S&P Dow Jones Indices

A Division of S&P Global

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Exploring the Road to Inflation Protection When Energy Fails
Diversifying With Real Assets From Brazil to Japan

INTRODUCTION

In our recent paper, Let's Get Real About Indexing Real Assets,[1] global real assets are defined for the first time in an index. The index includes a complete set of liquid real assets (infrastructure, property, natural resources, and inflation bonds) that have been blended using equities, fixed income, and futures. The results demonstrate that the S&P Real Assets Index may provide inflation protection and improve diversification when added to a mix of U.S. stocks and bonds.

The following analysis shows how real assets may provide inflation protection and affect portfolio diversification in different markets around the world, including Australia, Brazil, Canada, China, the Eurozone, Japan, Mexico and South Korea. The results are similar to those from the U.S. where natural resources and inflation bonds may provide the most inflation protection, though the excess returns of these individual assets may not be a satisfactory basis to improve risk-adjusted returns when added to a portfolio mix of traditional assets. Therefore, the combined real assets are an important aspect of trying to achieve a desired level of inflation protection and diversification.
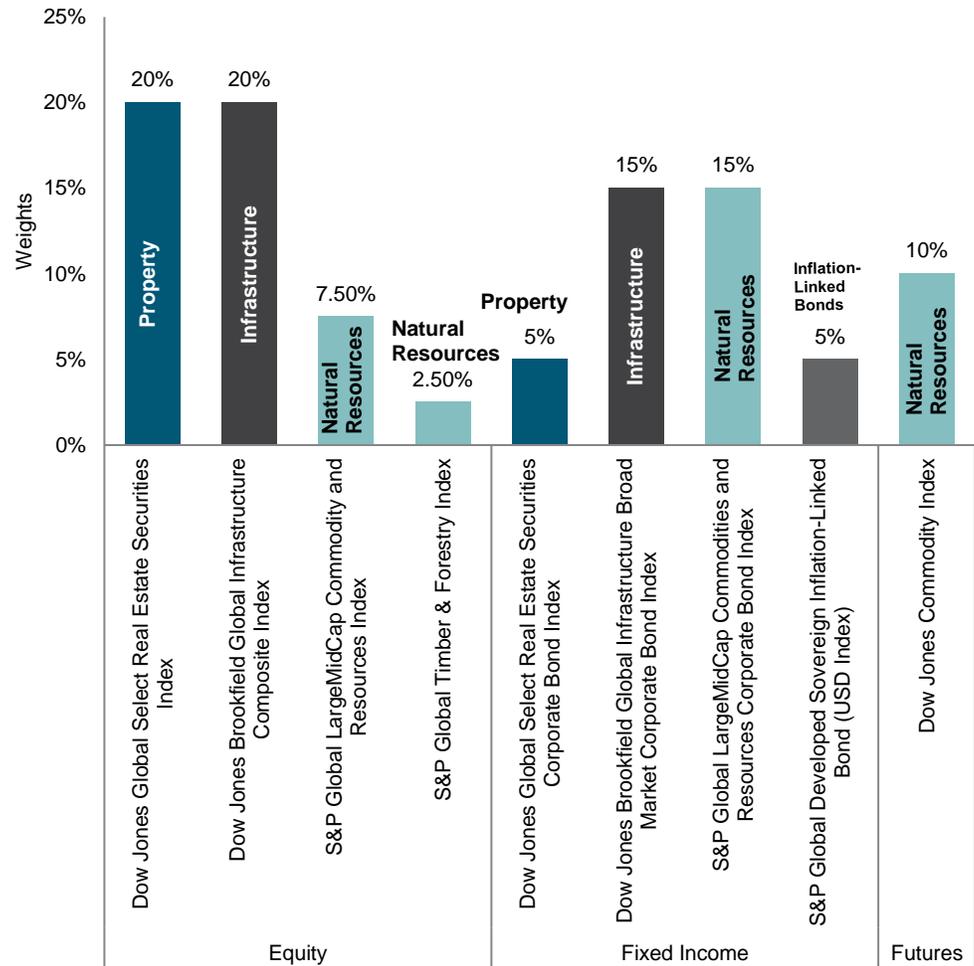
INFLATION PROTECTION

Data and Methodology

The study period is from April 2006 to December 2015, based on the earliest available data for indices that are used as proxies[2] for asset class returns. Monthly year-over-year percent changes in the Consumer Price Index (CPI) levels represent changes in inflation. Exhibit 1 shows the constituent indices inside the S&P Real Assets Index used in the analysis. The index is composed of 50% equities, 40% fixed income, and 10% commodity futures, allowing the full (public) capital structure of real asset companies to be represented.

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[1] http://spindices.com/documents/education/lets-get-real-about-indexing-real-assets.pdf

[2] Proxies for Real Assets are in Exhibit 1, proxies on the country level, are depicted in exhibits 6, 9, 10, 12-15. Source: S&P Dow Jones Indices LLC.

Exhibit 1: Breakdown of S&P Real Assets Index Components and Weights

Source: S&P Dow Jones Indices LLC. Data as of December 31, 2015. Chart is provided for illustrative purposes. Index target weights are rebalanced to these percentages every April and October.

For the purpose of the analysis, the index is compared to the individual composite sectors broken down by infrastructure, property, natural resources, and inflation-linked bonds. Also, the combined sectors across equities only are used for analysis since many investors are most familiar with equities or may consider using the equity-only subindex. The weights are normalized to 100% in each case, as summarized in Exhibit 2.

Exhibit 2: Real Asset Sectors Used For Analysis

REAL ASSET SECTORS	INDEX MIXES
Equity-Only Composite	100% Equity (40% Property, 40% Infrastructure, 15% Natural Resources, 5% Timber & Forestry)
Infrastructure Composite	100% Infrastructure (57% Equity, 43% Fixed Income)
Property Composite	100% Property (80% Equity, 20% Fixed Income)
Natural Resources Composite	100% Natural Resources (21% Commodity Equities, 7% Timber & Forestry Equities, 43%Fixed Income, 29% Commodity Futures)
Inflation-Linked Bonds	100% Fixed Income

Source: S&P Dow Jones Indices, LLC. Data as of December 31, 2015. Table is provided for illustrative purposes.

The sidebar text (left margin):

For the purpose of the analysis, the index is compared to the individual composite sectors broken down by infrastructure, property, natural resources, and inflation-linked bonds.

Global Inflation Levels

Exhibit 3 compares the current inflation rates of countries and regions in this study with their long-term historical average, maximum, and minimum. In recent years, inflation levels have remained fairly low across most countries compared with their long-term average, with the exception of Brazil. Also, Japan has had little or negative inflation, indicating deflationary pressures.

Exhibit 3: Inflation Levels of Selected Countries and Regions

REGION	CURRENT (%)	MAXIMUM (%)	AVERAGE (%)	MINIMUM (%)
Australia	1.7	5.0	2.6	1.1
Brazil	10.7	10.7	5.7	2.9
Canada	1.6	3.6	1.7	-0.9
China	1.8	8.8	3.0	-1.7
Eurozone	1.0	4.1	1.7	-0.6
Japan	0.2	3.7	0.3	-2.5
Mexico	2.1	6.5	4.0	2.1
South Korea	1.3	5.9	2.5	0.4

Source: S&P Dow Jones Indices, LLC. Data as of April 2016. Table is provided for illustrative purposes.

In recent years, inflation levels have remained fairly low across most countries compared with their long-term average, with the exception of Brazil.

Current low inflation levels can be deceiving and may provide a false sense of security in terms of market participants' responsiveness and preparedness for inflation. Long-term maximum levels, however, show that inflation can increase multiple times. In many cases, even a mild increase in inflation has the potential to meaningfully erode the purchasing power of wealth and a portfolio's value. Against that backdrop, it is important to compare the effectiveness of each real asset equity, fixed income, and multi asset composite in protecting against inflation risk.

Inflation Betas

A key measure in determining the power of inflation sensitivity of each real asset sector and the index is inflation beta. It measures the sensitivity of asset nominal prices to changes in inflation levels. For example, an asset with an inflation beta of 4.0 has historically risen on average 4.0% for an increase in inflation of 1%. All else equal, the higher the inflation beta, the more the asset prices move in tandem with changes in inflation, and the more inflation protection the asset could potentially provide.

Inflation beta is computed by taking the slope coefficient of the regression line in which the returns of each portfolio are regressed against changes in inflation levels for the countries in our study. The returns for each country are U.S. dollar returns translated back into the local currency using spot exchange rates. The regression equation can be summarized as follows:

$$R_i = \alpha + \beta \ \ Inflation + \varepsilon$$

where

R_i = year-over-year net total returns of the asset class,

Inflation = year-over-year changes in inflation levels, and

ε = part of the asset class returns not explained.

Exhibit 4 shows inflation betas of the countries and regions in our study through the lens of individual asset classes. The data reveals considerable dispersion in inflation betas across all the countries with respect to each asset class. The following are some immediate observations.

- Real assets were most sensitive to inflation in Brazil.
- Inflation in Mexico, Australia, and the Eurozone did not positively affect the index.
- Natural resources and inflation-linked bonds were most highly sensitive to inflation on average, and specifically from inflation in Brazil and South Korea.
- Natural resources had a highly positive inflation beta in every country except Mexico.

The data reveals considerable dispersion in inflation betas across all the countries with respect to each asset class.

Exhibit 4: Inflation Beta of the S&P Real Assets Index and Composite Sectors

REGION	S&P REAL ASSETS INDEX	EQUITY COMPOSITE	PROPERTY	INFRA-STRUCTURE	NATURAL RESOURCES	INFLATION-LINKED BONDS
Australia	-1.9	-2.4	-5.3	-4.1	3.0	-2.2
Brazil	4.6	4.0	5.9	4.9	3.0	6.6
Canada	1.2	2.6	0.1	-0.6	4.1	-0.3
China	1.2	1.5	0.0	0.4	2.7	0.9
Eurozone	-1.6	-2.1	-4.5	-3.0	1.9	-1.0
Japan	1.4	1.5	0.2	2.1	1.3	2.2
Mexico	-5.5	-11.2	-12.6	-3.5	-2.7	1.0
South Korea	1.5	-1.4	-3.7	0.8	5.7	5.0

Source: S&P Dow Jones Indices, LLC. Data as of April 2016. Table is provided for illustrative purposes.

Although not shown in the exhibit, real assets were also sensitive to inflation in the U.S., Switzerland, and the U.K., with inflation betas of 4.3, 2.9, and 1.6, respectively. Additionally, the commodity futures[3] alone had very high inflation betas across all the selected countries except Mexico, averaging 5.3. Inflation in Canada, Australia, South Korea, and the Eurozone had the largest impact on commodity futures, with inflation betas of 11.5, 10.9, 9.2, and 8.0, respectively. The commodity futures were also highly sensitive to inflation in Switzerland, the U.S., and the U.K., which had inflation betas of 13.9, 11.2, and 7.9, respectively.

Inflation-linked bonds were also able to provide inflation protection for most countries, but their sensitivity to inflation is limited compared with natural resources. Natural resources has a large energy exposure that is the most volatile component of the CPI, so the sensitivity is multiplicative, whereas in most cases, the inflation-linked bonds were more correlated to inflation, but the sensitivity was lacking.

The other real asset sectors are less reliably sensitive to inflation. Property overall had the lowest inflation beta; across the countries, the average was -2.5. Infrastructure worked best in Brazil and Japan, with inflation betas of 4.9 and 2.1, respectively, but on a stand-alone basis, it didn't provide much inflation protection in the rest of the world.

> The wide dispersion of inflation betas observed across the countries in the study serves as a reminder that real assets, much like other financial assets, respond differently to inflation in different parts of the world.

The wide dispersion of inflation betas observed across the countries in the study serves as a reminder that real assets, much like other financial assets, respond differently to inflation in different parts of the world. Moreover, the analysis proves that, historically, commodity futures and natural resources have been globally strong choices for inflation protection.

Excess Returns Over Inflation

While the inflation protection that real assets provide in different parts of the world is meaningful according to measures of inflation beta, it is also insightful to examine the inflation-adjusted returns. Excess returns are computed by subtracting the year-over-year percentage changes in inflation levels from asset class returns measured over the same period. Therefore, the returns can be thought of as the magnitude of inflation protection. The computation also reflects common thinking by market participants who expect the market returns to equal inflation + X%, where X% is the amount of inflation protection that investors expect to receive by investing in certain asset classes.

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[3] http://www.indexologyblog.com/2014/07/15/weighing-in-on-inflation/

Exhibit 5: Excess Returns Over Inflation by Country and Region

REGION	S&P REAL ASSETS INDEX (%)	EQUITY COMPOSITE (%)	PROPERTY (%)	INFRASTRUCTURE (%)	NATURAL RESOURCES (%)	INFLATION-LINKED BONDS (%)
Australia	4.2	6.5	5.1	6.6	1.3	2.2
Brazil	6.0	8.4	7.3	8.4	2.6	3.9
Canada	6.1	8.5	7.1	8.3	3.2	3.7
China	2.0	4.7	3.3	3.8	-0.8	-1.1
Eurozone	6.7	9.3	8.1	8.8	3.6	4.0
Japan	8.7	11.9	10.4	10.8	5.6	5.3
Mexico	7.2	9.6	8.1	9.5	4.4	4.9
South Korea	5.4	7.4	5.7	7.6	3.2	3.6

Source: S&P Dow Jones Indices LLC. Data as of April 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

> The infrastructure composite had the highest average inflation-adjusted returns.

Note that the average inflation-adjusted returns were largely positive across real asset sectors and countries, with natural resources and inflation-linked bonds in China being the only exceptions. In fact, not only did all of the countries show positive average year-over-year excess returns, but, with the exception of China, the outperformance is significant. Even in Australia, the Eurozone, and Mexico, where the inflation betas were low, there were average year-over-year excess returns of 4.2%, 6.7%, and 7.2%, respectively.

Based on the data, the infrastructure composite had the highest average inflation-adjusted returns, with an average year-over-year excess return of 8.0%. If only looking at the equities of the real assets index, the excess return of 8.3% is also relatively strong, which is not surprising given the equity market rally in the last seven years. However, the equities are naturally correlated to the traditional equities in most portfolios and the infrastructure had a slightly negative inflation beta.

Despite the high sensitivity of natural resources to inflation, its performance has been relatively weak due to the historically poor energy performance. This is a key reason why investors are looking to diversify across inflation-sensitive sectors and mix fixed income and futures with stocks.

DIVERSIFICATION

In the analysis to understand the diversification that real assets provide in each country or region, indices representative of each target country's equity and bond markets are selected, and the respective risk-free rate is used to calculate the portfolio's risk premium. Then the S&P Real Assets Index and composite sectors are used to replace portions of the traditional local mixes, and the diversification is measured by the Sharpe ratios (a measure of risk-adjusted returns). Specific portfolios were created to provide a framework for looking at the assets that seem most pertinent to the local markets. Unless otherwise noted, indices utilized in the study are all in U.S. dollars in order to reduce the effects of currency volatility and risk in the descriptive measures.

Despite the negative inflation beta of real assets to Mexican inflation, real assets are highly beneficial for diversification to Mexican equities, especially from the relatively high annualized risk of 24.6%.

To begin the analysis for each local market, a single asset was chosen by the prevalent investment profile in the respective country to best represent historical growth returns. This resulted in the selection of a broad market equity index for each country, with the exception of Brazil, which was assigned a broad bond index as the primary allocation. Also, although Mexico's starting single-asset allocation is equities, the annualized risk is relatively high, so the weight is reduced significantly in the mixed portfolios.

Exhibit 6 shows the risk/return profile for Brazil and Mexico, since the traditional allocations look different than those for most other countries. For example, Brazil starts with a portfolio of 100% S&P/BM&F Brazil Sovereign Inflation-Linked Bond Index, which had a Sharpe ratio of 1.5 with an annualized return of 12.3% and annualized risk of 6.3%. Next, 20% is moved out of that index and into the equity index, the S&P/BOVESPA Quality Index, which had significantly higher risk, so its Sharpe ratio fell to 1.0. Alternatively, the last portfolio analysis for Brazil moves 20% out of the S&P/BMF Brazil Sovereign Inflation-Linked Bond Index and into the S&P Real Assets Index, which helps more than local equities but is not more efficient than the bonds alone. Although the diversification is not strong when adding real assets in Brazil, the inflation protection is so high that one may consider taking the slight tradeoff in return for the inflation protection.

On the other hand, despite the negative inflation beta of real assets to Mexican inflation, real assets are highly beneficial for diversification to Mexican equities, especially from the relatively high annualized risk of 24.6%. When the 100% equity portfolio is taken down to 30% in equities and replaced with 70% fixed income, the Sharpe ratio more than doubles from 0.3 to 0.7. However, when an additional 10% is removed from equities and replaced with real assets, the Sharpe ratio increases slightly by 0.04 from a 134 basis points (bps) annualized risk reduction for a loss in return of only 57 bps.
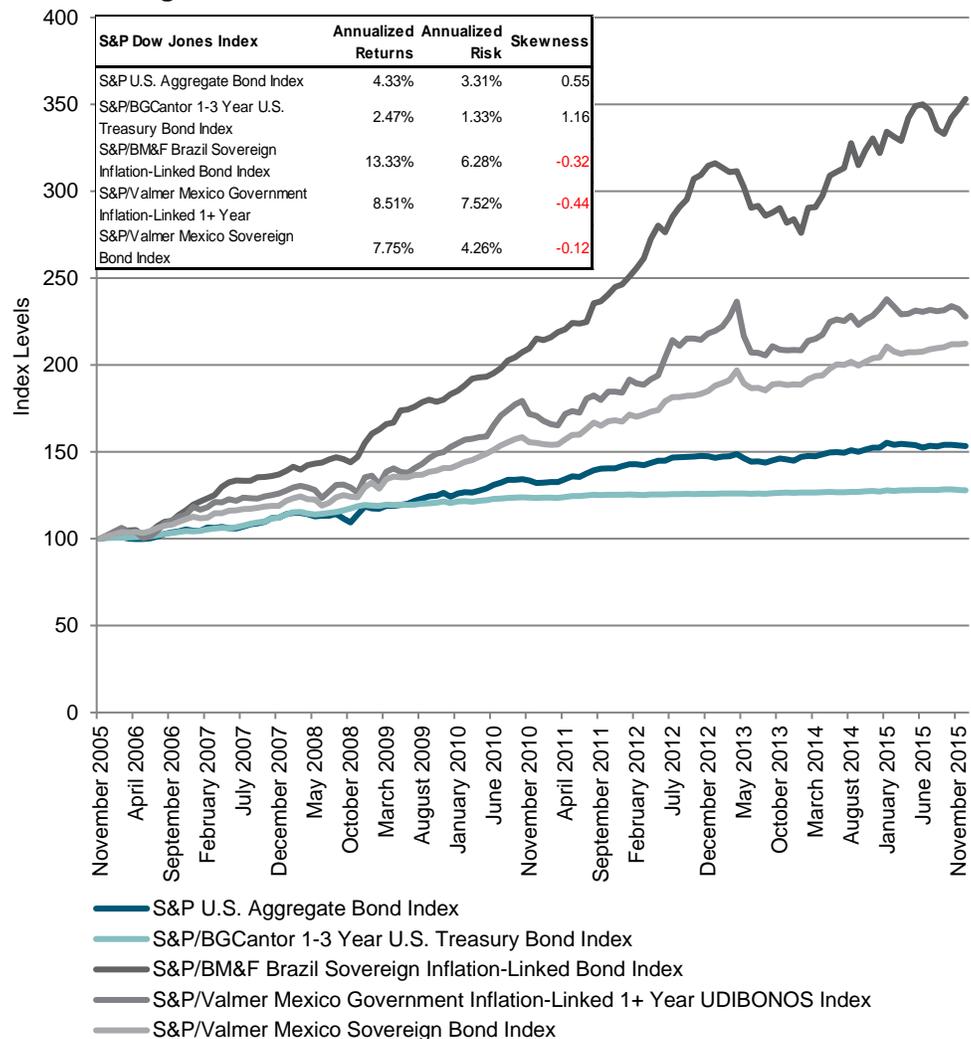
Exhibit 6: Adding Real Assets to Traditional Brazilian and Mexican Portfolios

CONSTITUENTS	SHARPE RATIO	ANNUALIZED RETURN (%)	ANNUALIZED RISK (%)
BRAZIL			
S&P/BM&F Brazil Sovereign Inflation-Linked Bond Index* (100%)	1.46	12.26	6.32
S&P/BOVESPA Quality Index + (20%)	1.02	12.51	9.27
S&P Real Assets Index + (20%)	1.28	11.00	6.21
MEXICO			
Mexican Stock Exchange (100%)	0.27	9.82	24.63
Mexico Inflation-Linked/Sovereign Bonds + (70%)	0.69	9.75	9.64
Mexico Inflation-Linked/Sovereign Bonds + (70%) S&P Real Assets + (10%)	0.73	9.18	8.30

Source: S&P Dow Jones Indices LLC. Data from April 2005 to December 2015. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. *Brazil inflation linked performance utilizes global developed inflation bonds prior to December 30, 2015. All data prior to the launch dates are back-tested.

Given the high inflation-linked bond allocation in the mixes for Brazil and Mexico, the risk of these bonds is relatively skewed to the downside, making them more risky to hold.

Additionally, it is important to note that, given the high inflation-linked bond allocation in the mixes for Brazil and Mexico, the risk of these bonds is relatively skewed to the downside, making them more risky to hold. Exhibit 7 shows the performance and downward risk of government bond indices in Brazil and Mexico measured against U.S. aggregate and treasury bonds indices.

Exhibit 7: Negative Skewness of Brazilian and Mexican Inflation Bonds

S&P Dow Jones Index	Annualized Returns	Annualized Risk	Skewness
S&P U.S. Aggregate Bond Index	4.33%	3.31%	0.55
S&P/BGCantor 1-3 Year U.S. Treasury Bond Index	2.47%	1.33%	1.16
S&P/BM&F Brazil Sovereign Inflation-Linked Bond Index	13.33%	6.28%	-0.32
S&P/Valmer Mexico Government Inflation-Linked 1+ Year	8.51%	7.52%	-0.44
S&P/Valmer Mexico Sovereign Bond Index	7.75%	4.26%	-0.12

— S&P U.S. Aggregate Bond Index
— S&P/BGCantor 1-3 Year U.S. Treasury Bond Index
— S&P/BM&F Brazil Sovereign Inflation-Linked Bond Index
— S&P/Valmer Mexico Government Inflation-Linked 1+ Year UDIBONOS Index
— S&P/Valmer Mexico Sovereign Bond Index

Source: S&P Dow Jones Indices LLC. All indices rebased to 100 in November 2005. Data as of Dec. 31, 2015. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. All data prior to the launch dates are back-tested.

While the emerging market bonds have generally had higher returns, they have exhibited higher volatility and potential downward risk as shown in the paper Understanding Emerging Market Bonds by Erb, Harvey, and Visconti.[4] The authors noted that while emerging market bonds outperformed the S&P 500® in the period between 1991 and 1997, they presented increased risk, which was realized during the 1998 financial crisis. Similar risks were realized as markets crashed in the recession of 2001-2003, the global financial crisis of 2007-2009, and more recently, as risky assets became correlated in the oil crash.

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[4] "Understanding Emerging Market Bonds" by Erb, Harvey, and Visconti. Draft Oct 1999.
https://faculty.fuqua.duke.edu/~charvey/Research/Working_Papers/W48_Understanding_emerging_market.pdf

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Sidebar: While the emerging market bonds have generally had higher returns, they have exhibited higher volatility and potential downward risk.

As emerging market countries improve economically, their creditworthiness may improve, and that can translate into lower yields.

In addition to the above instability, on a longer horizon, emerging market government bonds can be subject to more uncertainty about future yields than developed or global market bonds. As emerging market countries improve economically, their creditworthiness may improve, and that can translate into lower yields. In the short term, the market capitalization of emerging market bonds compared with those of the developed world could pose a challenge in terms of disproportionate market capitalization weightings that result from optimizations based solely on return, risk, and correlation. A report by the World Bank showed that while emerging market local currency sovereign debt grew substantially in 2014 (from USD 1.3 trillion in 2000 to USD 6.3 trillion), it is still only one-half the size of the U.S. Treasury market.[5] However, the S&P Real Assets Index and its components are unlikely to pose a liquidity challenge, due to their strict eligibility criteria and investable characteristics, which makes them viable alternatives to local inflation-linked bonds.

Exhibit 8 summarizes by country the hypothetical portfolio asset allocations for the basic mixes on the bottom chart and with an allocation to real assets on the top chart. Brazil, Canada, and the Eurozone present the opportunity for the biggest weights to real assets, at 20% each, while the rest of the countries are close to 10%.

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[5] Emerging Markets Local Currency Debt and Foreign Investors, Daniela Klingebiel Pension & Endowments Department December 3, 2014. http://treasury.worldbank.org/documents/DanielaKlingebiel.pdf

Exhibit 8: Summary of Weights to Real Assets by Country From Traditional Mixes
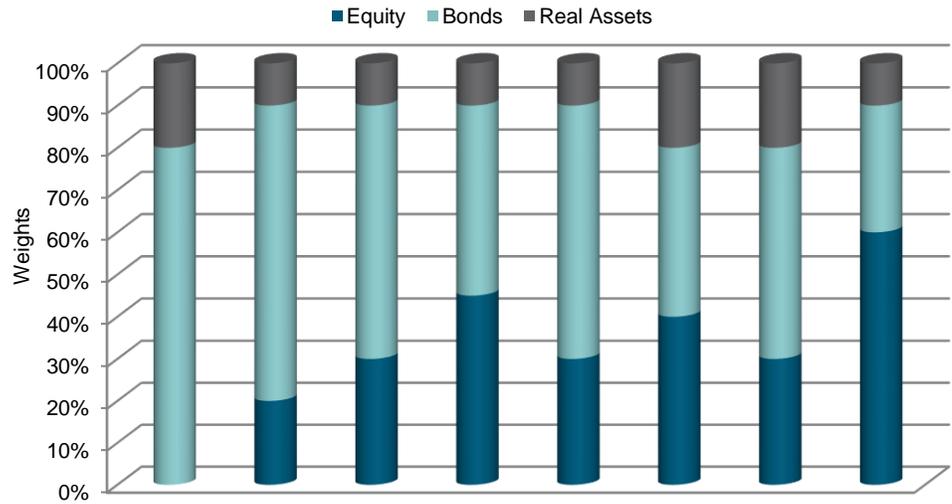
The Australia growth portion is represented by two benchmarks, one representative of the Australian market (80%) and the other of the global equity market excluding Australia (20%).
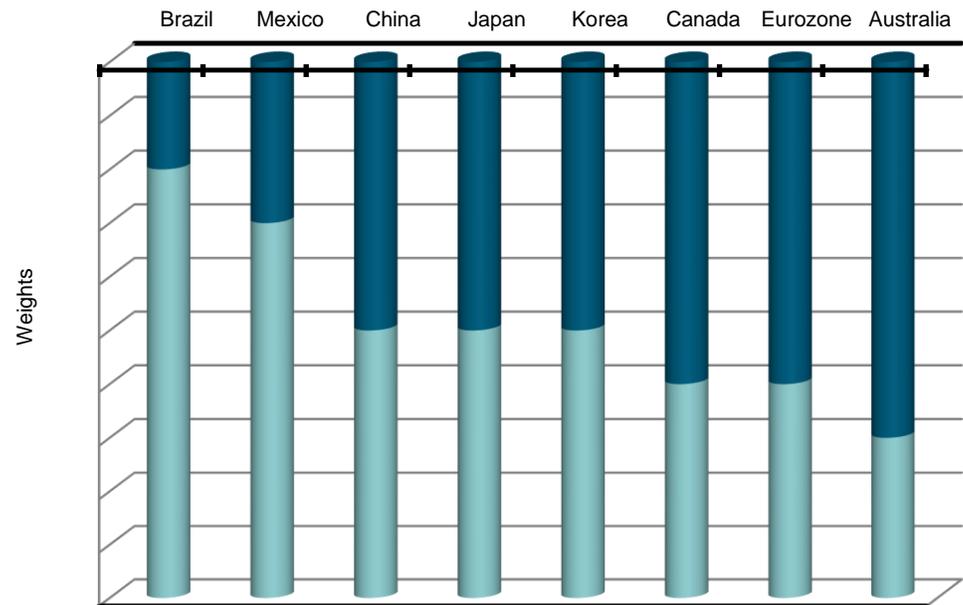
Source: S&P Dow Jones Indices LLC. Charts are provided for illustrative purposes.

The following sections look at the results of applying the above allocations to the selected geographical locations.

The Australia growth portion is represented by two benchmarks, one representative of the Australian market (80%) and the other of the global equity market excluding Australia (20%). The defensive part is composed of global corporates and Australian fixed interest and bank bill bonds.

Exhibit 9: Adding Real Assets to Traditional Australian Portfolios

CONSTITUENTS	SHARPE RATIO	ANNUALIZED RETURN (%)	ANNUALIZED RISK (%)
Australia Growth (100%)	0.09	6.41	19.07
Australia Growth (70%)/Australia Defensive (30%)	0.15	6.76	13.40
AUSTRALIA GROWTH (70%)/AUSTRALIA DEFENSIVE (30%)/(10%) LISTED ASSET:			
S&P Real Assets Index (100%)	0.15	6.66	12.57
Infrastructure (Equity + Fixed Income)	0.17	6.68	12.36
Property (Equity + Fixed Income)	0.15	6.77	13.07
Natural Resources (Equity + Fixed Income + Commodity Futures)	0.13	6.39	12.61
Property, Infrastructure, and Natural Resources (Equity Only)	0.16	6.86	13.09
Inflation-Linked Bonds	0.15	6.49	11.99

Source: S&P Dow Jones Indices LLC. Data from April 2005 to December 2015. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Components in Australia Growth are the S&P/ASX 200 and the S&P Global Australia BMI, in USD. The Defensive components are Barclays Global Agg Corporate Total Return Index Value Hedged AUD, S&P/ASX Australian Fixed Interest 0+ and the Total Return and the S&P/ASX Bank Bill Index Total Return.

Hypothetically adding the S&P Real Assets Index to the growth and defensive mix in Australia was beneficial, since the annualized risk is reduced by 83 bps for a loss in return of 10 bps.

Remember that natural resources showed a relatively high inflation beta to the Australian CPI, but the excess returns were relatively small, though positive. So, applying only natural resources as an inflation hedge diluted the Sharpe ratio. However, hypothetically adding the S&P Real Assets Index to the growth and defensive mix in Australia was beneficial, since the annualized risk is reduced by 83 bps for a loss in return of 10 bps. Infrastructure alone and the real asset equities improved portfolio efficiency slightly more, though they had low inflation betas.

Canada is much like Australia in the sense that it is a natural-resource-heavy country. It also benefited from an allocation to real assets, doubling the Sharpe ratio from 0.3 to 0.6 by replacing 20% equities with real assets from the 60% equity/40% fixed income mix. Not only did the annualized risk get cut by almost one-half, but the annualized return improved from 4.8% to 5.5%. Again, natural resources had the highest inflation beta of 4.1 to the Canadian CPI, but the excess return is too low to boost the portfolio efficiency, making it necessary to include the other real assets. Property had strong diversification characteristics but essentially no inflation beta, so it wasn't the strongest protection against inflation. The equity-only composite also had a high Sharpe ratio, with both improved returns and lower risk, in addition to relatively high inflation beta and excess returns, so it may be a desirable allocation to a traditional mix.

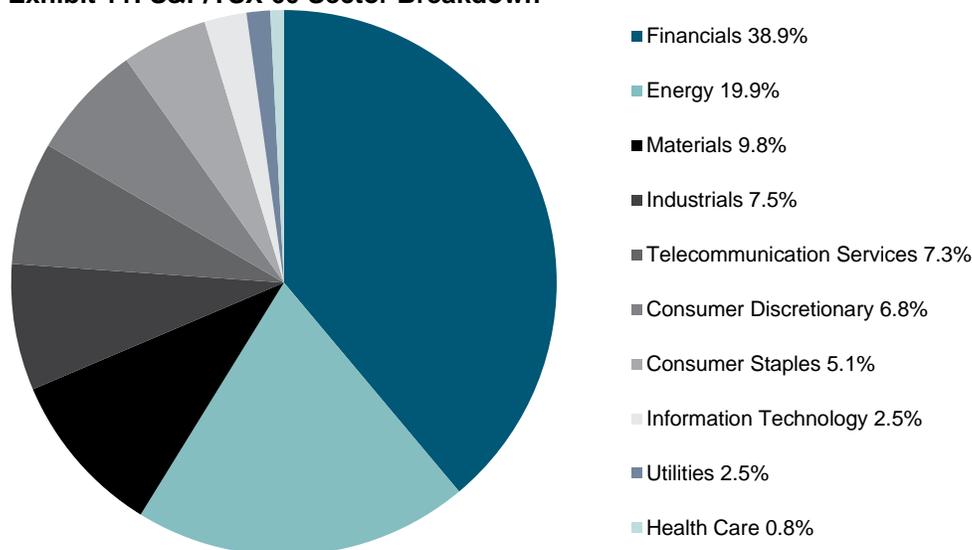**Exhibit 10: Adding Real Assets to Traditional Canadian Portfolios**

CONSTITUENTS	SHARPE RATIO	ANNUALIZED RETURN (%)	ANNUALIZED RISK (%)
S&P/TSX 60 Index (100%)	0.15	3.9	22.3
S&P/TSX 60(60%)/S&P Canada Aggregate Bond Index (40%)	0.32	4.8	13.7
S&P/TSX 60(40%)/S&P CANADA AGGREGATE BOND INDEX (40%)/(20%) LISTED ASSET:			
S&P Real Assets Index	0.64	5.5	7.8
Infrastructure (Equity + Fixed Income)	0.65	5.8	8.2
Property (Equity + Fixed Income)	0.70	5.8	7.6
Natural Resources (Equity + Fixed Income + Commodity Futures)	0.59	4.9	7.6
Property, Infrastructure, and Natural Resources (Equity Only)	0.77	6.0	7.3
Inflation-Linked Bonds	0.51	4.9	8.7

Source: S&P Dow Jones Indices LLC. Data from April 2005 to December 2015. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. All data prior to the launch dates are back-tested.

The S&P/TSX 60, the headline index for the Canadian large-cap stock market, has 38.9% of its capitalization in financials, as can be seen in the sector breakdown in Exhibit 11, so although there large allocation to energy, there is still the potential for a great diversification benefit from adding real asset equities.

> The S&P/TSX 60 has 38.9% of its capitalization in financials, so although there large allocation to energy, there is still the potential for a great diversification benefit from adding real asset equities.

Exhibit 11: S&P/TSX 60 Sector Breakdown

- Financials 38.9%
- Energy 19.9%
- Materials 9.8%
- Industrials 7.5%
- Telecommunication Services 7.3%
- Consumer Discretionary 6.8%
- Consumer Staples 5.1%
- Information Technology 2.5%
- Utilities 2.5%
- Health Care 0.8%

Source: S&P Dow Jones Indices LLC. Data as of March 31, 2016. Chart is provided for illustrative purposes. The weightings for each sector of the index are rounded to the nearest 10th of a percent; therefore, the aggregate weights for the index may not equal 100%.

In the case of China, the indices used to construct the first two portfolios are a broad market equity index of companies incorporated in mainland China and traded in Shanghai or Shenzhen, and a bond index designed to track the performance of local-currency-denominated government and corporate bonds in China.

Exhibit 12: Adding Real Assets to Traditional Chinese Portfolios

CONSTITUENTS	SHARPE RATIO	ANNUALIZED RETURN (%)	ANNUALIZED RISK (%)
S&P China A BMI (100%)	0.41	15.9	34.1
S&P China A BMI (50%)/ S&P China Bond Index (50%)	0.58	11.6	16.9
S&P CHINA A BMI (45%)/S&P CHINA BOND INDEX (45%)/(10%) LISTED ASSET:			
S&P Real Assets Index	0.68	9.0	10.5
Infrastructure (Equity + Fixed Income)	0.70	9.2	10.5
Property (Equity + Fixed Income)	0.67	9.0	10.7
Natural Resources (Equity + Fixed Income + Commodity Futures)	0.64	8.7	10.6
Property, Infrastructure, and Natural Resources (Equity Only)	0.67	9.1	10.8
Inflation-Linked Bonds	0.70	9.0	10.3

Source: S&P Dow Jones Indices. Data from December 2006 to December 2015. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. All data prior to the launch dates are back-tested.

> The allocation to real assets from the traditional Chinese portfolio mix was more efficient.

Again, the allocation to real assets from the traditional Chinese portfolio mix was more efficient. Despite a return loss of 2.7%, the Sharpe ratio still improved from 0.6 to 0.7 from a major annualized risk reduction of 6.3%. Infrastructure and inflation-linked bonds also produced a better Sharpe ratio but had only a fraction of the inflation beta provided by natural resources.

The story holds true in the eurozone, the group of European Union nations whose national currency is the euro. The equity-blended portfolio comprises the S&P Europe 350 and the S&P Global Ex-Pan Europe BMI, with a 2:1 ratio, while the bond index is a global aggregate.

Exhibit 13: Adding Real Assets to Traditional Eurozone Portfolios

CONSTITUENTS	SHARPE RATIO	ANNUALIZED RETURN (%)	ANNUALIZED RISK (%)
Europe Blended Equity (100%)	0.28	5.2	18.1
Europe Blended Equity (60%)/J.P Morgan Global Aggregate Bond Index (40%)	0.39	4.9	11.9
EUROPE BLENDED EQUITY (30%)/J.P MORGAN GLOBAL AGGREGATE BOND INDEX (50%)/(20%) LISTED ASSET:			
S&P Real Assets Index	0.49	4.7	9.2
Infrastructure (Equity + Fixed Income)	0.55	5.1	8.8
Property (Equity + Fixed Income)	0.46	4.9	10.2
Natural Resources (Equity + Fixed Income + Commodity Futures)	0.42	4.1	9.3
Property, Infrastructure, and Natural Resources (Equity Only)	0.48	5.1	10.1
Inflation-Linked Bonds	0.49	4.3	8.3

Source: S&P Dow Jones Indices LLC. Data from April 2005 to December 2015. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Components in Europe Blended Equity are the S&P Europe 350 and the S&P Global Ex-Pan Europe BMI.

In the eurozone, natural resources was the only real assets sector with positive inflation beta, but unfortunately the returns have been too low to potentially help a traditional portfolio. If a European investor were to use natural resources as an inflation hedge, the annualized returns in the one-year period ending December 2015 would have been just 4.1%, 120 bps lower than a local blended portfolio. While adding infrastructure, property, and real asset equities each yielded higher annualized returns than adding the real assets index, the inflation betas were the worst of the options, at   -3.0, -4.5, and -2.1, respectively as presented in Exhibit 4 above. By mixing the real asset equities with fixed income and commodity futures across property, infrastructure, natural resources, and inflation-linked bonds, the Sharpe ratio was improved from 0.4 to 0.5, with a meaningful risk reduction of 2.7% that cost a minimal 20 bps of return. Taken together, the inflation beta becomes far less negative at 1.2, but the excess return is considerable at 6.7%.

The country with the lowest current inflation level, and which showed deflation at times during the period measured, was Japan.

The country with the lowest current inflation level, and which showed deflation at times during the period measured, was Japan. However, an allocation to real assets improved returns over the period with the same risk as the local equity and fixed income mix. Although the inflation-linked bonds had the highest inflation beta to the Japanese CPI, the excess return is the lowest of all real assets, so the Sharpe ratio with the addition is no higher than from adding the real assets index. In Japan, the infrastructure composite is a strong choice for inflation protection and diversification. The inflation beta is 2.1, just behind the inflation-linked bonds, the excess return is 10.8% (and the highest of all the real assets), and its addition both improved return and reduced risk historically.

Exhibit 14: Adding Real Assets to Traditional Japanese Portfolios

CONSTITUENTS	SHARPE RATIO	ANNUALIZED RETURN (%)	ANNUALIZED RISK (%)
S&P Japan BMI (100%)	0.23	3.3	15.3
S&P Japan BMI (60%)/S&P Japan Bond Index (40%)	0.38	2.7	7.6
S&P JAPAN BMI/S&P JAPAN BOND INDEX (40%)/(10%) LISTED ASSET:			
S&P Real Assets Index	0.42	3.0	7.6
Infrastructure (Equity + Fixed Income)	0.46	3.2	7.5
Property (Equity + Fixed Income)	0.42	3.1	8.1
Natural Resources (Equity + Fixed Income + Commodity Futures)	0.39	2.7	7.6
Property, Infrastructure, and Natural Resources (Equity Only)	0.43	3.2	8.1
Inflation-Linked Bonds	0.42	2.8	7.2

Source: S&P Dow Jones Indices LLC. Data from April 2005 to December 2015. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. All data prior to the launch dates are back-tested.

Last, moving away from equities to a traditional mix of equities and fixed income in South Korea was shown to be highly beneficial, due to the major risk reduction. Further, there is the chance for more portfolio efficiency by reducing equities again to move some extra into fixed income and real assets. By doing this, the Sharpe ration increases to 0.5 with the mix, all

the way from 0.2 with just equities. Like in many other parts of the world, natural resources were most sensitive to inflation with the least excess return, creating the need to mix it with real asset sectors, especially since infrastructure is the best diversifier with the least inflation beta.

Exhibit 15: Adding Real Assets to Traditional South Korean Portfolios

CONSTITUENTS	SHARPE RATIO	ANNUALIZED RETURN (%)	ANNUALIZED RISK (%)
S&P Korea BMI (100%)	0.19	7.37	27.68
S&P Korea BMI (50%)/S&P Korea Bond Index (50%)	0.36	7.20	13.92
S&P KOREA BMI (30%)/S&P KOREA BOND INDEX (60%)/(10%) LISTED ASSET:			
S&P Real Assets Index	0.47	6.60	9.34
Infrastructure (Equity + Fixed Income)	0.50	6.79	9.15
Property (Equity + Fixed Income)	0.46	6.73	9.82
Natural Resources (Equity + Fixed Income + Commodity Futures)	0.44	6.33	9.37
Property, Infrastructure, and Natural Resources (Equity Only)	0.47	6.83	9.80
Inflation-Linked Bonds	0.47	6.40	8.89

Source: S&P Dow Jones Indices LLC. Data from April 2005 to December 2015. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

> The S&P Real Assets Index may provide inflation protection and enhance diversification around the world by mixing not just the equities of property, infrastructure, and natural resources, but also by adding fixed income, inflation-linked bonds, and commodity futures.

CONCLUSION

Unfortunately, inflation protection has been difficult to capture without paying a steep price in the past decade, especially from the energy crises in both the global financial crisis and the war for oil market share. While the natural resources sector is most sensitive to inflation globally, with an average inflation beta of 2.5 and inflation-linked bonds also provide some extra inflation protection, with an inflation beta of 1.5, the excess return over inflation for each of these real asset sectors is relatively weak, with only 3.2% for natural resources and 3.6% for inflation-linked bonds.

On the other hand, infrastructure and property have been shown to improve risk-adjusted returns in most markets around the world, but they lack the inflation protection power required to satisfy the risk management needs of today. As shown in the U.S., the S&P Real Assets Index may provide inflation protection and enhance diversification around the world by mixing not just the equities of property, infrastructure, and natural resources, but also by adding fixed income, inflation-linked bonds, and commodity futures.

Glossary

INDEX NAME	INDEX DESCRIPTION
S&P Real Assets Index	The S&P Real Assets Index is the first index of its kind designed to measure global property, infrastructure, commodities, and inflation-linked bonds using liquid and investable component indices that track public equities, fixed income, and futures.
Dow Jones Global Select Real Estate Securities	The Dow Jones Global Select Real Estate Securities IndexSM (RESI) represents equity real estate investment trusts (REITs) and real estate operating companies (REOCs) traded globally.
Dow Jones Brookfield Global Infrastructure Composite	The Dow Jones Brookfield Global Infrastructure Index intends to measure the stock performance of pure-play infrastructure companies domiciled globally. The index covers all sectors of the infrastructure market.
S&P Global LargeMidCap Commodity and Resources	The S&P Global LargeMidCap Commodity and Resources measures the performance of constituents that fall into three different natural resources buckets: Energy, Materials, and Agriculture
S&P Global Timber and Forestry	The S&P Global Timber & Forestry Index is comprised of 25 of the largest publicly traded companies engaged in the ownership, management or the upstream supply chain of forests and timberlands.
Dow Jones Global Select Real Estate Securities Corporate Bond Index	The Dow Jones Global Select Real Estate Securities Corporate Bond Index is designed to measure the performance of corporate debt issued globally by real estate companies.
Dow Jones Brookfield Global Infrastructure Broad Market Corporate Bond	The Dow Jones Brookfield Global Infrastructure Broad Market Corporate Bond Index is a market-value-weighted index that is designed to track the performance of corporate debt issued by infrastructure companies globally
S&P Global LargeMidCap Commodity and Resources Corporate Bond	The S&P Global LargeMidCap Commodity and Resources Corporate Bond index measures the performance of constituents that fall into three different natural resources buckets: Energy, Materials, and Agriculture
S&P Global Developed Sovereign Inflation-Linked Bond Index	The S&P Global Developed Inflation-Linked Bond Index is a broad, comprehensive, market value weighted index designed to track the performance of the inflation-linked securities market in developed countries.
Dow Jones Commodity Index	The Dow Jones Commodity Index is a broad measure of the commodity futures market that emphasizes diversification and liquidity through a simple, straightforward, equal-weighted approach.
S&P/ASX 200	The S&P/ASX 200 covers approximately 80% of Australian equity market capitalization. Index constituents are drawn from eligible companies listed on the Australian Securities Exchange.
S&P Global Ex-Australia BMI	The S&P Global ex-Australia BMI is comprised of the S&P Global BMI, measuring stock market performance globally, excluding Australia.
S&P/ASX Australian Fixed Interest 0+ Index	The S&P/ASX Australian Fixed Interest 0+ Index is a broad benchmark index family designed to measure the performance of Australian bonds meeting investability criteria.
S&P/ASX Bank Bill Index	The S&P/ASX Bank Bill Index offers short term exposure to Australian denominated bank bills with maturity profiles of up to three months.
S&P/BOVESPA Quality Index	The S&P BOVESPA Quality Index is designed to track the performance of the top quartile of high-quality securities in the Brazilian equity market as determined by their quality score. This score is calculated based on return on equity, accruals ratio, and financial leverage ratio.
S&P/BM&F Brazil Sovereign Inflation-Linked Bond Index	The S&P/BM&F Brazil Sovereign Inflation-Linked Bond Index is a comprehensive, market-value-weighted index designed to track the performance of Brazilian real-denominated inflation-linked securities publicly issued by the Brazilian government for the domestic market.
S&P Global Developed Sovereign Inflation-Linked Bond Index	The S&P Global Developed Inflation-Linked Bond Index is a broad, comprehensive, market value weighted index designed to track the performance of the inflation-linked securities market in developed countries.
S&P/TSX 60	The S&P/TSX 60 addresses the needs of investment managers who require a portfolio index of the large-cap market segment of the Canadian equity market
S&P Canada Aggregate Bond Index	The S&P Canada Aggregate Bond Index TR The index is a broad, comprehensive, market value-weighted index designed to measure the performance of the investment grade Canadian fixed income market including government, provincial and municipal, corporate, covered bond, and collateralized securities
S&P BMI China ex-A-B Shares	The S&P China Ex-A-B-Shares BMI is designed as a tool for Chinese institutional investors to gain exposure to all eligible securities of Chinese domiciled companies excluding A-Shares and B-Shares.
S&P China Bond Index	The S&P China Bond Index is designed to track the performance of local-currency denominated government and corporate bonds from China.
S&P Europe 350	The S&P Europe 350 consists of 350 leading blue-chip companies drawn from 16 developed European markets.
S&P Global Ex-Pan Europe BMI	The S&P Global Ex-Pan Europe BMI (US Dollar) Net Total Return The Index comprises the S&P Developed BMI and S&P Emerging BMI, measuring stock market performance globally, excluding Pan Europe.
S&P Japan BMI	The S&P Japan BMI (US Dollar) Net Total Return is a comprehensive, rules-based index designed to measure stock performance in Japan.

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

Glossary (cont.)

INDEX NAME	INDEX DESCRIPTION
S&P Japan Bond Index	The S&P Japan Bond Index is designed to track the performance of local-currency denominated government and corporate bonds issued in Japan.
S&P Korea BMI	The S&P Korea BMI (US Dollar) Net Total Return is a comprehensive, rules-based index designed to measure stock performance in Korea.
S&P/BGCantor U.S. Treasury Bond Index	The S&P/BGCantor U.S. Treasury Bond Index a broad, comprehensive, market-value weighted index that seeks to measure the performance of the U.S. Treasury Bond market.
S&P South Korea Bond Index	The S&P Korea Bond Index is designed to track the performance of local-currency denominated government and corporate bonds from Korea.
S&P/Valmer Mexico Government Inflation-Linked 1+ year UDIBONOS Index	The S&P/Valmer Mexico Government Inflation-Linked 1+ year UDIBONOS Index is designed to measure the performance of the Mexican fixed income real-rate market. Constituents of the index must be Mexican government securities with maturities greater than or equal to one year and denominated in Inflation Index Investment Units
S&P/Valmer Mexico Sovereign Bond Index	The S&P/Valmer Mexico Sovereign Bond Index is designed to measure the performance of Treasury Certificates (CETES) and nominal fixed-rate bonds (MBONOS). Constituents of the index must be Mexican government securities with maturities greater than one month.
S&P U.S. Aggregate	S&P U.S. Aggregate is designed to measure the performance of publicly issued U.S. dollar denominated investment-grade debt.
S&P/BGCantor 1-3 Year US Treasury	The S&P/BGCantor U.S. Treasury Bond Index is a broad, comprehensive, market-value weighted index that seeks to measure the performance of the U.S. Treasury Bond market.

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

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PERFORMANCE DISCLOSURE

Exhibit Presentation	Index Name	Launch Date
1, 2,4,5,6,9,10,12,13,14,15	S&P Real Assets Index NTR	12/31/2015
1, 2,4,5,9,10,12,13,14,15	Dow Jones Global Select Real Estate Securities	12/31/2004
1, 2,4,5,9,10,12,13,14,15	Dow Jones Brookfield Global Infrastructure Composite	7/14/2008
1, 2,4,5,9,10,12,13,14,15	S&P Global LargeMidCap Commodity and Resources	10/1/2008
1, 2,4,5,9,10,12,13,14,15	S&P Global Timber and Forestry	8/13/2007
1, 2,4,5,9,10,12,13,14,15	Dow Jones Global Select Real Estate Securities Corporate Bond Index	10/5/2015
1, 2,4,5,9,10,12,13,14,15	Dow Jones Brookfield Global Infrastructure Broad Market Corporate Bond	7/16/2015
1, 2,4,5,9,10,12,13,14,15	S&P Global LargeMidCap Commodity and Resources Corporate Bond	10/1/2008
1, 2,4,5,9,10,12,13,14,15	S&P Global Developed Sovereign Inflation-Linked Bond USD Index	7/15/2014
1, 2,4,5,9,10,12,13,14,15	Dow Jones Commodity Index	10/26/2011
9	S&P/ASX 200 USD NTR	4/3/2000
9	S&P Global Ex-Australia BMI (US Dollar) Net Total Return	12/31/1992
9	S&P/ASX Australian Fixed Interest 0+ Index Total Return	10/31/2011
9	S&P/ASX Bank Bill Index Total Return	10/31/2011
6	S&P/BOVESPA Quality Index NTR (USD)	4/30/2015
6,7	S&P/BM&F Brazil Sovereign Inflation-Linked Bond Index	3/18/2015
6	S&P Global Developed Sovereign Inflation-Linked Bond USD Index	3/15/2014
10,11	S&P/TSX 60 USD	12/31/1998
10	S&P Canada Aggregate Bond Index TR	12/30/2013
12	S&P BMI China ex-A-B Shares (US Dollar) Net Total Return	11/15/2007
12	S&P China Bond Index Total Return	12/31/2013
13	S&P Europe 350 USD	10/7/1998
13	S&P Global Ex-Pan Europe BMI (US Dollar) Net Total Return	12/31/1992
14	S&P Japan BMI (US Dollar) Net Total Return	12/31/1992
14	S&P Japan Bond Index	12/31/2013
15	S&P Korea BMI (US Dollar) Net Total Return	12/31/1992
15	S&P/BGCantor U.S. Treasury Bond Index	3/24/2010
15	S&P South Korea Bond Index Total Return	12/31/2013
6,7	S&P/Valmer Mexico Government Inflation-Linked 1+ year UDIBONOS Index	7/15/2014
6,7	S&P/Valmer Mexico Sovereign Bond Index	3/4/2015
7	S&P U.S. Aggregate	7/15/2014
7	S&P/BGCantor 1-3 Year US Treasury	3/24/2010

defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via S&P Dow Jones Indices's public website or its datafeed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the index's public release date.

Prospective application of the methodology used to construct the index(es) as well as revisions to economic data may not result in performance commensurate with the back-test returns shown. The back-test period does not necessarily correspond to the entire available history of the index(es). Please refer to the index methodology for the particular index in question, available at www.spdji.com, for more details about such index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

Another limitation of using back-tested information is that the back-tested calculation is generally prepared with the benefit of hindsight. Back-tested data and/or information reflects the application of the index methodology and selection of index constituents in hindsight. No hypothetical record can completely account for the impact of financial risk in actual trading. For example, there are numerous factors related to the equities, fixed income, or commodities markets in general which cannot be, and have not been accounted for in the preparation of the index information set forth, all of which can affect actual performance.

The index returns shown do not represent the results of actual trading of investable assets/securities. S&P Dow Jones Indices LLC maintains the index(es) and calculates the index levels and performance shown or discussed, but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the index(es) or investment funds that are intended to track the performance of the index(es). The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the index performance shown. As a simple example, if an index returned 10% on a US $100,000 investment for a 12-month period (or US $10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US $1,650), the net return would be 8.35% (or US $8,350) for the year. Over a three year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US $5,375, and a cumulative net return of 27.2% (or US $27,200).

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