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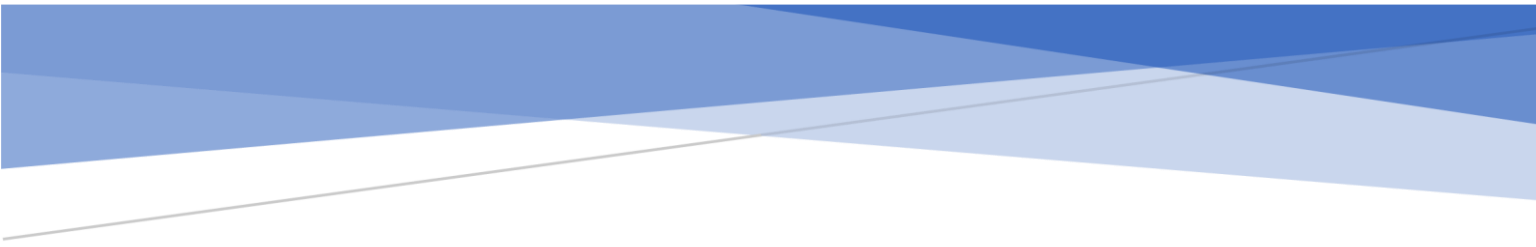
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PORTFOLIO OPTIMIZATION WITH INTERNATIONAL DIVERSIFICATION

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Introduction

There have been a variety of techniques used in the past to ensure that the portfolio created by an investor is according to his/her risk-return preferences. Most asset managers in the US, prefer to invest domestically due to home bias and barriers that are involved in investing abroad. Home bias is the tendency of investors to overweight their portfolio with domestic equities, despite the many benefits of diversifying internationally. Obviously, there is a protocol that needs to be followed when one is considering investing abroad, but due to globalization there are various investment choices that can be opted to surpass these barriers to invest abroad and achieve a better risk-return trade off.

Some of the most common reasons that cause home bias (as shown in Exhibit 1) are Economic Development, Capital Control, Stock Market Development, Familiarity, and Investor Protection.

Economic Development comprises of factors like GDP and inflation rates. A country's level of advancement in economic development ought to affect its ability to draw foreign investment to the country. This means that a higher GDP and a low inflation rate, attracts foreign investment in that particular country. Capital Control includes determinants like laws which prevent foreigners from holding a certain percentage (%) in the countries stock market. Stock market development contains variables like the liquidity of the stock market and transparency of information in that country. Familiarity comprises of factors like culture and language barriers. Finally, Investor protection consists of factors like efficiency of the judicial system and local Stock monitoring agencies.

The focus of this paper is to investigate the benefits and risks of foreign portfolio investments and the various investment vehicles that are available while investing abroad. This paper will also

contain the simulations that were conducted to construct an optimal portfolio, where weights are allocated to all countries based on their risk-return characteristics.

As shown in Exhibit 2, the correlations between countries is considerably lower, compared to the correlation within domestic markets. This means there is a high potential to realize gains by diversifying internationally. For example, the correlation within the US market (0.439) is much higher than the correlation between US and Australia, France Germany, Japan, Netherlands, Switzerland, or United Kingdom.

Exhibit 3 shows the share in the world market value of each country against the proportion of domestic equities in the portfolio of mutual funds in that country. Once again, we can see the US representing 46.85% of the world market capitalization and investing almost 86% in domestic equities. The clear disparity in investing based on the market share is evident here. This paper will go on to show how investing abroad will not only reduce this gap but also talk about what would be the optimal amount to invest in each country based on the risk-return profiles of each country.

Literature Review

Difference between Foreign Portfolio Investment and Foreign Direct Investment

As far as investing abroad is concerned, there are mainly two types of investment, Foreign Portfolio Investment (FPI) and Foreign Direct Investment (FDI). According to the world bank, “Foreign direct investment refers to direct investment equity flows in an economy. It is the sum of equity capital, reinvestment of earnings, and other capital Direct investment is a category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another

economy.” The intent with FDI is typically to help make a business more profitable and generate a return on investment. It may take several different forms including:

- I. the establishment of a new enterprise in an overseas country; either as a branch or as a subsidiary
- II. the expansion of an existing overseas branch or subsidiary
- III. the acquisition of an overseas business enterprise or its assets.

On the contrary, Foreign Portfolio Investment is the purchase of international securities that can be easily liquidated, meaning they can be easily bought or sold. The intent with FPI is generally to invest money into another country's stock and/or bond market with the hope of generating higher returns.

Although, FDI and FPI both involve putting money into a foreign country, the two investment options differ significantly. With FDI, investors can exercise control over their investments and are typically actively involved in the management of the companies they invest in. On the other hand, with FPI, investors do not actively participate in the management or operations of the companies they're invested in.

Another big difference between FDI and FPI is that investors with an FDI approach are generally looking for a long-term investment and the FDI projects are on much larger scale. Because it can take time to build up a company, those who go the FDI route usually wait a while before they can enjoy capital gains. With FPI, investors tend to take a shorter-term approach and can receive earnings on the investments earlier on.

Lastly, FPI is generally considered to be a more liquid and less risky investment option than FDI. Because foreign securities are traded regularly, an investor looking to liquidate a foreign

portfolio can sell off assets like stocks or bonds with relative ease, compared to liquidating a company/business in a foreign company. With FDI, all the money is usually invested in a single plant/business, which means that the risk cannot be diversified making it less attractive to single investors. This paper will focus on FPI, talking about the benefits, risks and the various types of options in FPI.

Benefits of International Portfolio Diversification

As mentioned above, FPI is a less-risky, usually short-term investment. FPI is also available for the average investor. There are numerous advantages that come with investing in securities abroad. A few of them are mentioned below.

Diversifying

Buying securities overseas can help an investor diversify their portfolio, simply because of the lower correlation across countries stock markets. The way the global stock market works make it possible for the same factors at a given time to have different effects to the markets located at different countries. This means that if you have stocks in different countries, you will have the opportunity to experience less volatility over your entire portfolio. Securities abroad have lower correlations with each other which will help the investor to branch out and manage the risk involved with the portfolio. This can be seen in Exhibit 2 which show the correlation amongst various countries. Countries that have greater growth rate could not only help realize greater capital gains but also help with lowering risk in the portfolio.

Greater Choice

In the list for the world's biggest stock exchanges NYSE and NASDAQ take the 1st and the 2nd position with the market capitalization for \$24.2 trillion and \$11.8 trillion each. However other

stock exchanges are not far behind with stock exchanges for Tokyo, Shanghai and London having a market capitalization of \$6.2 trillion, \$5.02 trillion and \$4.5 trillion respectively.

By not investing beyond one's particular country or region, investors can become too concentrated in the movements of their domestic market and economy, increasing the volatility risk level to the portfolio. When an investor is not properly globally diversified, they may also miss opportunities to invest in faster-growing markets.

Research from a 2012 Indiana University study¹ found that some professional U.S. mutual fund managers are also likely to demonstrate the same behavioral biases in their portfolio decisions as individual investors. It showed that the average fund tends to be overweight in stocks from its managers' home states, although the bias was stronger among managers who are less experienced. The Exhibit 3 shows the home bias in equity portfolios against the fraction of the world stock market in that particular country.

Benefit from Exchange Rate

One of the biggest factors involved in FPI is the Exchange Rate, meaning the price of a nation's currency in terms of another currency. Investing abroad involves holding the foreign security and the foreign currency. Foreign currency, in most cases, reflects each country's economic prospects. Assume an investor from the US invests \$1000 in Tokyo Stock Exchange. According to the current exchange rate, the investor will be investing around ¥113,768 (1USD=113.77JPY). If the dollar weakens against the Yen, it means that the investor will get more dividends/gains due to exchange rate difference. Therefore, investing internationally could be a great way to realize gains, provided the currency is not too volatile.

¹ Pool, V. K., Stoffman, N., & Yonker, S. E. (2012). No Place Like Home: Familiarity in Mutual Fund Manager Portfolio Choice. *SSRN Electronic Journal*. doi:10.2139/ssrn.1844464

In another scenario, let's say that the investor realizes a loss on their investment, a stronger local currency could help the investor, recover the loss (in USD). For example, if we buy a foreign stock and the stock falls by 10%, and in the meantime, the dollar depreciates by 20%, relative to the exchange rate, the loss can be offset by gains in the currency. Obviously, the opposite is true if the dollar strengthens against the local currency, which is described later in the paper.

Costs and Risks associated with International Portfolio Diversification

At the same time, investing abroad comes with its additional potential risks. Some of them are mentioned below:

Higher Transaction Costs

A major barrier to investing abroad is the transaction costs. It varies from country to country but in general, it is more expensive for an investor to buy securities in a market different than their national country. In certain cases, it is required that the investor opens an international account where all the losses/profits would be debited/credited.

Developed countries usually have lower transaction costs compared to emerging countries making them preferable compared to other emerging economies. However, in some countries it is hard to access the stock market as it restricts capital accounts. The biggest solution to this problem is American Depositary Receipts (ADR).

Foreign Exchange Risks

Foreign Exchange Risk is associated with fluctuations in a foreign currency relative to the U.S. dollar. For example, a foreign company may report 25 percent earnings growth, but if its local currency depreciates by 10 percent relative to the U.S. dollar, the real growth rate is closer to 15

percent when the profits are converted back into U.S. dollars. This sometimes causes the investment to take a hit and could be one of the many reasons why investors have a home bias.

However, business have found a way around this risk involved, which is that it may attempt to hedge some of its foreign-exchange risk by buying derivative contracts like currency futures, forwards options or swaps. This gives the investor some sort of protection from this kind of risk.

Political and Liquidity factors

Foreign investments are always risky because the political situation in some countries can change in an instant. The investor could suddenly find his investment in serious jeopardy due to several different reasons, so the risk factor is always extremely high. For example, Brazil nationalized part of its largest oil company — Petroleo Brasileiro — in a move that caused many investors to lose money. A subsequent corruption scandal involving the company pushed shares even lower.

Some foreign markets trade at much lower volumes compared to the exchanges in the US. There could be fewer investing options, and the markets may not be open during all traditional business hours. This shows the lack of liquidity of the investor.

Data

There are various ways an investor can invest internationally, using different investment choices. Some of the most common ones are described below

Investment choices

Investing abroad can be tricky, but there are several instruments that can be used when it comes to investing abroad. These instruments may directly or indirectly hold securities in other countries. Buying these instruments or buying a share of these instruments may help gain the benefits of investing abroad.

American Depositary Receipt (ADR)

An ADR is a certificate that represents shares of a foreign stock owned and issued by a U.S. bank. The foreign shares are usually held in custody overseas, but the certificates trade in the U.S. Through this system, many foreign-based companies are actively traded on U.S. equity markets. Holders of ADRs realize any dividends and capital gains in U.S dollars, but dividend payments in foreign currency are converted to U.S dollars.

There are several risks involved in investing in ADRs. Firstly, although the investment is valued in dollars the returns are exposed to the fluctuation of foreign currency exchange rate. This increases the overall volatility of the financial return. Secondly, since the companies that offer ADRs are based out of U.S, this may cause problem when acquiring or disposing of the shares since the company is not popular in the U.S, therefore it is not ideal to hold ADRs for a short-term. Lastly, the holding bank of the ADRs may incur expenses in managing the entire process, this cost is passed on to the investors and is usually deducted from the dividends.

In contrast, there are several benefits that come with investing in ADRs. Firstly, holding ADRs can result in favorable currency conversion for the dividends. Secondly, access to emerging markets is another huge advantage, countries like China and India who have had a rapid increase in GDP have a fast-growing stock market which people in US can take advantage of. Lastly,

investing in ADRs is like buying a domestic stock, therefore the convenience of having such a facility is great from an investors stand-point.

Mutual Funds

A mutual fund is a company that brings together money from many people and invests it in stocks, bonds or other assets. The combined holdings of stocks, bonds or other assets the fund owns are known as its portfolio. Each investor in the fund owns shares, which represent a part of these holdings. Lately, we have been seeing a lot Mutual funds which provide international exposure. Mutual Funds like Fidelity International Growth (FIGEX) and Vanguard Total International Stock ETF (VXUS) have shown tremendous growth and given big returns to its investors.

Investing in Mutual Funds can come with its shortcomings. For example, investing in Mutual Funds means that you place your money in the hands of a professional manager, therefore the returns on your investment depends heavily on the skill and judgement of the manager.

Secondly, there are active or passive fees involved with investing, depending on the type of Mutual Fund, which can reduce the returns on the investment.

On the other hand, Mutual Funds have their advantages. A single mutual fund can hold securities from hundreds or even thousands of issuers which diversifies the investment. Secondly, mutual funds can be bought and sold any business day thus providing investors with easy access to their money.

Exchange-Traded Funds (ETF)

An ETF is a type of a fund that owns underlying assets and divides ownership of those asset into shares, it is then traded on stock exchanges much like stocks. An ETF can hold assets like stocks, commodities, bonds and even currencies. They are usually inexpensive, and easy to trade. One of

the biggest type of ETFs traded on the stock exchanges are iShares, which are managed by BlackRock, world's largest investment management corporation with \$6.29 trillion in assets under management. Some of the most common ETFs with international exposure are iShares Core MSCI Total International Stock ETF (NASDAQ: IXUS), Schwab International Equity ETF (NYSEMKT: SCHF) and Vanguard FTSE Emerging Markets ETF (NYSEMKT: VWO).

Data sources for Portfolio Simulations

The data used in the simulations was extracted from the website of Morgan Stanley Capital International (MSCI). To fully track the stock market of a country, indices specific to that country were used. Initially, the approach was to track Exchange-traded funds (ETFs) corresponding to each country's stock market but since they have not been on the market for a long time, indices from the MSCI website were used. The countries included, along with the starting date of the indices are shown in Exhibit 4. Exhibit 4 also shows the calculated annual return and standard deviation for each country, first they were calculated in USD and then they were again calculated in their local currency. All the indices tracked contained large and mid-cap securities for that particular country.

Results

Simulation 1: US vs World ex.US

This simulation was run on the indices of World ex. USA and USA, to find the optimum portfolio and the optimum weights that should be allocated to the US equities compared to the rest of the world equities. Exhibit 5 shows the Efficient frontier based on the return and standard

deviation of both the indices. The countries included in the World ex. USA are shown in Exhibit 6.

The results were very close where the US gave an average return of 7.85% against World ex. US's 7.28% annual return. The standard deviation was also very close between the 2 indices where US had a standard deviation of 15.03% against World ex. US of 14.56%. There was a high correlation of 0.94 between the 2, but the weights for the optimal portfolio were 69.48% to US and 30.52% to the World ex.US equities.

On an individual level, comparing the returns of Brazil against the US, it was very fascinating to see the simple returns for both the countries. On an annual basis over the period of 1987-2019, Brazil gave an average return of 21.56%, compared to 8.93% average returns on the US equities.

This simulation further strengthened the case for international diversification since it is evident by the results that in order to get the optimal risk-return trade-off, international equities should be included in a portfolio.

Simulation 2: Optimal Portfolio in USD

After downloading the data for various countries in United States Dollar (USD), returns and standard deviation were calculated. After this process, the variance covariance matrix was calculated based on the returns of all the countries. The Variance-Covariance matrix further helped in calculating the Variance and the Expected Returns of the optimum portfolio. Using the Variance, Expected Returns and the Risk-free rate², Microsoft Excel's Solver function was used to maximize the Sharpe ratio, by allocating the optimum weights on each country.

² The risk-free rate used was 0.4% (annual) or 0.04%(monthly), since it was the average of the risk-free rate over the time of the data that was used in the simulation.

The Solver function was again used to calculate the Minimum-Variance Portfolio where Variance, Expected Returns and Standard Deviation was calculated. The Optimum Portfolio and Minimum Variance Portfolios were used to calculate the Expected Returns and Standard Deviation for all the portfolios on the Efficient Frontier. Exhibit 7 shows the Efficient Frontier that was created.

The Country level indices showed that the top performers were the Brazilian equities and the Turkish equities, giving huge annual returns of 21.56% and 16.076% with considerably high standard deviation of 48.22% and 53.92% meaning, they come at a high-risk level. US equities showed a steady average returns of 7.85% with a standard deviation of 15.03%, they proved to be more stable over the period, at the expense of mediocre returns, comparatively. The weights for each country in an optimum portfolio are shown in Exhibit 8. Despite the overwhelming returns from most of the countries, the most weight was put on the US equities (40.90%). After the US, Japanese equities proved to be the second-best investment with a substantial weight (24.99%)

For a US investor investing in USD, who wants to invest abroad, this could work as guide on the where to invest. Investors could pick countries based on their risk-return preference based on the annual returns and standard deviation. As seen in Exhibit 4, the values vary on whether the investor in investing in USD or the local currency.

Simulation 3: Optimal Portfolio in local currency

The same process as the previous simulation was used in this simulation with the only change that instead of using USD, the local currency for each country was used to show the implications of currency exchange rate and what effect it has on the annual returns and standard deviation and composition of the Optimal Portfolio.

On this Country level indices with local currency, the results changed drastically with Brazil and Turkey still maintaining the title of the best performing equities. Brazilian equities average returns increased drastically, jumping from 21.56% to a staggering 88.45% with standard deviation also increasing from 48.22% to 64.48%. Turkey's return also increased to 41.64%, with standard deviation falling to 49.66% from 53.92%. This simulation clearly showed the implications currency exchange rates have on investments. This simulation further concurred the fact that Brazilian Real and Turkish Lira have taken a hit against the USD over time, and it was evident as well in the weights that were allocated to each country based on their returns in local currency. Exhibit 8 shows the optimum portfolio weights in local currency for each country. This time around, Brazil and Turkey took the most weight in this portfolio with 57.75% and 28.93%, respectively.

This simulation clearly demonstrated the control that currency fluctuation has on the returns and the standard deviation. Another evident example of currency fluctuation is Japan. As shown in Exhibit 8, the initial weight in USD simulation was 24.99%, whereas it can be seen in Exhibit 8 that the weight went down to 0%. This clearly demonstrates the effect of the strong Japanese currency on the composition of the optimal risky portfolio. This also indicates that the foreign investments consist of 2 parts, first one being the foreign security and the second being the foreign currency. Both the components play an instrumental role in international diversification.

Conclusion

In conclusion, it is clear that the strong home bias is hindering investors from exploiting equities other than their domestic ones. The optimal portfolio in World ex.US vs US simulation gave a weight of 69.48% to the US and it is seen in Exhibit 3, almost 86% of the equities held in the US

mutual fund are domestic. There is a further need to diversify into international equities to get better risk-return trade-off. It is also clear through the local currency simulation that currency exchange rates can cut both ways. Currency fluctuation can increase/decrease returns on the portfolio depending on how the strong/weak a currency is. Therefore, thorough research should be done before investing internationally both on the foreign securities as well as the foreign currency involved.

Exhibits

Exhibit 1

Factors that contribute towards Home Bias

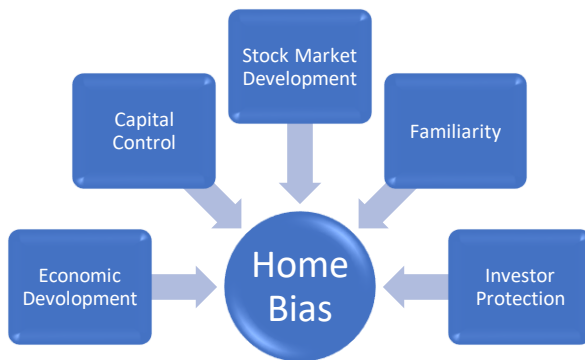


Exhibit 2³

Correlation of countries stock market within and with each other

Stock Market	AU	FR	GM	JP	NL	SW	UK	US
Australia (AU)	0.586							
France (FR)	0.286	0.576						
Germany (GM)	0.183	0.312	0.653					
Japan (JP)	0.152	0.238	0.300	0.416				
Netherlands (NL)	0.241	0.344	0.509	0.282	0.624			
Switzerland (SW)	0.358	0.368	0.475	0.281	0.517	0.664		
United Kingdom (UK)	0.315	0.378	0.299	0.209	0.393	0.431	0.698	
United States (US)	0.304	0.225	0.170	0.137	0.271	0.272	0.279	0.439

³The correlations are in terms of U.S dollars and computed using the weekly return data from 1973-1982

Exhibit 3

World Market Capitalization Weight of each country against the Share the Mutual Fund Holdings in the Domestic Market

Country	World Market Capitalization Weight of Each Country (%)	Share of Mutual Fund Holdings in the Domestic Market (%)
Canada	2.44	26.99
France	4.32	55.29
Germany	3.99	33.49
Italy	2.22	35.37
Japan	11.29	71.29
United Kingdom	8.13	43.06
USA	46.85	85.66

Source: "What Determines the Domestic Bias and Foreign Bias? Evidence from Mutual Fund Equity Allocations Worldwide", *Journal of Finance*, 60, 1495-1534

Exhibit 4

Returns and Standard Deviation of Each Country in USD and their local currency

Country (Starting date)	Returns (USD)	Standard Deviation (USD)	Returns (Local Currency)	Standard Deviation (Local Currency)
Australia (1970)	7.09%	23.56%	6.90%	18.51%
Brazil (1988)	21.56%	48.22%	88.45%	64.48%
Canada (1970)	7.62%	19.30%	7.45%	15.99%
China (1993)	4.56%	32.77%	4.59%	32.73%
France (1970)	8.36%	22.02%	7.93%	19.48%
Germany (1970)	8.36%	21.53%	6.37%	19.15%
Greece (1988)	2.22%	38.26%	4.28%	36.61%
India (1993)	10.88%	28.57%	13.09%	25.19%
Italy (1970)	5.15%	25.30%	6.67%	23.19%
Japan (1970)	9.09%	20.56%	6.28%	18.35%
Malaysia (1988)	7.45%	26.44%	8.34%	23.65%
Pakistan (1993)	4.90%	34.51%	11.01%	33.42%
Qatar (2005)	4.02%	27.17%	4.02%	27.14%

Singapore (1970)	11.19%	27.54%	9.07%	25.78%
South Africa (1993)	9.34%	26.13%	11.72%	18.34%
Spain (1970)	5.66%	23.24%	6.60%	20.61%
Sweden (1970)	11.38%	23.28%	12.13%	21.44%
Turkey (1988)	16.08%	52.93%	41.64%	49.66%
United Arab Emirates (2005)	1.00%	33.01%	1.00%	33.03%
United Kingdom (1970)	7.14%	21.27%	7.92%	18.84%
United States of America (1970)	7.85%	15.03%	7.85%	15.03%

Exhibit 5

US vs World ex. US Optimal Portfolio Efficient Frontier

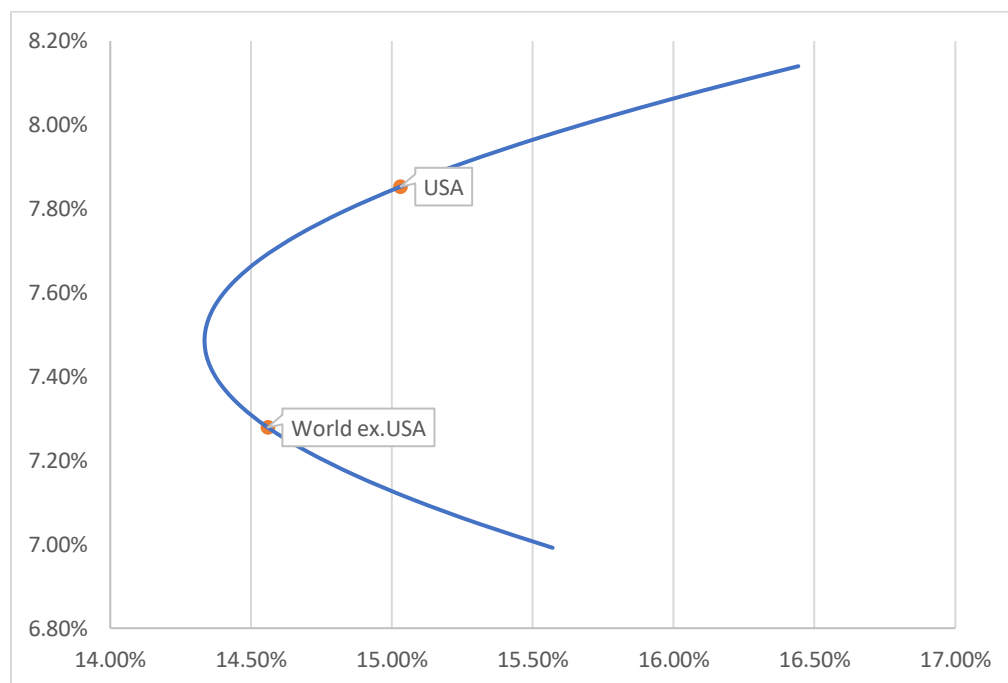


Exhibit 6

Countries included in the World ex. US index

Note: The countries in the MSCI world index were all included in the World ex. US index, with the exception of US

MSCI ACWI INDEX MARKET ALLOCATION

MSCI ACWI INDEX					
MSCI WORLD INDEX			MSCI EMERGING MARKETS INDEX		
DEVELOPED MARKETS			EMERGING MARKETS		
Americas	Europe & Middle East	Pacific	Americas	Europe, Middle East & Africa	Asia
Canada United States	Austria Belgium Denmark Finland France Germany Ireland Israel Italy Netherlands Norway Portugal Spain Sweden Switzerland United Kingdom	Australia Hong Kong Japan New Zealand Singapore	Brazil Chile Colombia Mexico Peru	Czech Republic Egypt Greece Hungary Poland Qatar Russia South Africa Turkey United Arab Emirates	China India Indonesia Korea Malaysia Pakistan Philippines Taiwan Thailand

Exhibit 7

Efficient Frontier for the Country level indices

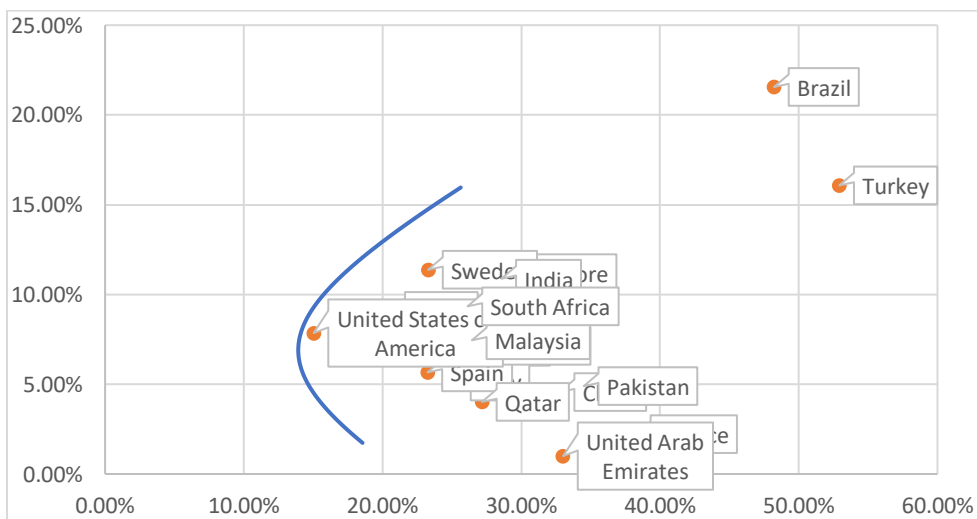


Exhibit 8

Weights for each country in USD and local currency based on simulations 2 and 3

Country	Weights (USD)	Weights (Local Currency)
Australia	0.000%	0.000%
Canada	0.000%	0.000%
France	0.000%	0.000%
Germany	0.000%	0.000%
Italy	0.000%	0.000%
Japan	24.991%	0.000%
Brazil	11.424%	57.752%
Singapore	3.813%	0.000%
Spain	0.000%	0.000%
Sweden	11.263%	0.000%
United Kingdom	0.000%	2.307%
USA	40.906%	0.000%
China	0.000%	0.000%
Greece	0.000%	0.000%
India	4.851%	0.000%
Malaysia	0.000%	0.000%
Pakistan	0.000%	0.000%
Qatar	0.000%	0.000%
South Africa	0.000%	11.006%
Turkey	2.753%	28.935%
United Arab Emirates	0.000%	0.000%

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