Global Investing: An Efficient Frontier Approach

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Abstract

The objective of this paper is to empirically investigate as to which emerging market portfolios lie on the efficient frontier, exploring further whether certain markets provide better diversification alternatives, and whether such relationships are time invariant. Consistent with the literature, I find that certain markets do indeed provide better diversification alternatives for US investors, though not necessarily in a time-invariant pattern. As expected, countries that seem more economically independent from the US provide better diversification for US investors.

I conduct two experiments consisting of building portfolios in discrete increments, first using regional indexes, and second using country indexes, for the time period 1990-2014. I further subdivide the1990-2014 long time- period into shorter intervals of pre- vs. post the 2000 crisis; and pre- vs. post the 2007 crisis.

The long time-period efficient frontier is book-ended by the US and Latin America, regardless of whether I use regional or country indexes, with the loci of points consisting of linear combinations (barbell strategies) of the two, and with the total absence of other regions. When I use shorter time-periods, other regional or country indexes such as Australia's ASX, Hong Kong's Hang Seng, and Japan's Nikkei start making strong appearances, in synchrony with their macroeconomic performance. As for Latin America, Mexico's Bolsa dominates Brazil's Bovespa, possibly because of Mexico's post-1994 Tequila crisis reforms that have remedied most of Mexico's macroeconomic imbalances. Unsurprisingly, European stocks rarely make an appearance on the efficient frontier possibly because of Europe's strong integration with the US economy, combined with the ills that have overtaken Europe in the last several years.

Looking forward, this study suggests that US investors should include at least one Latin American index (most likely the Mexican Bolsa), the European index because of Europe's pending stimulative monetary policies and relatively low-priced stocks, and another country depending this country's macroeconomic outlook and its independence from the US.

Introduction

International portfolio diversification has become increasingly more important among US institutional and even private investors since the early 1970s (see Solnik and McLeavy 2009). According to Solnik and McLeavey, "In 1974, the New York Stock Exchange was the only significant market in the world, representing 60 percent of world market capitalization of less than $1 trillion. The size of the world market multiplied by a factor of 50 in the next 32 years, and the share of US equity moved from 60 percent to less than 30 percent in 1988 and back to 40 percent by the end of 2006."

Theoretically speaking, international diversification allows investors to reduce the total risk of their portfolios, given a return expectation; or increase their return expectation, given a risk (standard deviation of returns) expectation. This theoretical assertion exists because international stocks are not perfectly correlated. Naturally, international returns need to be adjusted for exchange rate movements.

As stated in DeFusco et al. (2007), a portfolio is mean-variance efficient if it has the highest level of expected return for a given level of risk. The set of all efficient portfolios is called the efficient frontier.

Using historical data, and armed with good computational hardware, software, and skills, we can determine the efficient frontier for an array of international investments. Trying to determine the efficient frontier looking forward, however, is more of an art than science and may require economic forecasting skills as well.

Though investing internationally in general, and in emerging markets in particular, may pose additional risks (volatility, liquidity, political risk, foreign-exchange risk) and costs, the general consensus among academics and practitioners is that international diversification pays off. Stated differently, academics have long maintained that international diversification provides an efficient frontier that dominates the domestic-only efficient frontier because domestic returns are not perfectly correlated with international returns.

Factors such as independence of national economies, fiscal and monetary policies, varying regulatory frameworks and national factor endowments may cause less than perfect correlations among national economies and stock markets, suggesting that international diversification enhances the domestic efficient frontier.

The literature suggests that compared with developed markets, emerging markets exhibit higher volatility than developed markets, with asymmetric return distributions and increasing return correlations in times of crisis, but they also exhibit higher return opportunities because of early growth stages of their economies.

Given this backdrop, the objective of this paper is to empirically investigate as to which emerging market portfolios lie on the efficient frontier, exploring further whether certain markets provide better diversification alternatives, and whether such relationships are time invariant. First, I survey the

literature; second, I describe my empirical method; third, I analyze my results; and finally, I conclude the paper. Consistent with my literature survey, I find that certain markets do indeed provide better diversification alternatives for US investors, though not necessarily in a time-invariant pattern. As expected, countries that seem more economically independent from the US provide better diversification for US investors.

I would expect that researchers and investors would find my approach useful as my empirical method is rigorous, yet easy to understand. Another conclusion that emerges from my work is that when planning forward, investors may want to marry modern portfolio analysis, as embodied in the efficient-frontier approach, with careful scenario analysis of future macroeconomic and stock market developments.

Literature Survey

Jorion and Goetzman (1996) report that the expected returns on equity capital is possibly the most important driving factor in asset allocation decisions, and compute that among 39 markets with histories going back as far back as the 1920s, the US has by far the highest uninterrupted real rate of appreciation. Despite this observation, these authors find that international diversification is beneficial.

Goetzman, Li, and Rouwenhorst (2004) observe that globalization is associated with relatively high correlations among world equity markets, and an increase in the investment opportunity set. From this, they infer that periods of globalization have both benefits and drawbacks for international investors.

Huang, Eun, and Lai (2006) show that returns to large-cap or stock market indices tend to co-move, mitigating the benefits from international diversification, and conclude that small-cap funds are more efficient vehicles for international diversification.

Bekaert, Hodrick, and Zhang (2008) examine international stock return co-movements using country-industry and country-style portfolios as the base portfolios. Except for European stock markets, they do not find evidence for an upward trend in return correlations. Moreover, they find that country factors outweigh industry factors in driving returns.

De Roon, Eiling, Hillion, and Gerard (2009) examine the relative importance of country, industry, world market and currency risk factors for international equity returns, and find that equity returns are mainly driven by global industry and currency risk factors.

Christoffersen, Errunza, Jacobs, and Jin (2010) investigate patterns and trends in correlations over time using weekly returns for developed and emerging markets during the period 1973-2009. These authors find that diversification benefits might have lessened for developed markets; the case for diversification for emerging markets remains intact, particularly when we start worrying about tail risk.

Jacobs, Muller, and Weber (2013) evaluate numerous diversification strategies as possible remedy against widespread costly investment mistakes of individual investors. Their results suggest that simple heuristic allocation schemes offer similar diversification gains as more sophisticated portfolio optimization approaches. They conclude by suggesting easy-to-implement allocation guidelines for individual investors.

The bottom line. The above literature survey confirms our theoretical prior that while major global markets have by and large integrated, pockets that are uncorrelated with the US economy still lie out there that may provide diversification benefits. And, indeed my empirical results will also point in the same direction.

Empirical Method

This paper explores global efficient frontier equity investment strategies in the period 1990-2014.

- Efficient frontier is defined as a set of optimal portfolios that offers the highest expected return for a defined level of risk, or the lowest risk for a given level of expected return.

I conduct two experiments, comprising regional and country indexes:

- First, with five regional (other than Japan) indexes consisting of:
  - S&P 500,
  - SX5E Index – Euro Stoxx 50 Index, selected stocks from super sector leaders of the Euro Zone,
  - MXLA Index – The MSCI Latin America weighted average equity index ,
  - NKY Index – Nikkei Japan's 225 top high-fund rates companies, and
  - MXASJ Index – The MSCI Asia weighted - average equity index, excluding Japan
- Second, with the following seven country indexes (except Euro Stoxx):
  - S&P 500,
  - SX5E Index – Euro Stoxx 50 Index, selected stocks from super sector leaders of the Euro Zone,
  - ASX Index – index of 200 largest Australian companies, based on eligible stocks listed on the ASX,
  - IBOV Index – Brazilian Ibovespa Index, represents the most liquid stocks on the Sao Paulo Index,
  - HSI Index – Hang Seng Index, Hong Kong capitalization - weighted index,
  - MEXBOLD Index – Mexican Bolsa Index, capitalization-weighted index of leading stocks, and
  - NKY Index –– Japan's Nikkei 225 top-rates companies.

My experiments consist of building portfolios of 10% increments (except for the case where I have seven equally weighted investments when my increments are at 14.29%). I attempt to answer the question as to which combinations are on the efficient frontier.

All indexes are based on US Dollar returns, as reported by Bloomberg:

- ⇨ The data start in March 1990, and
- ⇨ I present our calculations based on monthly, annualized returns.

The returns are always annualized and are calculated on a continuously compounded basis. Depending on data availability, dividends may or may not be included in the analysis.

Analysis of Results

Using Five Regional Indexes

The long-period (1990-2014) regional analysis suggests that adding Latin America to a US portfolio greatly enhances the efficient frontier. This efficient frontier is book-ended by the US and Latin America, with the loci of points consisting of linear combinations (barbell strategies) of the two, and with the total absence of other regions. The 1990-2007 results are virtually identical.

A shorter – time period (2001-2007) analysis suggests that though the efficient frontier is still book-ended by the US and Latin America, Asia and Japan show strong appearances on the efficient frontier. Moreover, an equally weighted portfolio consisting of Asia, Europe, Japan, Latin America and the US is very close to the efficient frontier.

Adding dividends or reinvesting dividend yields clearly enhances returns without changing the nature of the relative asset allocations.

Results may change depending on how we slice and dice the time periods in question. Nonetheless, the overwhelming conclusion is that foreign investing enhances (expands the efficient frontier) a 100 percent US – based portfolio:

- It seems, however, the underlying macroeconomic predicament of a certain region may change the character of the efficient frontier,
- Moreover, my results suggest that the more independent is a certain region from the US, the more likely it is that it will contribute significantly to the efficient frontier, and
- As I expand my index universe, indexes such as the Mexican Bolsa, the Brazilian Bovespa, The Japanese Nikkei and the Australian ASX start playing important roles, depending on the time period under investigation.

My results are consistent with the academic literature that finds:

- A significant positive relation between hedge fund returns and their exposure to both emerging market equities and emerging market currencies (see Aggarwal and Jorion 2010), and
- Hedge funds can earn positive excess returns by timing their exposures to emerging market securities in response to macroeconomic conditions and the state of financial markets so as to generate a strong link between their returns and their exposures to emerging market securities (see Bali et. al 2011 & 2012, and Caglayan and Ulutas 2014).

The conclusion of the regional analysis is that investing in emerging markets does indeed enhance the efficient frontier, but one needs to carefully scrutinize the macroeconomic conditions before jumping in.

Figure 1. Investing in Asia-ex-Japan, Europe, Japan, Latin America & the US, Mar 1990 – Mar 2014

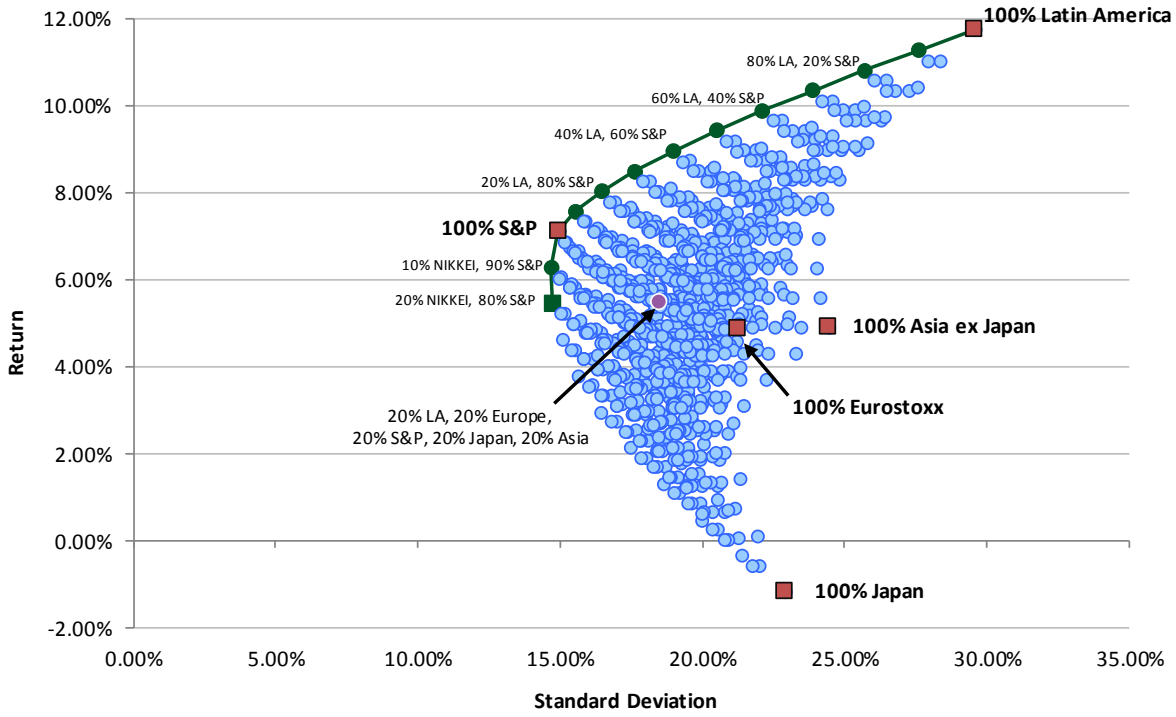


Figure 2. Pre – Crisis Global Investing, Mar 1990 – Mar 2007

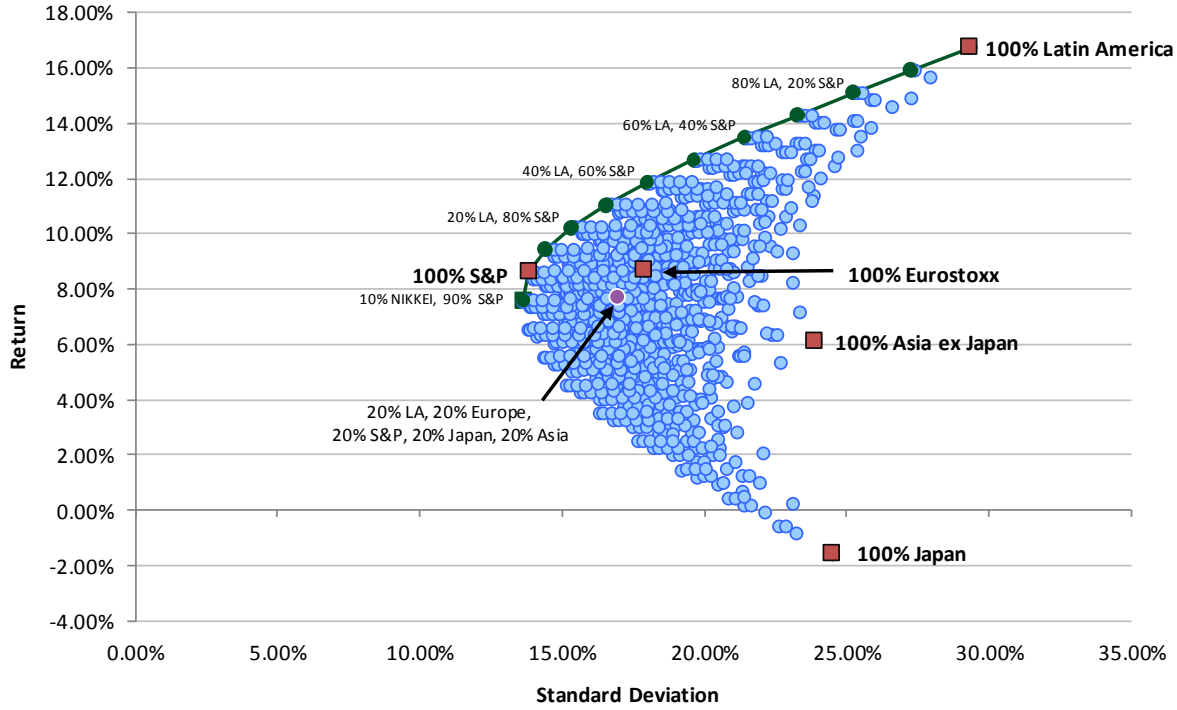


Figure 3. Global Investing: Crisis to Crisis, Mar 2001 – Mar 2007

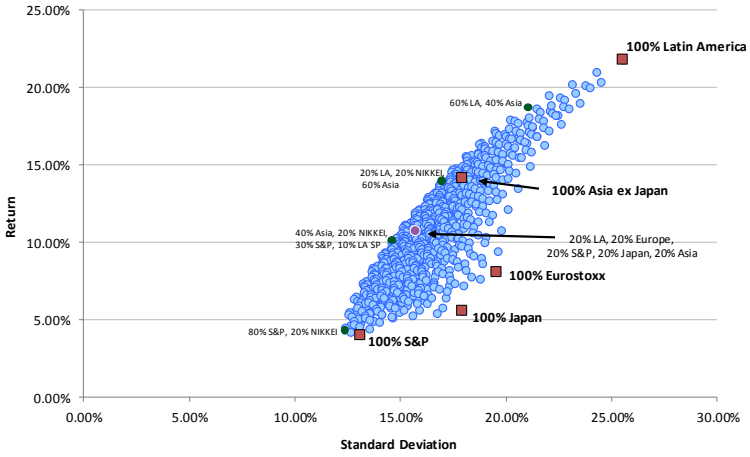


Figure 4. Mar 2001 – Mar 2007, with Dividend Yield

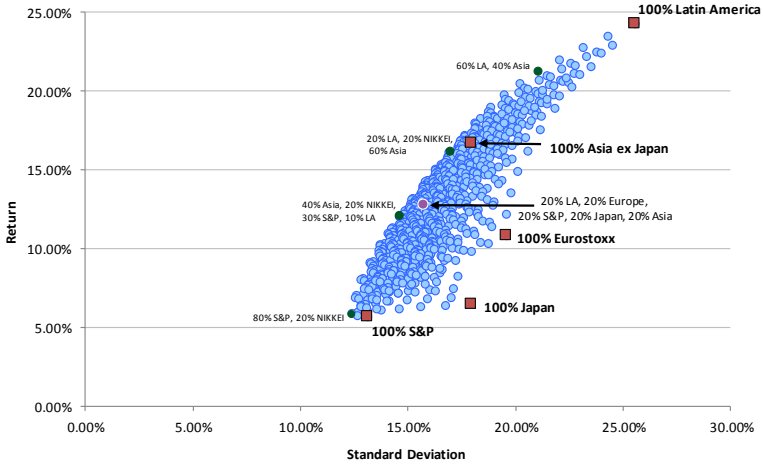


Figure 5. Mar 2001 – Mar 2007, with Dividends Reinvested

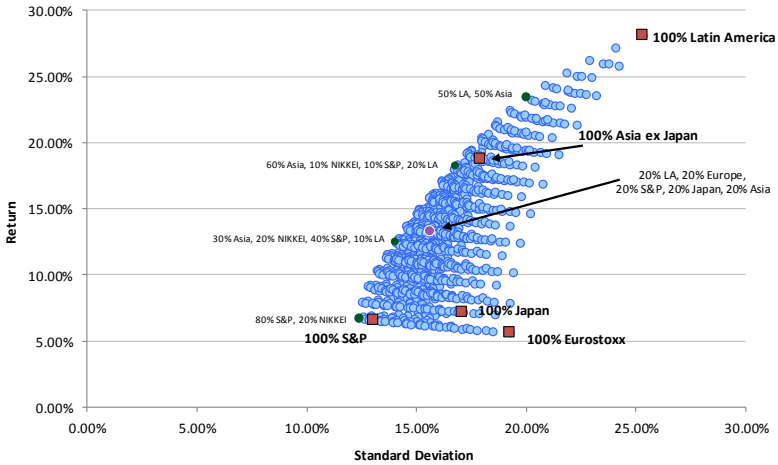


Figure 6. Post 9/11 and TMT Crash Investing, Mar 2001– Mar 2014

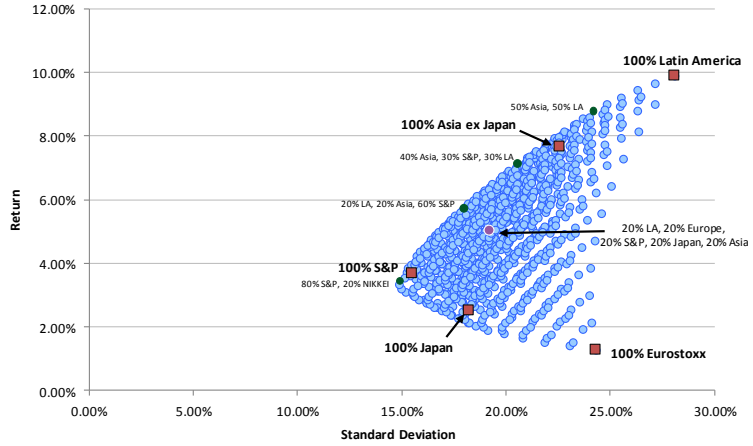


Figure 7. Mar 2001– Mar 2014, with Dividend Yield

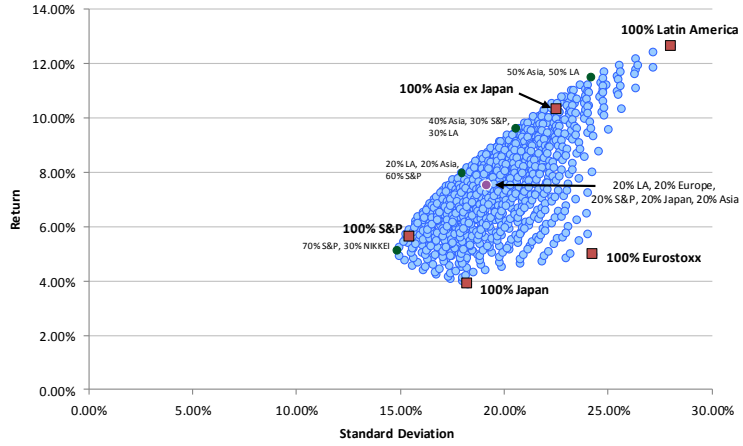


Figure 8. Mar 2001– Mar 2014, with Dividends Reinvested

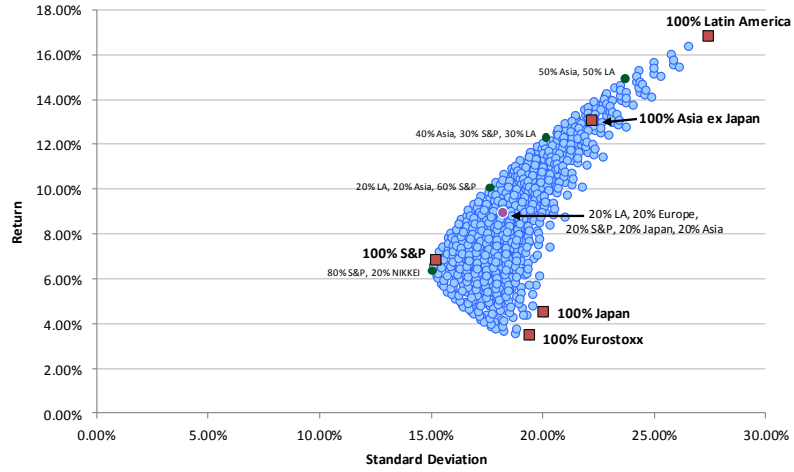


Figure 9. Post-Crisis Global Investing, Mar 2009 – Mar 2014

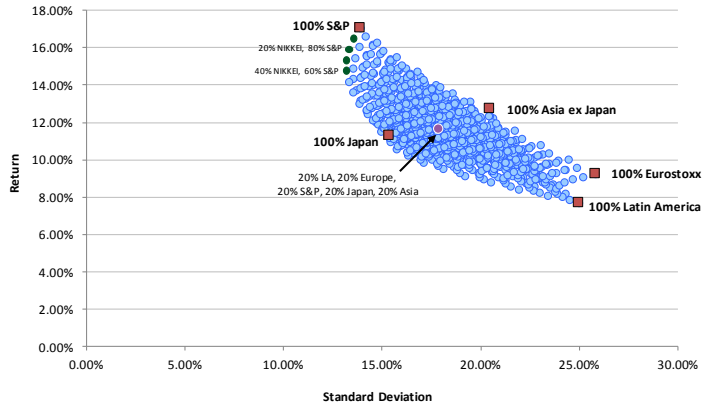


Figure 10. Mar 2009 – Mar 2014, with Dividend Yield

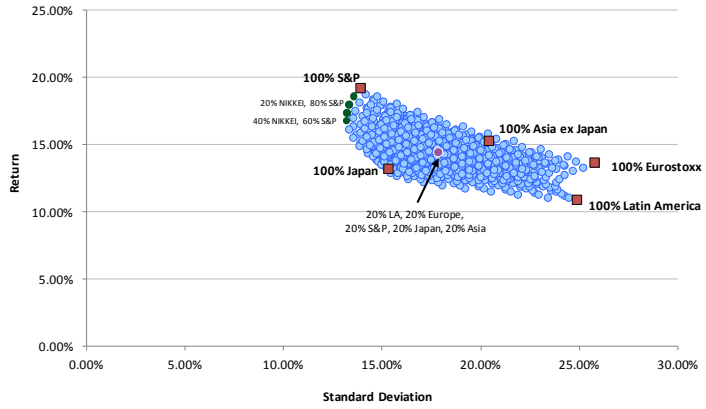
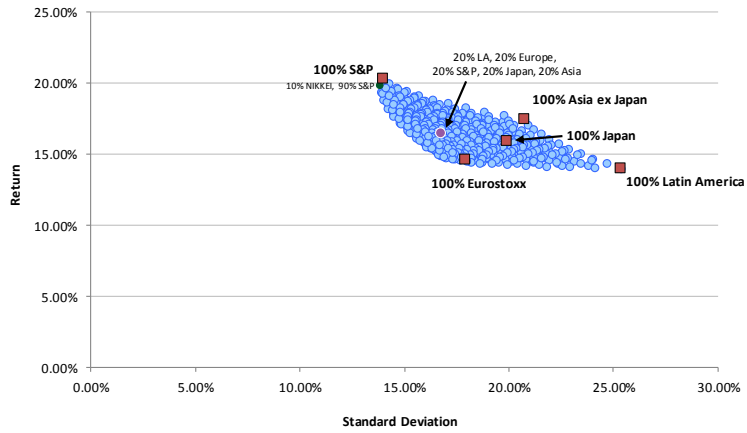


Figure 11. Mar 2009 – Mar 2014, with Dividends Reinvested



Using Seven Country Indexes

In this section, I expand on my earlier work by including data from the following ***seven US Dollar adjusted country indexes:***

- ASX Index – Australian 200 largest index – eligible stocks listed on the ASX,
- IBOV Index – Brazilian Ibovespa Index, represents the most liquid stocks on the Sao Paulo Index,
- SX5E Index – Euro Stoxx 50 Index, selected stocks from super sector leaders of the Euro Zone,
- HSI Index – Hang Seng Index of Hong Kong capitalization weighted index,
- MEXBOLD Index – Mexican Bolsa Index, capitalization weighted index of leading stocks,
- NKY Index –– Japans Nikkei 225 top rates companies, and
- SPX Index – S&P 500 – benchmark for US stock market representing all major industries.
    - All data start in 1990.
    - Returns are continuously compounded and annualized.

I observe the following patterns:

- The 1990 – 2014 efficient frontier is bounded at the low-risk end by the S&P 500, and at the high-risk end by the Mexican Bolsa and the Bovespa. The interim points largely consist of the S&P 500 and the Bolsa with intermittent appearances of the Bovespa, the ASX, and the Hang Seng.
- The 1990 – 2007 efficient frontier's composition is somewhat similar to the longer period, with strong cameo appearances by the ASX and the Hang Seng. Such cameo appearances should not be surprising given the high correlation of the Australian economy with China's in the pre-crisis period.
- The 2001 -2007 efficient frontier is book-ended by the S& 500 and the Mexican Bolsa, with strong interim appearances of the ASX and the Nikkei.
- The 2001 -2014 efficient frontier is very similar to the 2001 – 2007 period.
- The 2001 – 2014 efficient frontier is book-ended by the Nikkei and the S&P 500, with the absence of all other countries.

The above patterns make sense in light of the following macroeconomic realities:

- In the 1990 – 2014 period, the US and the Chinese economies performed very strongly, with the Australian economy benefiting significantly from Chinese growth due to Australia's strong commodity endowment.
- Though European economies are well integrated with the US, the European problems of the recent several years may explain why Europe is largely non-existent in my efficient frontiers.
- Of all the global regions in the world, Latin America is probably the least correlated with the US, except Mexico, due to its idiosyncratic macroeconomic and political regimes.
- The Mexican economy is closely linked to that of the US, has cleaned up its act after the Tequila crisis of 1994, and enjoys a risk premium.
- Post the 2007 – 2009, crisis US and Japanese stock markets did relatively well, possibly due to their expansionary monetary policies.

Figure 12. Global Investment Returns: ASX, Bolsa, Bovespa, Eurostoxx, Hang Seng, NIKKEI, and the S&P 500, Mar 1990 – Mar 2014

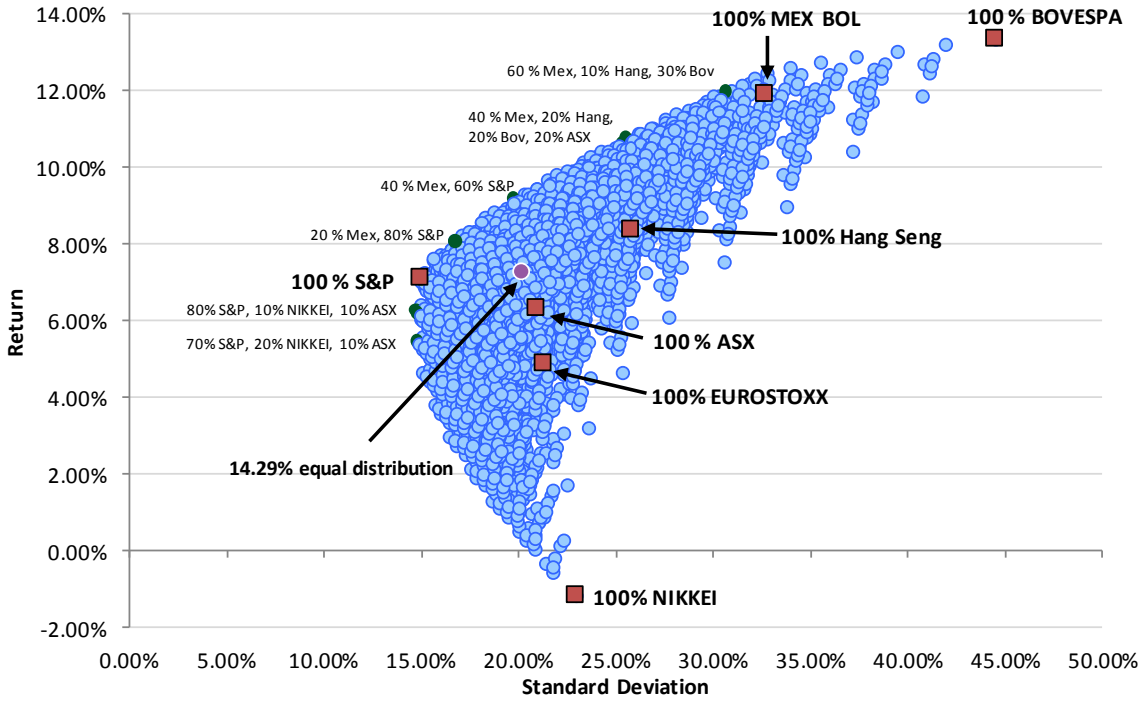


Figure 13. Pre – Crisis Global Investing, Mar 1990 – Mar 2007

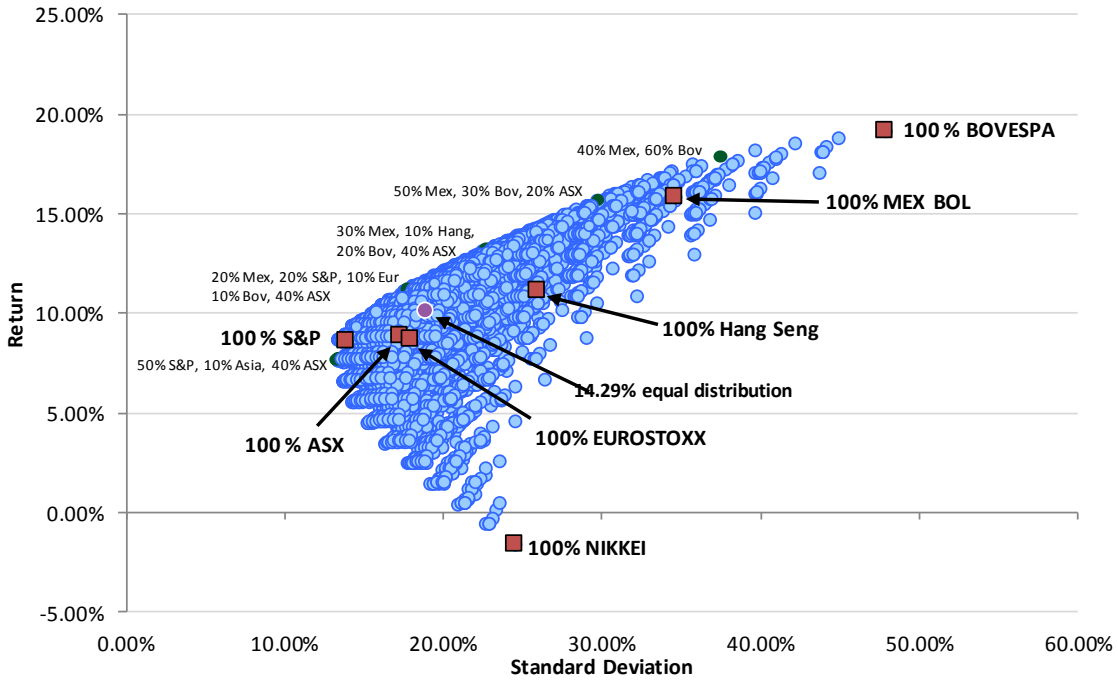


Figure 14. Global Investing: Crisis to Crisis, Mar 2001– Mar 2007

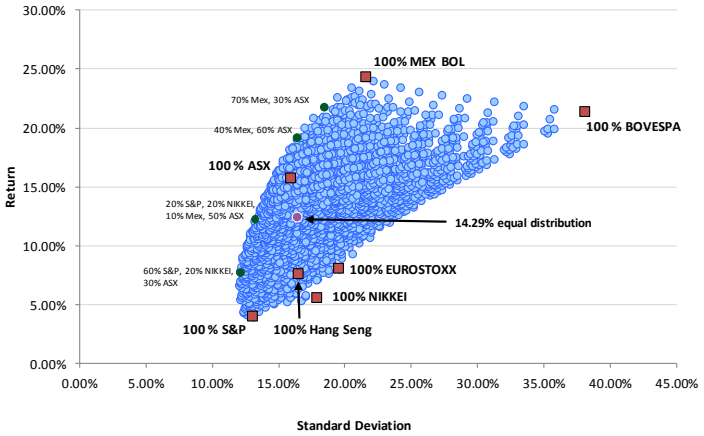


Figure 15. Mar 2001– Mar 2007, with Dividend Yield

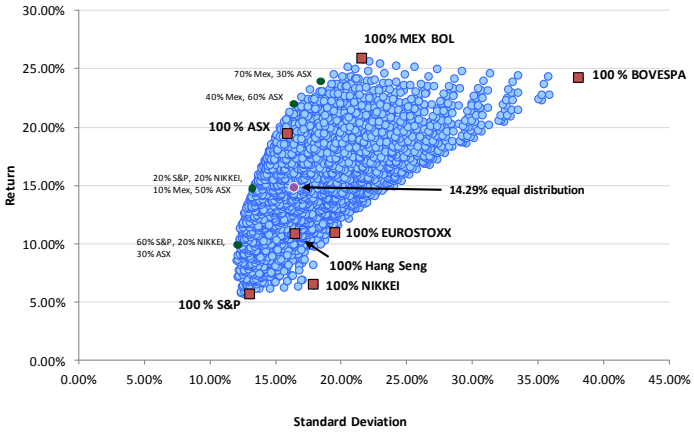


Figure 16. Mar 2001– Mar 2007, with Dividends Reinvested

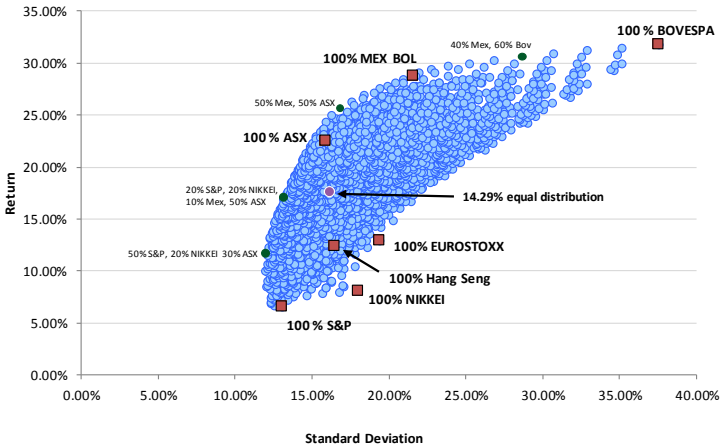


Figure 17. Post 9/11 and TMT Crash Investing, Mar 2001– Mar 2014

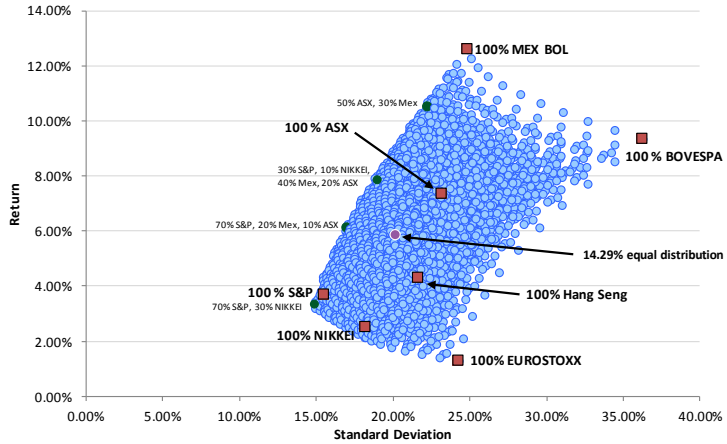


Figure 18. Mar 2001– Mar 2014, with Dividend Yield

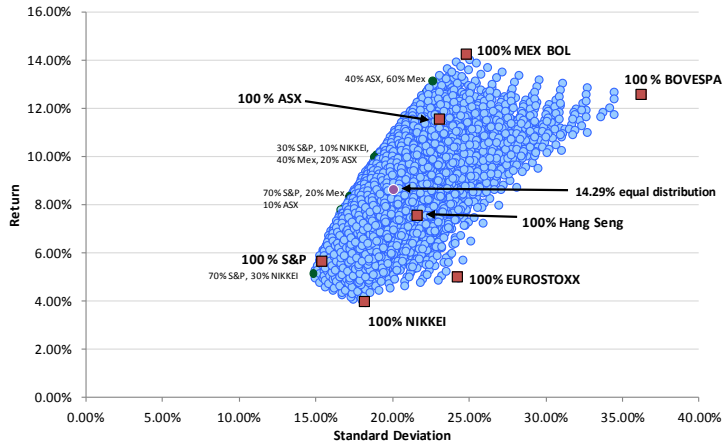


Figure 19. Mar 2001– Mar 2014, with Dividends Reinvested

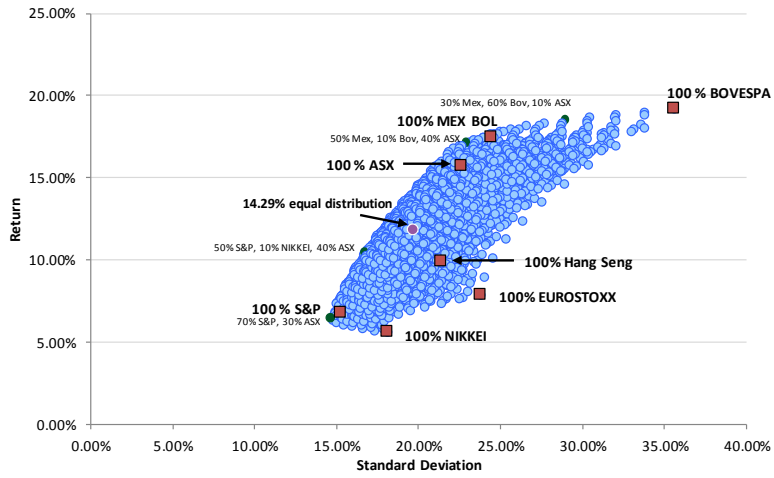


Figure 20. Post-Crisis Global Investing, Mar 2009 – Mar 2014

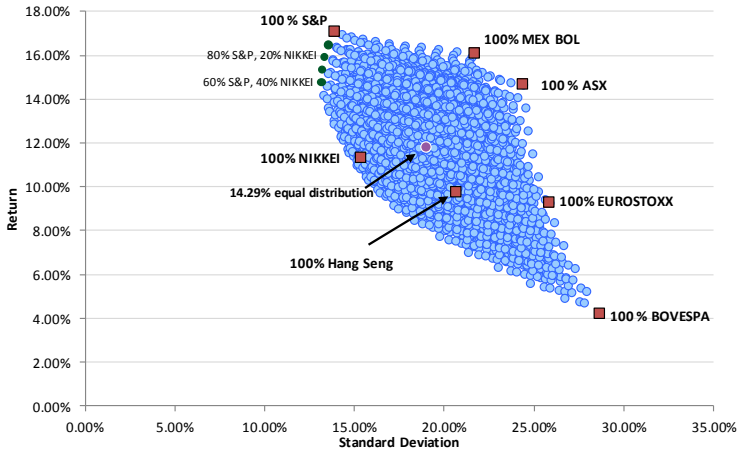


Figure 21. Mar 2009 – Mar 2014, with Dividend Yield

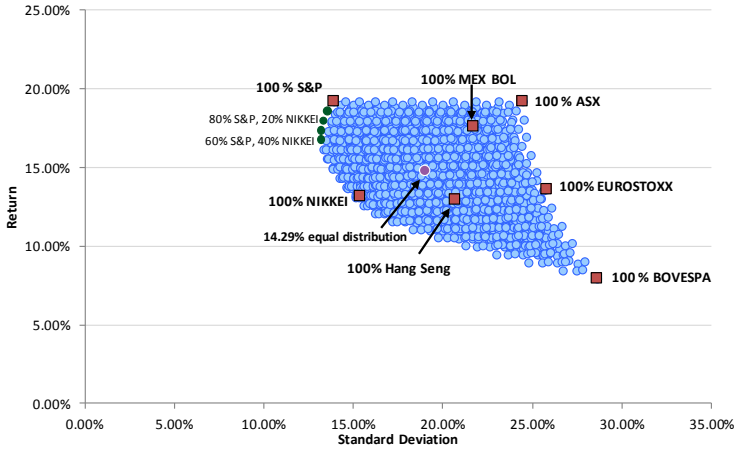
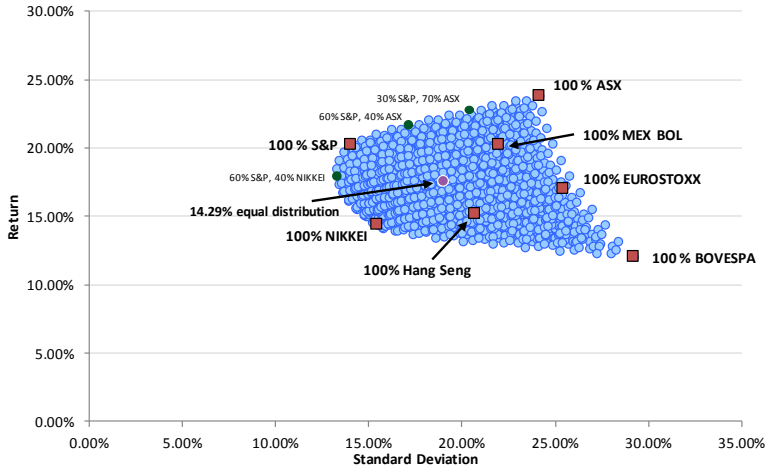


Figure 22. Mar 2009 – Mar 2014, with Dividends Reinvested



Conclusion

Though international portfolio diversification has become increasingly more important among US institutional and even private investors since the early 1970s, the question remains whether certain markets provide better diversification alternatives than other markets.

I empirically address this question by using up to seven global stock market indexes from all regions of the world and by constructing portfolios that use all combinations of these indexes in discrete increments. Plotting the mean-variance return outcomes, I then identify the indexes that lie on the efficient frontier.

Consistent with the literature, I find that certain markets do indeed provide better diversification alternatives for US investors, though not necessarily in a time-invariant pattern. As theoretical reasoning suggests, countries that seem more economically independent from the US provide better diversification for US investors.

Researchers and investors would find this paper's approach useful as my empirical method is rigorous, yet easy to understand. When planning forward, investors may want to marry modern portfolio analysis as embodied in the efficient-frontier approach, with careful scenario analysis of future macroeconomic and stock market developments

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