables Associated with Diversification Indexes

TED Spread, Percent, Annual. 1986-2012. From FRED.
VIX, Annual. 1990-2012. From FRED.
SENT, Investor sentiment data, Annual, 1986-2010, Described in Baker and Wurgler (2006). From Jeffrey Wurgler.
US MONETARY BASE, Annual, 1986-2012, From DataStream.
FEDFUNDS, Annual, 1986-2012, From DataStream.
OIL, Crude oil, avg, spot, $/bbl, nominal$, Annual, 1986-2012, From World Bank WDI.
GLOBAL SUPPLY CHAIN, Global Supply Chain, Annual, 1986-2012, From World Bank WDI.
INTERNET, Percentage of Individual Using the Internet, Annual, 1986-2012.
GDP PER CAPITA, GDP per capita (constant 2005 US$), Annual, 1986-2012, From World Bank WDI.
AIR TRANSPORT, Air transport, passengers carried, Annual, 1986-2012, From World Bank WDI.
GENDER EQUALITY, Out-of-school children of primary school age, female (number), Annual, 1986-2012, From World Bank WDI.
POPULATION, Urban population (% of total) Annual, 1986-2012, From World Bank WDI.
1992- ERM crises dummy.
2009-10 - Eurozone bond crises dummy.

Notes: The table defines the independent variables considered for the panel regressions and their data sources. The variables are both macro-financial (TED Spread, SENT, US MONETARY BASE, FEDFUNDS, and OIL) and developmental proxies (GLOBAL SUPPLY CHAIN, INTERNET, GDP PER CAPITA, AIR TRANSPORT, GENDER EQUALITY and POPULATION). All variables are annual for the timeframe 1986-2012 inclusive, except VIX which is from 1990-2012, and SENT which is from 1986-2010. TED Spread is the annual TED spread obtained from FRED. VIX is the option volatility index from the Chicago Board Options Exchange obtained from FRED. SENT is investor sentiment described in Baker and Wurgler (2006) obtained from Jeffrey Wurgler. US MONETARY BASE is the US monetary base change in millions obtained from Datastream. FEDFUNDS is the US Federal Funds Rate obtained from DataStream. OIL is crude oil defined as the average spot price of Brent, Dubai and West Texas Intermediate, equally weighed) obtained from World Bank WDI. GLOBAL SUPPLY CHAIN is Global Supply Chain proxied by the sum of imports and exports obtained from World Bank WDI. INTERNET is the percentage of Individuals using the Internet. It is computed as a population weighted average of the percentage of individuals using the internet by the country and is obtained from ITU. It is for countries only with available data in given year. Note 1986-1989 values are 0. GDP PER CAPITA is gross domestic product divided by midyear population obtained from World Bank WDI. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. AIR TRANSPORT is passengers carried including both domestic and international aircraft passengers of air carriers registered in the country and is obtained from World Bank WDI. GENDER EQUALITY is the Children out of school and are the number of primary-school-age female children not enrolled in primary or secondary school obtained from World Bank WDI. POPULATION is the

Urban population (% of total) where Urban population refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects and obtained from World Bank WDI. 1992 is an ERM crises dummy, 1 for year and 0 for other years. 2009-10 is a Eurozone bond crises dummy, 1 for years and 0 for other years.

Table 6

Correlations of Variables Associated with Diversification Indexes

	TED	VIX	SENT	MBASE	FED	OIL	SUP-CHAIN	NET	GDP	AIR	GEND	POP
TED	1.000											
VIX	0.411	1.000										
SENT	0.098	0.019	1.000									
MBASE	-0.083	0.403	-0.067	1.000								
FED	0.356	-0.269	0.293	-0.704	1.000							
OIL	0.355	0.276	-0.112	0.747	-0.473	1.000						
SUP-CHAIN	0.227	0.287	0.111	0.676	-0.461	0.873	1.000					
NET	0.080	0.363	-0.099	0.899	-0.674	0.916	0.900	1.000				
GDP	0.154	0.333	0.023	0.772	-0.560	0.889	0.981	0.959	1.000			
AIR	0.091	0.323	0.059	0.876	-0.601	0.883	0.941	0.973	0.973	1.000		
GEND	-0.083	-0.291	0.157	-0.809	0.641	-0.914	-0.887	-0.975	-0.945	-0.921	1.000	
POP	0.071	0.354	-0.004	0.849	-0.659	0.866	0.947	0.975	0.985	0.984	-0.940	1.000

Notes: The table presents the correlations between the independent variables considered for the panel regressions. The variables are both macro-financial (TED Spread, SENT, US MONETARY BASE, FEDFUNDS, and OIL) and developmental proxies (GLOBAL SUPPLY CHAIN, INTERNET, GDP PER CAPITA, AIR TRANSPORT, GENDER EQUALITY and POPULATION). TED is the annual TED spread obtained from FRED. VIX is the option volatility index from the Chicago Board Options Exchange obtained from FRED. SENT is investor sentiment described in Baker and Wurgler (2006) obtained from Jeffrey Wurgler. MBASE is the US monetary base change in millions obtained from Datastream. FED is the US Federal Funds Rate obtained from DataStream. OIL is cude oil defined as the average spot price of Brent, Dubai and West Texas Intermediate, equally weighed) obtained from World Bank WDI. SUP-CHAIN is Global Supply Chain proxied by the sum of imports and exports) obtained from World Bank WDI. NET is the percentage of Individuals using the Internet. It is computed as a population weighted average of the percentage of individuals using the internet by the country and is obtained from ITU. It is for for countries only with available data in given year. Note 1986-1989 values are 0. GDP is gross domestic product divided by midyear population obtained from World Bank WDI. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. AIR is passengers carried including both domestic and international aircraft passengers of air carriers registered in the country and is obtained from World Bank WDI. GEND

represents Gender Equality and is the Children out of school and are the number of primary-school-age female children not enrolled in primary or secondary school obtained from World Bank WDI. POP is the Urban population (% of total) where Urban population refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects and obtained from World Bank WDI.

Table 7
Panel Regression Analysis of Diversification Indexes

	Balanced (1996-2010)			Unbalanced (1986-2012)		
	Equity	Bond	REIT	Equity	Bond	REIT
TED	0.079	-17.351	-13.409	-0.398	-11.912	-14.001
	(0.974)	(0.000)***	(0.044)**	(0.854)	(0.000)***	(0.005)***
VIX	-0.340	1.493	0.259	-0.304	1.069	0.407
	(0.003)***	(0.000)***	(0.312)	(0.001)***	(0.000)***	(0.013)**
SENT	1.973	-1.510	3.763	-3.239	-0.172	2.012
	(0.004)***	(0.019)**	(0.007)***	(0.000)***	(0.612)	(0.002)***
FEDFUND	-2.121	3.078	-1.077	-0.161	1.222	-0.013
	(0.000)***	(0.000)***	(0.206)	(0.392)	(0.000)***	(0.973)
INTERNET	-1.662	-0.406	-1.489	-1.602	-0.839	-1.447
	(0.000)***	(0.000)***	(0.001)***	(0.000)***	(0.000)***	(0.000)***
ERM				-9.381	-24.289	-16.614
				(0.000)***	(0.000)***	(0.000)***
Eurozone	2.009	-23.005	-16.774	7.090	-20.175	-10.182
	(0.460)	(0.000)***	(0.002)***	(0.011)**	(0.000)***	(0.041)**
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Nobs	900	300	135	1475	452	230
Adj. R2	0.441	0.614	0.658	0.473	0.620	0.615

The regressions estimate the relation between the diversification indexes, Equity, Bond and REIT, and proxies for macro-financial and developmental factors. The macro-financial factors include TED, VIX, SENT, FEDFUND. Given the high correlation between many developmental factors in table 6, a single variable, INTERNET, is included in the regressions. Results are reported for both balanced panels with timeframe 1996-2010 and unbalanced panels with a timeframe 1986-2012. Country fixed effects are included in all regressions. TED is the annual TED spread obtained from FRED. VIX is the option volatility index from the Chicago Board Options Exchange obtained from FRED. SENT is investor sentiment described in Baker and Wurgler (2006) obtained from Jeffrey Wurgler. FEDFUND is the US Federal Funds Rate obtained from DataStream. INTERNET is the percentage of Individuals using the Internet. It is computed as a population weighted average of the percentage of individuals using the internet by the country and is obtained from ITU. It is for countries only with available data in a given year. Note 1986-1989 values are 0. ERM is an ERM crises dummy, 1 for 1992 year and 0 for other years. Eurozone is a Eurozone bond crises dummy, 1 for 2009-10 years and 0 for other years. P-values are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 8
Panel Regression Analysis of Equity Diversification Indexes for Developed and Emerging Markets

	Balanced (1996-2010)		Unbalanced (1986-2012)	
	Developed	Emerging	Developed	Emerging
TED	5.925	-7.566	4.669	-7.498
	(0.140)	(0.000)***	(0.172)	(0.000)***
VIX	-0.608	0.011	-0.566	0.069
	(0.001)***	(0.884)	(0.000)***	(0.189)
SENT	2.881	0.785	-4.188	-1.455
	(0.006)***	(0.296)	(0.000)***	(0.017)
FEDFUND	-2.764	-1.281	-0.280	-0.010
	(0.000)***	(0.065)*	(0.209)	(0.970)
INTERNET	-2.317	-0.806	-2.358	-0.671
	(0.000)***	(0.001)**	(0.000)***	(0.000)***
ERM			-13.417	-4.725
			(0.000)***	(0.020)**
Eurozone	9.053	-7.201	16.078	-4.881
	(0.041)**	(0.000)***	(0.000)***	(0.003)***
Country FE	Yes	Yes	Yes	Yes
Nobs	510	390	778	697
Adj. R2	0.551	0.352	0.642	0.328

The regressions estimate the relation between the diversification indexes, Equity, and proxies for macro-financial and developmental factors for developed and emerging markets. The identification of developed and emerging economies uses the United Nations Human Development Index that incorporates a number of distinguishing features such as income and education. The United Nations country title of 'very high human development' is designated as developed economies and those outside this list as emerging economies. The developed markets are: Argentina, Australia, Austria, Bahrain, Belgium, Canada, Chile, Croatia, Cyprus, Czech Rep., Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, Kuwait, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Poland, Portugal, Qatar, Saudi Arabia, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, UAE, UK and US. The associated emerging equity markets are: Bangladesh, Botswana, Brazil, Bulgaria, China, Colombia, Cote d'Ivoire, Ecuador, Egypt, Ghana, India, Indonesia, Jamaica, Jordan, Kazakhstan, Kenya, Lebanon, Macedonia, Malaysia, Mauritius, Mexico, Montenegro, Morocco, Namibia, Nigeria, Oman, Pakistan, Panama, Peru, Philippines, Romania, Russia, Serbia, South Africa, South Korea, Sri Lanka, Taiwan, Thailand, Trinidad, Tunisia, Turkey, Ukraine, Venezuela, Vietnam and Zambia. The macro-financial factors include TED, VIX, SENT, FEDFUND. Given the high correlation between many developmental factors in table 6, a single variable, INTERNET, is included in the regressions. Results are reported for both balanced panels with timeframe 1996-2010 and unbalanced panels with a timeframe 1986-2012. Country fixed effects are included in all regressions. TED is the annual TED spread obtained from FRED. VIX is the option volatility index from the Chicago Board Options Exchange obtained from FRED. SENT is investor sentiment described in Baker and Wurgler (2006) obtained from Jeffrey Wurgler. FEDFUND is the US Federal Funds Rate obtained from DataStream. INTERNET is the percentage of Individuals using the Internet. It is computed as a population weighted average of the percentage of individuals using the internet by the country and is obtained from ITU. It is for countries only with available

data in a given year. Note 1986-1989 values are 0. ERM is an ERM crises dummy, 1 for 1992 year and 0 for other years. Eurozone is a Eurozone bond crises dummy, 1 for 2009-10 years and 0 for other years. P-values are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 9
Panel Regression Analysis of the Diversification Indexes by Time Period

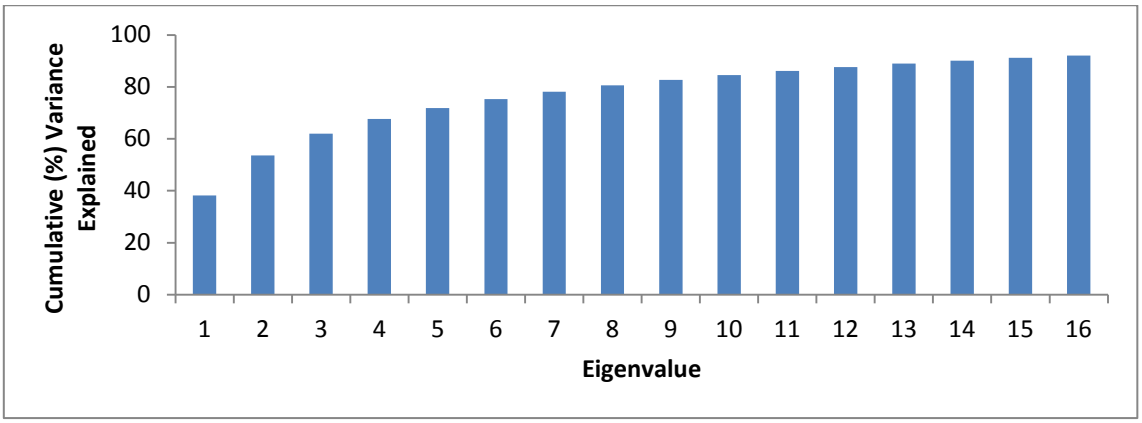
	Balanced (1996-2003)			Unbalanced (1986-1999)		
	Equity	Bond	REIT	Equity	Bond	REIT
TED	16.215	3.279	15.242	-64.475	15.679	-24.581
	(0.001)***	(0.404)	(0.052)*	(0.000)***	(0.032)**	(0.298)
VIX	-1.123	-0.065	-0.749	-0.489	-0.410	-0.359
	(0.000)***	(0.514)	(0.015)**	(0.010)**	(0.003)***	(0.209)
SENT	7.685	0.916	2.870	-13.049	1.867	-6.723
	(0.000)***	(0.664)	(0.488)	(0.000)***	(0.098)*	(0.279)
FEDFUND	-7.720	-0.614	-2.314	5.918	1.384	2.897
	(0.000)***	(0.716)	(0.474)	(0.000)***	(0.001)***	(0.094)*
INTERNET	-2.231	0.144	0.059	3.280	0.159	2.547
	(0.000)***	(0.723)	(0.923)	(0.000)***	(0.640)	(0.201)
ERM				-8.010	-21.855	-10.638
				(0.000)***	(0.000)***	(0.015)**
Eurozone						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Nobs	488	160	72	569	195	81
Adj. R2	0.051	-0.086	-0.060	0.237	0.742	0.172
	Balanced (2004-2010)			Unbalanced (2000-2012)		
	Equity	Bond	REIT	Equity	Bond	REIT
TED	-9.203	84.848	-26.193	10.385	-33.909	14.176
	(0.392)	(0.009)***	(0.349)	(0.001)***	(0.000)***	(0.123)
VIX	0.424	-4.354	1.261	-0.566	2.222	-0.751
	(0.456)	(0.008)***	(0.367)	(0.000)***	(0.000)***	(0.070)*
SENT	-54.450	338.976	-62.818	-6.626	1.997	-6.406
	(0.002)***	(0.000)***	(0.122)	(0.000)***	(0.213)	(0.047)**
FEDFUND	3.552	-23.688	5.329	-0.302	3.658	-1.146
	(0.028)**	(0.000)***	(0.199)	(0.377)	(0.000)***	(0.270)
INTERNET	-2.791	5.495	-3.216	-2.540	0.712	-3.743
	(0.000)***	(0.000)***	(0.006)***	(0.000)***	(0.012)**	(0.000)***
ERM						
Eurozone	17.925	-56.439	6.279	21.349	-43.621	26.579
	(0.011)**	(0.000)***	(0.705)	(0.000)***	(0.000)***	(0.011)**
Country	Yes	Yes	Yes	Yes	Yes	Yes
Nobs	553	161	84	906	257	149
Adj. R2	0.31	0.50	0.46	0.40	0.57	0.59

The regressions estimate the relation between the diversification indexes, Equity, Bond and REIT, and proxies for macro-financial and developmental factors for different sub-periods. The macro-financial factors include TED, VIX, SENT, FEDFUND. Given the high correlation between many developmental factors in table 6, a single variable, INTERNET, is included in the regressions. Results are reported for both balanced panels with timeframes 1996-2003 and 2004-2010, and unbalanced

panels with timeframes 1986-1999 and 2000-2012. Country fixed effects are included in all regressions. TED is the annual TED spread obtained from FRED. VIX is the option volatility index from the Chicago Board Options Exchange obtained from FRED. SENT is investor sentiment described in Baker and Wurgler (2006) obtained from Jeffrey Wurgler. FEDFUND is the US Federal Funds Rate obtained from DataStream. INTERNET is the percentage of Individuals using the Internet. It is computed as a population weighted average of the percentage of individuals using the internet by the country and is obtained from ITU. It is for countries only with available data in a given year. Note 1986-1989 values are 0. ERM is an ERM crises dummy, 1 for 1992 year and 0 for other years. Eurozone is a Eurozone bond crises dummy, 1 for 2009-10 years and 0 for other years. P-values are in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Appendix Figure 1

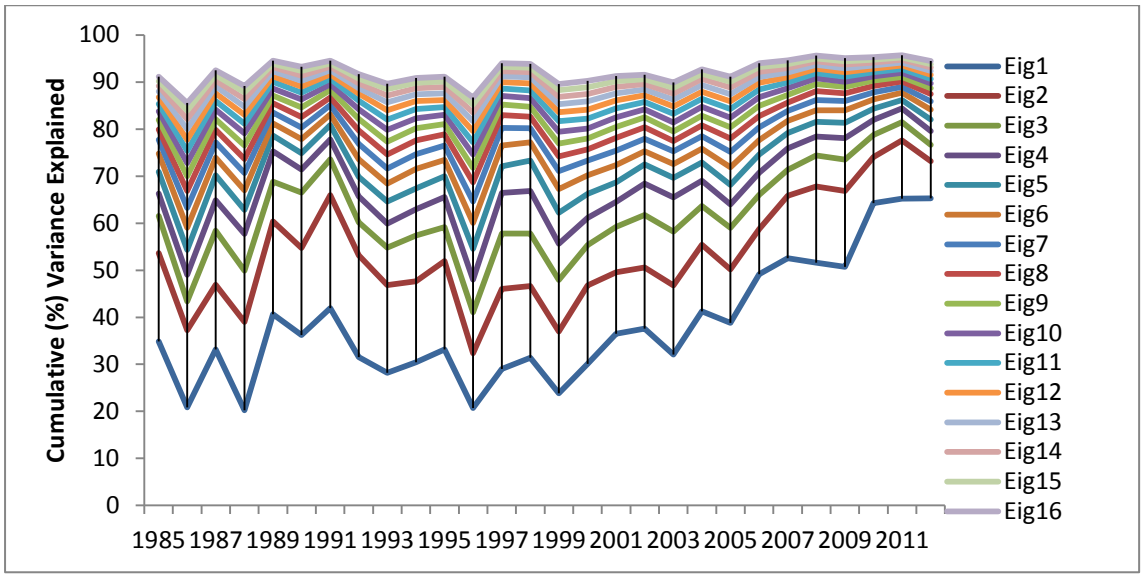
Average Cumulative Percentage of Variance Explained by Sorted Eigenvalues from Pre-1986 Cohort Covariance Matrices



Notes: This figure shows the average cumulative percentage of variance explained by the sorted (low to high) eigenvalues from pre-1986 cohort covariance matrices. These eigenvalues represent averages for the period 1986-2012. The principal components are obtained from the pre-1986 markets (Equity: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; Bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and REIT: Australia, Netherlands, UK, and US).

Appendix Figure 2

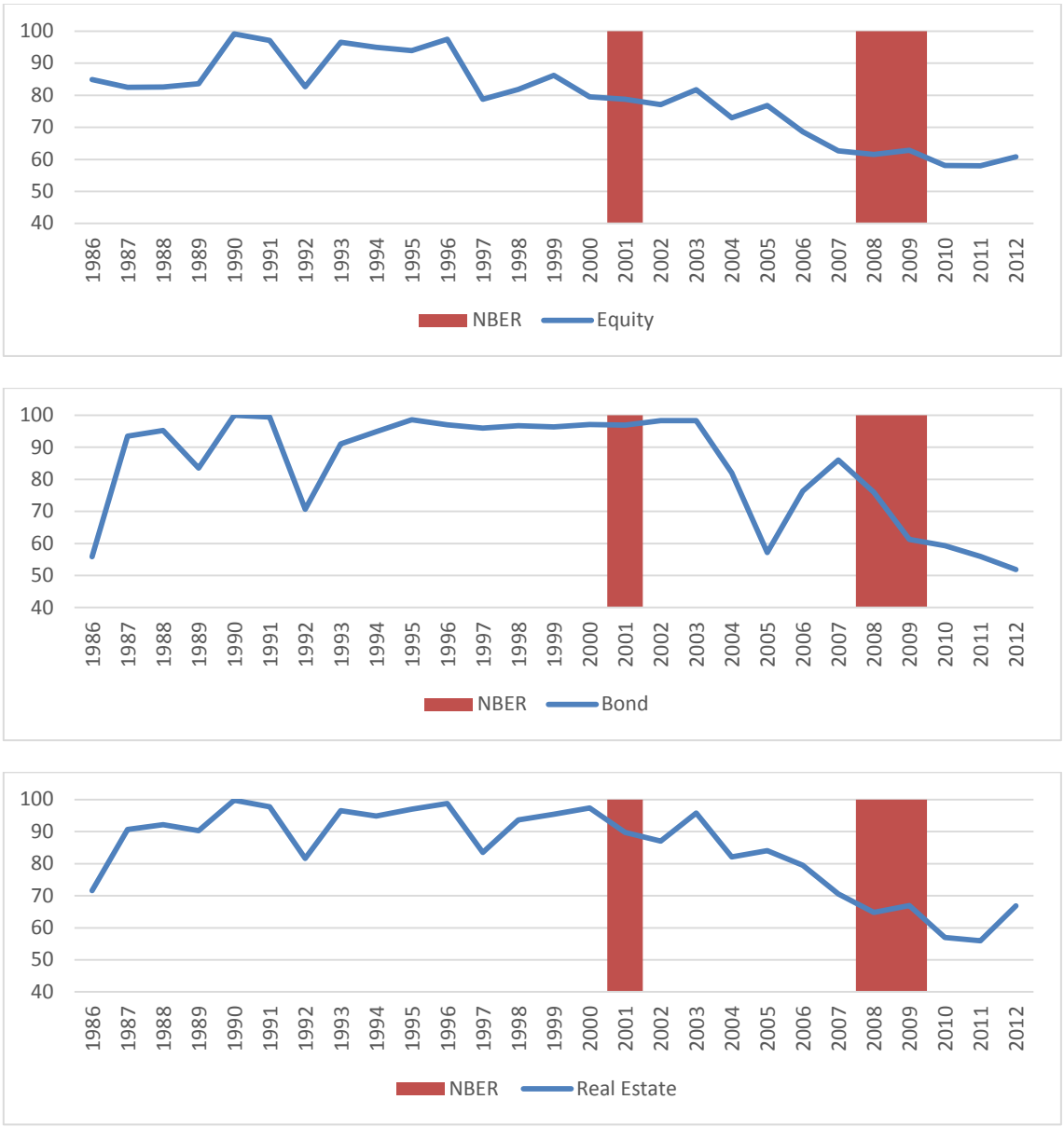
Percentage of Variance Explained over Time by Sorted Eigenvalues from Pre-1986 Cohort Covariance Matrices



Notes: This figure shows the time series of cumulative percentage of variance explained by the sorted (low to high) eigenvalues from pre-1986 cohort covariance matrices. The principal components are obtained from the pre-1986 markets (Equity: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; Bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and REIT: Australia, Netherlands, UK, and US).

Appendix Figure 3

Trends in World Diversification Indexes and Recessions

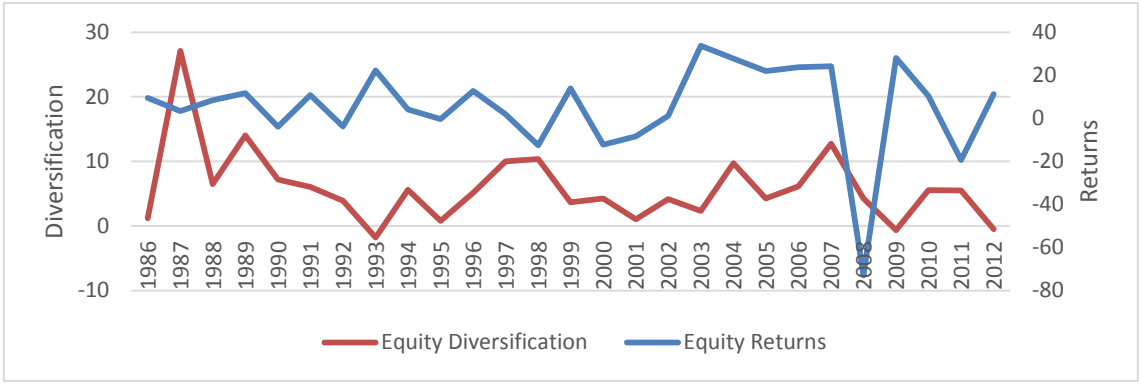


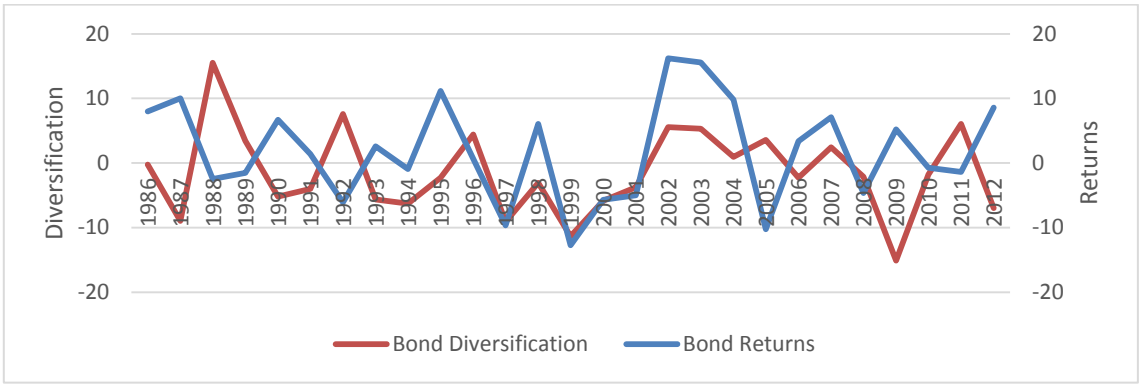
Notes: This figure shows the average diversification indexes for each asset class and NBER recessions between 1986 and 2012. There is a time-series plot of the diversification indexes and NBER recessionary period (red bars). The diversification index is measured by the average R-squares from the multi-factor asset returns model fitted using daily data every year between 1986 and 2012 for all markets in the database. The model fits asset returns within each year on global factors. The global factors are 16 principal components obtained from the pre1986 markets (Equity: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; Bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and REIT: Australia, Netherlands, UK, and US). A diversification value is obtained for each market assuming there are 50 valid daily returns per year.

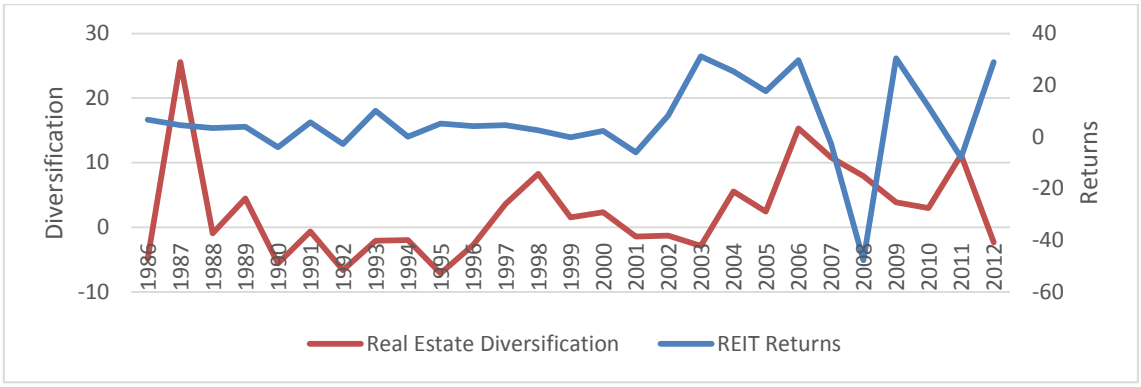
Appendix Figure 4

Trends in Diversification Indexes

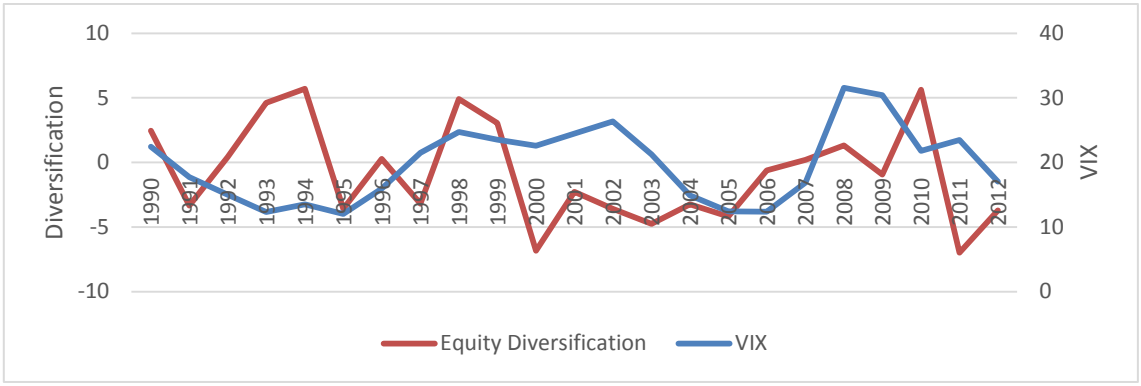
Panel A: Differences in Diversification Indexes for Bear and Bull returns and Mean Returns

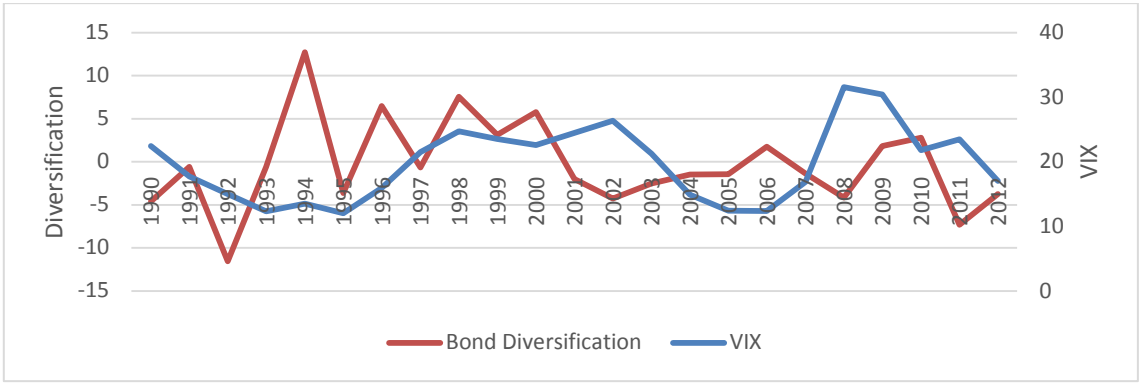


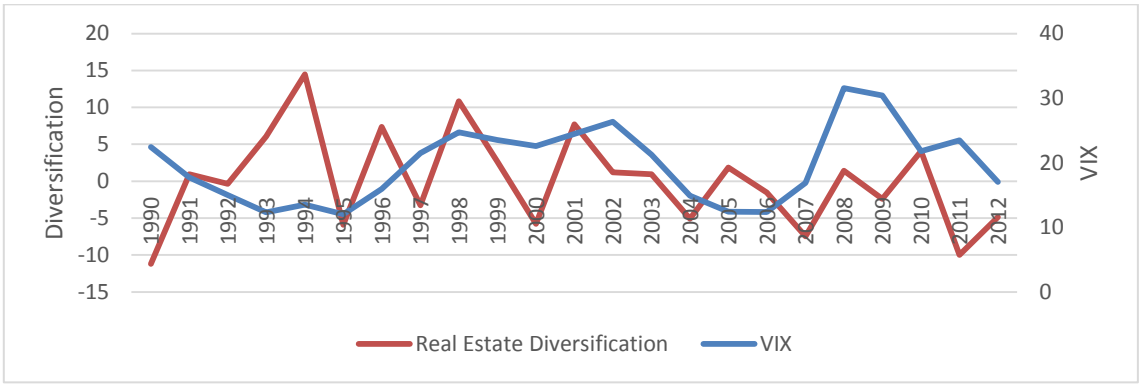




Panel B: Differences in Diversification Indexes for High and Low VIX and Mean VIX







Panel C: Differences in Diversification Indexes for High and Low TED and Mean TED

Notes: This figure uses the average diversification indexes for each asset class between 1986 and 2012. In panel A there are the average returns and the difference in diversification between bear and bull returns using values above (bull) and below (bear) the median return. In panel B there are the average VIX and the difference in diversification between above (high VIX) and below (low VIX) the median VIX values. In panel C there are the average TED spreads and the difference in diversification between above (high TED) and below (low TED) the median TED values. The diversification index is measured by the average R-squares from the multi-factor asset returns model fitted using daily data every year between 1986 and 2012 for all markets in the database. The model fits asset returns within each year on global factors. The global factors are 16 principal components obtained from the pre1986 markets (Equity: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; Bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and REIT: Australia, Netherlands, UK, and US). A diversification value is obtained for each market assuming there are 50 valid daily returns per year.

Appendix Table 1

Correlations of World Diversification Indexes

Correlations between World Diversification Indexes for Raw Returns

Full Period				Pre2000				Post2000			
Contemporaneous				Contemporaneous				Contemporaneous			
	Equity	Bond	REITs		Equity	Bond	REITs		Equity	Bond	REITs
Equity	1.000			Equity	1.000			Equity	1.000		
Bond	0.664	1.000		Bond	0.363	1.000		Bond	0.729	1.000	
REITs	0.884	0.837	1.000	REITs	0.656	0.874	1.000	REITs	0.977	0.774	1.000
Lead Equity				Lead Equity				Lead Equity			
	Equity	Bond	REITs		Equity	Bond	REITs		Equity	Bond	REITs
Equity	1.000			Equity	1.000			Equity	1.000		
Bond	0.707	1.000		Bond	-0.103	1.000		Bond	0.770	1.000	
REITs	0.786	0.836	1.000	REITs	-0.229	0.711	1.000	REITs	0.885	0.738	1.000
Lead Bonds				Lead Bonds				Lead Bonds			
	Equity	Bond	REITs		Equity	Bond	REITs		Equity	Bond	REITs
Equity	1.000			Equity	1.000			Equity	1.000		
Bond	0.531	1.000		Bond	-0.081	1.000		Bond	0.771	1.000	
REITs	0.922	0.601	1.000	REITs	0.683	-0.069	1.000	REITs	0.979	0.734	1.000
Lead REITs				Lead REITs				Lead REITs			
	Equity	Bond	REITs		Equity	Bond	REITs		Equity	Bond	REITs
Equity	1.000			Equity	1.000			Equity	1.000		
Bond	0.739	1.000		Bond	0.332	1.000		Bond	0.692	1.000	
REITs	0.725	0.742	1.000	REITs	0.137	-0.036	1.000	REITs	0.844	0.813	1.000

Notes: This table shows the contemporaneous, lead and lag correlation coefficients between the average diversification indexes. Correlation coefficients are reported for the full period, a pre2000 period and a post2000 period. The full period is 1986 to 2012 inclusive for all correlations. The diversification index is measured by the average R-squares from the multi-factor asset returns model fitted using daily data every year between 1986 and 2012 for all markets in the database. The model fits asset returns within each year on global factors. The global factors are 16 principal components obtained from the pre1986 markets (Equity: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; Bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and REIT: Australia, Netherlands, UK, and US). A diversification value is obtained for each market assuming there are 50 valid daily returns per year.

Appendix Table 3

Correlations of Diversification Indexes

Panel A: Correlations between Diversification Indexes for Bear and Bull Returns (Bear minus Bull Returns) and Average Returns			
	Equity	Bond	REITs
Full Period	-0.024	0.080	-0.051
Pre 2000	-0.271	-0.024	0.168
Post 2000	0.111	0.186	-0.236
Panel B: Correlations between Diversification Indexes for high and low TED (High TED minus Low TED) and Mean TED			
	Equity	Bond	REITs
Full Period	0.386	-0.221	0.288
Pre 2000	0.400	-0.050	0.386
Post 2000	0.299	-0.240	0.186
Panel C: Correlations between Diversification Indexes for high and low VIX (High VIX minus Low VIX) and Mean VIX			
	Equity	Bond	REITs
Full Period	-0.022	-0.054	-0.051
Pre 2000	0.127	0.120	-0.146
Post 2000	0.130	-0.127	0.205

Notes: This table shows the correlation coefficients between the diversification indexes for bear and bull returns (bear minus bull returns) and average returns (panel A), correlations between diversification indexes for high and low TED (high TED minus low TED) and mean TED (panel B), and correlations between diversification indexes for high and low VIX (high VIX minus low VIX) and mean VIX (panel C). In each panel correlation coefficients are reported for the full period, a pre2000 period and a post2000 period. The full period is 1986 to 2012 inclusive for all correlations except for the VIX (1990 to 2012) due to availability of this index from 1990 onwards. The differences between bear and bull returns use values above (bull) and below (bear) the median return. The differences for high and low VIX values use above (high VIX) and below (low VIX) the median VIX values. The differences for high and low TED spread values uses above (high TED) and below (low TED) the median TED values. The diversification index is measured by the average R-squares from the multi-factor asset returns model fitted using daily data every year between 1986 and 2012 for all markets in the database. The model fits asset returns within each year on global factors. The global factors are 16 principal components obtained from the pre1986 markets (Equity: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; Bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and REIT: Australia, Netherlands, UK, and US). A diversification value is obtained for each market assuming there are 50 valid daily returns per year.

Appendix Table 3

Differences in World Diversification Indexes

	Equity	Bonds	REITs
Bear minus Bull Returns	5.868 (5.290)	-1.454 (-1.137)	2.408 (1.711)
High minus Low VIX	-0.815 (-1.017)	-0.351 (-0.321)	0.070 (0.052)
High minus Low Ted	1.280 (0.937)	-2.800 (-2.748)	-2.234 (-1.501

Notes: The table shows the mean difference between diversifications indexes stratified by bear minus bull returns, high minus low VIX and high minus low TED spreads. These are followed in parentheses by t-statistics of testing whether the differences are significantly different from zero. This table uses the average diversification indexes for each asset class between 1986 and 2012. The difference in diversification between bear and bull returns uses values above (bull) and below (bear) the median return. The difference in diversification for high and low VIX values uses above (high VIX) and below (low VIX) the median VIX values. The difference in diversification for high and low TED spread values uses above (high TED) and below (low TED) the median TED values. The diversification index is measured by the average R-squares from the multi-factor asset returns model fitted using daily data every year between 1986 and 2012 for all markets in the database. The model fits asset returns within each year on global factors. The global factors are 16 principal components obtained from the pre1986 markets (Equity: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, South Africa, Switzerland, UK, US, Brazil, Malaysia, Norway, South Korea, Spain, Sweden; Bond: Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Sweden, Switzerland, UK, US, and REIT: Australia, Netherlands, UK, and US). A diversification value is obtained for each market assuming there are 50 valid daily returns per year.