Aon Hewitt
Retirement and Investment

Benchmark Study

Federal Retirement Thrift Investment Board

Thrift Savings Plan

October 2017

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EXECUTIVE SUMMARY

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The Federal Thrift Savings Plan (TSP) requested Aon Hewitt Investment Consulting, Inc. ("AHIC") review and evaluate the appropriate indexes to use for the following investment options:

- Common Stock Index Investment Fund (C Fund)
- Small Capitalization Stock Index Investment Fund (S Fund)
- Fixed Income Index Investment Fund (F Fund)
- International Stock Index Investment Fund (I Fund)

As part of our analysis, we reviewed multiple indexes/benchmarks for each investment option, the construction methodology and opportunity set covered by each, the investability and liquidity of the indexes, acceptance of the indexes by the investment community, the appropriateness of the indexes for the TSP, and the estimated costs associated with making a change. We believe the above factors are the most relevant to consider when choosing a benchmark. Based on our review, we have the following recommendations:

C Fund and S Fund

Maintain the S&P 500 Index for the C Fund and the DJ U.S. Completion Total Stock Market Index for the S Fund

Our recommendation is based on the following primary reasons:

- The combination of the S&P 500 Index with the DJ U.S. Completion Total Stock Market Index provides 100% coverage.
- The stocks in the S&P 500 Index and DJ U.S. Completion Total Stock Market Index are liquid and trade frequently, allowing index fund managers to hold the majority of the stocks in these indices.
- Total passive assets benchmarked to the S&P 500 and DJ U.S. Completion Total Stock Market Index are about six times of those benchmarked to the other combination considered: Russell 1000 and Russell 2000.[1]
- The S&P 500 Index has high recognition value among non-investment professionals, which constitute the vast majority of the participants.

F Fund

Maintain the Bloomberg Barclays U.S. Aggregate Index

We considered the Bloomberg Barclays U.S. Universal Bond Index and the Citigroup Broad Investment Grade (BIG) Bond Index as the main alternatives. Our recommendation is based on the following main reasons:

- The Bloomberg Barclays U.S. Aggregate Index provides broad coverage to the investment-grade U.S. fixed income market and is the most widely recognized fixed income benchmark in the U.S.

[1]Assets are based on the passive providers' ERISA-qualified institutional index fund

- The Bloomberg Barclays U.S. Universal Index provides broader coverage to an investor; however, it includes high yield debt which is more correlated to stocks, reducing the diversification benefit relative to the Bloomberg Barclays U.S. Aggregate.
- The Bloomberg Barclays U.S. Universal Index and the Citigroup Broad Investment Grade (BIG) Bond Index have not received material traction in the institutional marketplace. None of the major index fund managers offer ERISA qualified DC index funds benchmarked to these indexes.

I Fund

Replace the MSCI EAFE Index with the MSCI All Country World ex-U.S. Investable Market Index

Our recommendation is based on the following reasons:

- The MSCI indices remain the most popular indices for U.S. based institutional investors investing in overseas equity markets.
- The transition costs associated with the change in the I Fund benchmark are reasonable.
- Market Exposure:
  - Canada is the fourth-largest equity market in the world, representing 6.6% of the developed non-U.S. equity opportunity set.
  - Emerging Markets represents 23.5% of the international non-U.S. equity investable universe.
- Liquidity:
  - We believe the inclusion of emerging markets and international small cap equities to the I Fund will not hinder the ability to meet the TSP's daily liquidity needs.
  - Overall, liquidity is managed through the use of the I Fund's cash buffer and other tools such as optimization and derivatives.
  - Additionally, historical daily cash flow assessment scaled to 25% illustrates cash flow activity was at reasonable levels to be traded in emerging markets without adversely impacting the prices of securities.
- Securities Lending:
  - The ACWI ex U.S. IMI generated the highest expected yield and percentage out on loan.
    - Across each of the last three calendar years, the income to the TSP is estimated to have been at least 1.5x more if the I Fund tracked the MSCI ACWI ex U.S. IMI instead of the MSCI EAFE index.

C FUND AND S FUND

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C Fund and S Fund

We have reviewed the legislative guidelines related to the investment objectives for the Common Stock Index Investment Fund (C Fund) and the Small Capitalization Stock Index Investment Fund (S Fund), and have compared each of these Funds' existing benchmarks to several reasonable alternatives. We find that the existing benchmarks, the S&P 500 Index for the C Fund and the Dow Jones U.S. Completion Total Stock Market Index for the S Fund, are appropriate.

We therefore recommend no change in the benchmarks for the C and S Funds.

Legislative Guidelines

The goal or objective of any investment option or portfolio plays an important role in determining the appropriate benchmark for that investment. The Federal Employees Retirement System Act of 1986 (FERSA), as amended, states the following regarding the C Fund and the S Fund, under section 8438 (b):

C Fund

(2)(A) The Board shall select an index which is a commonly recognized index comprised of common stock the aggregate market value of which is a reasonably complete representation of the United States equity markets.

(B) The Common Stock Index Investment Fund shall be invested in a portfolio designed to replicate the performance of the index selected under subparagraph (A). The portfolio shall be designed such that, to the extent practicable, the percentage of the Common Stock Index Investment Fund that is invested in each stock is the same as the percentage determined by dividing the aggregate market value of all shares of that stock by the aggregate market value of all shares of all stocks included in such index.

S Fund

(3)(A) The Board shall select an index which is a commonly recognized index comprised of common stock the aggregate market value of which represents the United States equity markets excluding *the common stocks included in the Common Stock Index Investment Fund.*

(B) The Small Capitalization Stock Index Investment Fund shall be invested in a portfolio designed to replicate the performance of the index in subparagraph (A). The portfolio shall be designed such that, to the extent practicable, the percentage of the Small Capitalization Stock Index Investment Fund that is invested in each stock is the same as the percentage determined by dividing the aggregate market value of all shares of that stock by the aggregate market value of all shares of all stocks included in such index.

The C Fund is benchmarked against the S&P 500 Index, which provides coverage of the large capitalization segment of the U.S. equity market. The FERSA guidelines for the C Fund do not specify that it should be benchmarked to a large capitalization U.S. stock index. If the C Fund were *the only* U.S. equity investment option available to TSP participants, it would have made sense to consider a broader, more inclusive benchmark that also includes smaller capitalization stocks, such as the Russell 3000 Index or the Dow Jones U.S. Total Market Index.

We recognize, however, that the S Fund is meant to complement the C Fund, not to compete or overlap with it. This clearly implies that the C Fund should be benchmarked to a large capitalization U.S. index.

As the C and S Funds are complementary, and in combination should represent the broad U.S. equity market, we have included the broad-based Russell 3000 Index and the Dow Jones U.S. Total Market Index in our analysis of benchmarks to aid the decision-making process.

C Fund

We began our review by first listing several broad U.S. equity benchmarks for the C Fund:

- CRSP U.S. Large Cap Index (The top 85% of the U.S. equity investable market capitalization)
- CRSP U.S. Total Stock Market Index (Broad U.S. equity universe across large, mid, small and micro capitalizations)
- Dow Jones U.S. Large Cap Total Stock Market Index (The largest 750 names in DJ U.S. Total Stock Market Index Set)
- Dow Jones U.S. Broad Stock Market Index (All names in DJ U.S. Total Stock Market Index, excluding those defined as micro-caps)
- Dow Jones U.S. Total Stock Market Index (Including all U.S. equity issues with readily available prices, except for bulletin-board issues)
- MSCI USA All Cap Index (Broad U.S. equity universe across large, mid, small and micro capitalizations)
- MSCI USA Index (Captures the large and mid-capitalizations of U.S. equity universe)
- MSCI USA Investable Market Index (IMI) (Captures the large, mid and small capitalizations of U.S. equity universe)
- Russell 1000 Index (The largest approximately 1000 names in Russell 3000 Index)
- Russell 3000 Index (The largest 3000 U.S. companies)
- Standard & Poor's (S&P) 500 Index (500 leading companies in leading industries of U.S. economy – ***Current Benchmark***)
- S&P Composite 1500 Index (The combination of S&P 500, S&P MidCap 400 and S&P SmallCap 600 Indexes)

From the perspective of U.S. based investors, the MSCI indices are the most commonly used indices to measure and benchmark the performance of international equity investments. MSCI adopts a building block approach constructing regional indices that can be combined to capture the full extent of the investable global equity opportunity set. MSCI U.S. indices have not, however, received material traction in the institutional marketplace. The MSCI indices lack significant assets managed to them, either actively or passively. The Dow Jones U.S. Large Cap Total Stock Market Index, the Dow Jones U.S. Broad Stock Market Index, and the S&P 1500 Index are also not widely used by the investment community. None of the major passive providers track ERISA qualified DC assets to this benchmark.

As for the Center for Research in Security Prices ("CRSP") indices, Vanguard is the only investment management firm out of the five major index fund providers in the U.S. that has assets benchmarked to CRSP's U.S. indices. Although assets managed to CRSP U.S. indices through Vanguard index funds are meaningful in size, the benchmark is not common across the rest of the major passive providers. Additionally, competitive bidding would not be feasible if a CRSP index is recommended as the benchmark for the C Fund.

We have therefore focused our analysis on the following four benchmarks (from lowest to broadest market coverage):

- S&P 500 Index
- Russell 1000 Index
- Russell 3000 Index
- Dow Jones U.S. Total Stock Market Index

Table 1 below provides a broad comparison of these benchmarks.

Table 1: Benchmark Comparison (As of 6/30/2017)

	S&P 500	Russell 1000	Russell 3000	DJ U.S. Total Stock Market Index
Inclusion criteria	Market cap and other criteria such as profitability	Largest 1,000 stocks based on market cap	Largest 3,000 stocks based on market cap	All stocks, subject to some liquidity considerations
# of securities	505	990	3,000	3,799
Market cap[1]	$20.8 Trillion	$23.2 Trillion	$25.1 Trillion	$25.3 Trillion
Largest company's market cap	$750.9 Billion	$750.9 Billion	$750.9 Billion	$750.9 Billion
Smallest company's market cap	$2.8 Billion	$1.8 Billion	$90 Million	$1.7 Million
Coverage of U.S. stocks	82%	92%	98%	100.0%
Reconstitution frequency	Quarterly	Annual	Annual	Annual
Turnover[2]	5.2%	3.1%	3.1%	5.8%

Source: S&P, Russell, and DJ Index Service

[1] Float adjusted

[2] As of 12/31/2016

The Russell 1000 Index and the Russell 3000 Index rely on market capitalization to determine which stocks are included in the index. Stocks are ranked from highest to lowest capitalizations; the largest 1,000 stocks are included in the Russell 1000 Index and the largest 3,000 in the Russell 3000 Index. The Dow Jones U.S. Total Stock Market Index is generally all-inclusive. The S&P 500 Index is not made up of the largest 500 stocks by market capitalization. S&P uses some subjective criteria, most notable being the requirement for a stock to have "financial viability," and that the index sector allocations should be representative of the sector allocations of all stocks with market capitalizations of $6.1 billion or more.

We believe the Russell and Dow Jones indexes are superior from a construction methodology point of view, with little to no subjectivity involved. Nevertheless, we find the S&P 500 Index as an acceptable benchmark for U.S. large capitalization stocks as the S&P 500 Index provides very close coverage of the largest 500 U.S. stocks.

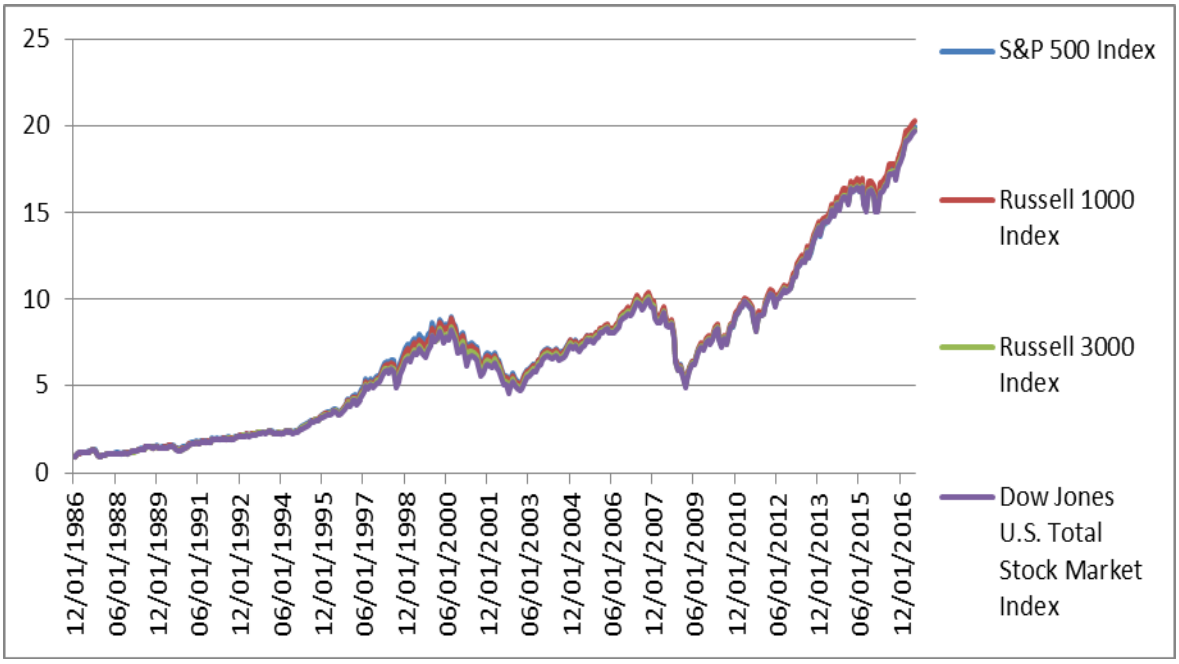
As for CRSP U.S. equity indices, in 2013, Vanguard's US equity index funds that were benchmarked to MSCI indices were changed to track against Center for Research in Security Prices ("CRSP") indices. The primary reason given for the change was the desire to reduce costs for investors in these funds by reducing the licensing fees of index data. The methodologies of MSCI and CRSP are similar; however,

one difference is that MSCI approaches market capitalization segmentation by a fixed number of names; whereas, CRSP utilizes breakpoints based on the cumulative market capitalization.

Performance

Chart 1 below illustrates how $1 invested in each of the indexes over the longest common time period would have grown over time. As shown, all four indexes have tended to perform quite similarly over time.

Chart 1



(As of 6/30/2017)	S&P 500	Russell 1000	Russell 3000	DJ U.S. Total Stock Market Index
Value At The End of 30 Years	**$19.93**	**$20.26**	**$19.78**	**$19.65**

The correlation coefficients between each pair of indexes are shown on the following page in Table 2. Correlation coefficients can range from +1 to -1. A correlation of +1 between two indexes implies that the returns of the two indexes move in the same direction and in the same proportion, while a correlation of -1 means that the returns move in opposite directions but in the same proportion. As can be seen, all the indexes are highly positively correlated to each other.

Table 2: Correlation Matrix (As of 6/30/2017)

	S&P 500	Russell 1000	Russell 3000	DJ U.S. Total Stock Market Index
S&P 500	1.00			
Russell 1000	1.00	1.00		
Russell 3000	0.99	1.00	1.00	
DJ U.S.	0.99	1.00	1.00	1.00

(Longest common time period = 30 years)

Table 3 referenced below details the cumulative annualized returns over several trailing historical periods.

Table 3: Return History (As of 6/30/2017)

	S&P 500	Russell 1000	Russell 3000	DJ U.S. Total Stock Market Index
1 Year	17.9%	18.0%	18.5%	18.5%
3 Years	9.6	9.3	9.1	9.0
5 Years	14.6	14.7	14.6	14.5
10 Years	7.2	7.3	7.3	7.3
15 Years	8.3	8.6	8.7	8.8
20 Years	7.2	7.4	7.4	7.5
25 Years	9.6	9.7	9.7	9.7
30 Years	9.6	9.7	9.6	9.6
35 Years	12.0	12.0	11.9	--

*See appendix for annual returns

While returns do vary year to year, long term returns tend to be in a very tight range. However, the numbers above do not indicate the risk incurred to earn these returns. Table 4 shows the annualized standard deviation over various time periods. The ten-year standard deviation of the S&P 500 Index of 15.2% means that based on the last ten years of historical returns data, the return of the S&P 500 Index in any given year is expected to be in a range of +/- 15.2% around the average return, about two-thirds of the time.

Table 4: Annualized Standard Deviation (As of 6/30/2017)

	S&P 500	Russell 1000	Russell 3000	DJ U.S Total Market Index
3 Years	10.4%	10.5%	10.6%	10.6%
5 Years	9.6	9.7	9.8	9.8
10 Years	15.2	15.5	15.8	15.7
15 Years	14.1	14.2	14.5	14.4
20 Years	16.5	16.9	17.1	17.3
25 Years	15.4	15.7	15.9	16.1
30 Years	15.6	16.0	16.2	16.3
35 Years	15.8	16.2	16.4	--

The risk, as measured by the standard deviation of returns, also tends to be in a narrow range. The Sharpe ratio measures excess return over the risk-free rate (such as T-Bills) per unit of additional risk. Sharpe ratios are appropriate for any kind of investment, including indexes and managers. The Sharpe ratio can be used to compare the *risk-adjusted* performance of two or more indexes, compare the risk-adjusted performance of a manager with an index, or compare the risk-adjusted performance of two or more managers. A higher Sharpe ratio is always better. A positive Sharpe ratio means that the investment has produced a better return than the risk-free rate over the period analyzed. The Sharpe ratios for each of the indexes over various periods are shown below in Table 5.

Table 5: Sharpe Ratios (As of 6/30/2017)

	S&P 500	Russell 1000	Russell 3000	DJ U.S. Total Stock Market Index
5 Years	1.47	1.46	1.43	1.42
10 Years	0.50	0.50	0.49	0.50
15 Years	0.55	0.57	0.56	0.58
20 Years	0.38	0.39	0.39	0.39
25 Years	0.51	0.51	0.51	0.51
30 Years	0.47	0.47	0.46	0.45
35 Years	0.57	0.56	0.55	--

Based on historical performance, we do not find evidence of superiority of one or more benchmarks relative to the others on a risk-adjusted basis.

Investable & Liquidity

A good benchmark should be investable, i.e. an investor should be able to earn a return similar to that of the index *after* costs.

The stocks in the S&P 500 Index are liquid and trade frequently, allowing index fund managers to hold all the stocks at the appropriate index weights. The existence of an extremely liquid market for S&P 500 futures contracts also allows index fund managers to manage cash flows more efficiently, resulting in tighter tracking of the Index.

The Russell 1000 Index is also large cap-oriented and relatively liquid, allowing index fund managers to replicate the Index and control tracking error. As the opportunity set broadens to include small capitalization stocks, liquidity tends to decline. While the major index fund providers replicate their Russell 3000 Index funds, they are willing to incur slightly higher tracking error due to the costs associated with trying to match the index weightings precisely for the Dow Jones U.S. Total Stock Market Index. Index fund managers typically do not hold all the stocks in their Dow Jones U.S. Total Stock Market Index funds; rather, they hold the largest stocks at approximately the market weights and use an optimization strategy for the smaller capitalization stocks. Optimization refers to the process of holding a representative, risk-controlled sample of the index constituents to avoid investing in the least liquid constituents in an effort to minimize trading costs. While this results in higher tracking error than say, an S&P 500 Index fund, it still tends to be within narrow bands. It should also be noted that index fund managers that have managed broad market strategies, such as the Dow Jones U.S. Total Stock Market Index, for long periods of time and have substantial passive assets benchmarked to such indices have over time been able accumulate most, if not all, the securities comprised in the broad market indices, trading opportunistically when liquidity opportunities present/have presented themselves.

Table 6 compares the historical 5-year tracking errors of institutional index funds (ERISA-qualified[1]) managed by BlackRock, State Street Global Advisors (SSgA), Vanguard, Bank of New York Mellon (BNY Mellon) and Northern Trust, five of the major index fund managers in the world, for the S&P 500 Index, Russell 1000 Index, Russell 3000 Index, and Dow Jones U.S. Total Stock Market Index. While the tracking error increases as the index coverage increases, we consider the tracking error on the Dow Jones U.S. Total Stock Market Index funds to be reasonable.

Table 6: Index Fund 5-Year Tracking Error[1] (As of 6/30/2017)

	S&P 500	Russell 1000	Russell 3000	DJ U.S. Total Stock Market Index
BlackRock	0.01%	0.01%	0.02%	0.07%
SSgA	0.02	0.03	0.07	0.05
Vanguard	0.01	0.06	0.06	N/A[2]
BNY Mellon	0.01	0.01	0.07	N/A
Northern Trust	0.01	0.02	0.02	N/A

Source: BlackRock, SSgA, Vanguard, BNY Mellon and Northern Trust
[1] Stock tracking error is based on the passive providers' ERISA-qualified daily valued institutional index fund. Majority of passive providers used non-securities lending products if they were available.
[2] Vanguard's Total Stock Market Index Fund is benchmarked to CRSP U.S. Total Stock Market

Acceptance

An important consideration for benchmark selection is the benchmark's acceptance and use among the investment community. Table 7 displays the value of passively managed assets in all vehicles benchmarked to each of the four indexes by the above five index managers.

Table 7: Assets Indexed to Benchmark (As of 6/30/2017)

	S&P 500	Russell 1000	Russell 3000	DJ U.S. Total Stock Market Index
Passive Assets[1]	$782 Billion	$130 Billion	$68 Billion	$24 Billion

[1]Assets are based on the passive providers' ERISA-qualified daily valued institutional index fund

The S&P 500 Index has, by far, the greatest amount of assets indexed to it. The table only shows less than half of the total passive assets benchmarked to the S&P 500 Index. If the assets managed by other fund families are counted, the total passive assets benchmarked to the S&P 500 Index total approximately $2.2 trillion as of June 30th, 2017. Assets indexed to the Russell 3000 Index and the Dow Jones U.S. Total Stock Market Index are much lower, but still high on an absolute basis. In addition, based on the Russell 1000's share of the Russell 3000 and the DJ U.S. Total Stock Market Index on a market cap basis, we estimate that there is $168 billion managed to the Russell 1000 as a part of these broader passive U.S. equity mandates. Although the passive assets managed to CRSP U.S. Large Cap Index is low, the total passive assets benchmarked to CRSP U.S. Total Stock Market is high at $581 billion. However, as mentioned previously, Vanguard is the only major passive provider that tracks to this benchmark which results in concentration risk in the event Vanguard decides to change passive providers in the future.

Summary

Although the Russell 3000 Index and DJ U.S. Total Stock Market Index provide broader coverage of the U.S. equity market than the S&P 500 Index and Russell 1000, both indexes could overlap with the benchmark for S Fund. Given that the C Fund and the S Fund are statutorily intended to be complementary and provide coverage of the entire U.S. opportunity set, we shortlist the large cap indices, namely the S&P 500 Index and the Russell 1000 Index, for further consideration. We believe the S&P 500 Index and Russell 1000 Index are compatible by many criteria.

Both indexes will be reviewed in conjunction with a recommendation for the benchmark for the S Fund to determine the most suitable combination for C and S Funds.

S FUND

Benchmarks Considered

We considered the following U.S. equity mid/small capitalization indexes in our initial review of benchmarks for the S Fund:

- CRSP U.S. Small Cap Index (U.S. companies that fall between the bottom 2%-15% of the investable market capitalization)
- Dow Jones U.S. Small Cap Total Stock Market Index (including 751-2500th stocks in DJ U.S. Total Stock Market Index ranked by capitalization)
- DJ U.S. Completion Total Stock Market Index ***(current benchmark, DJ U.S. Total Stock Market Index excluding S&P 500 Index members)***
- MSCI USA Small Cap Index
- Russell 2000 Index
- S&P MidCap 400 Index
- S&P SmallCap 600 Index
- S&P 1000 Index (Combination of S&P 400 and S&P 600 Indexes)
- S&P Completion Index (S&P Total Market Index excluding S&P 500 members)

We eliminated the Dow Jones U.S. Small Cap Total Stock Market Index and the MSCI USA Small Cap Index as these indexes do not complement either of the two C Fund benchmarks under consideration, the S&P 500 Index and the Russell 1000 Index. While the S&P MidCap 400 Index complements the S&P 500 Index, it fails to capture a significant portion of U.S. small capitalization stocks. The S&P SmallCap 600 Index leaves out 400 mid-capitalization stocks when combined with the S&P 500 Index, and creates overlap when combined with the Russell 1000 Index. Though the S&P 1000 Index is more inclusive and complements the S&P 500 Index, it is not widely used, and lacks significant assets managed against it, either actively or passively. The S&P Completion Index complements the S&P 500 Index very well. The combination covers the entire U.S. opportunity set.

However, with about $57 billion in passive assets, Vanguard is the only fund manager who offers a fund benchmarked to the S&P Completion Index. Competitive bidding would not be feasible if the S&P Completion Index is recommended as the benchmark for S Fund.

As for the Center for Research in Security Prices (“CRSP”) indices, Vanguard is the only investment management firm out of the five major index fund providers in the U.S. that has assets benchmarked to CRSP’s U.S. indices. Although assets managed to CRSP U.S. indices through Vanguard index funds are meaningful in size, the benchmark is not common across the rest of the major passive providers.

Additionally, competitive bidding would not be feasible if a CRSP index is recommended as the benchmark for the S Fund.

We therefore focus our attention on the remaining two benchmarks:

- Russell 2000 Index (as a complement to the Russell 1000 Index)
- DJ U.S. Completion Total Stock Market Index (as a complement to the S&P 500 Index)

A comparison between the two benchmarks is shown below in Table 8.

Table 8: Benchmark Comparison (As of 6/30/2017)

	Russell 2000	DJ U.S. Completion Total Stock Market Index
Inclusion criteria	Stocks ranking from 1,001 to 3,000 based on market cap	All stocks in the DJ U.S. Total Market Index minus the stocks in the S&P 500
# of securities	2,010	3,290
Market cap[1]	$1.9 Trillion	$4.5 Trillion
Largest company's market cap	$5.9 Billion	$59.4 Billion
Smallest company's market cap	$90 Million	$1.7 Million
Coverage of U.S. stocks	8%	18%
Reconstitution frequency	Annual	Annual
Turnover[2]	13.5%	21.4%

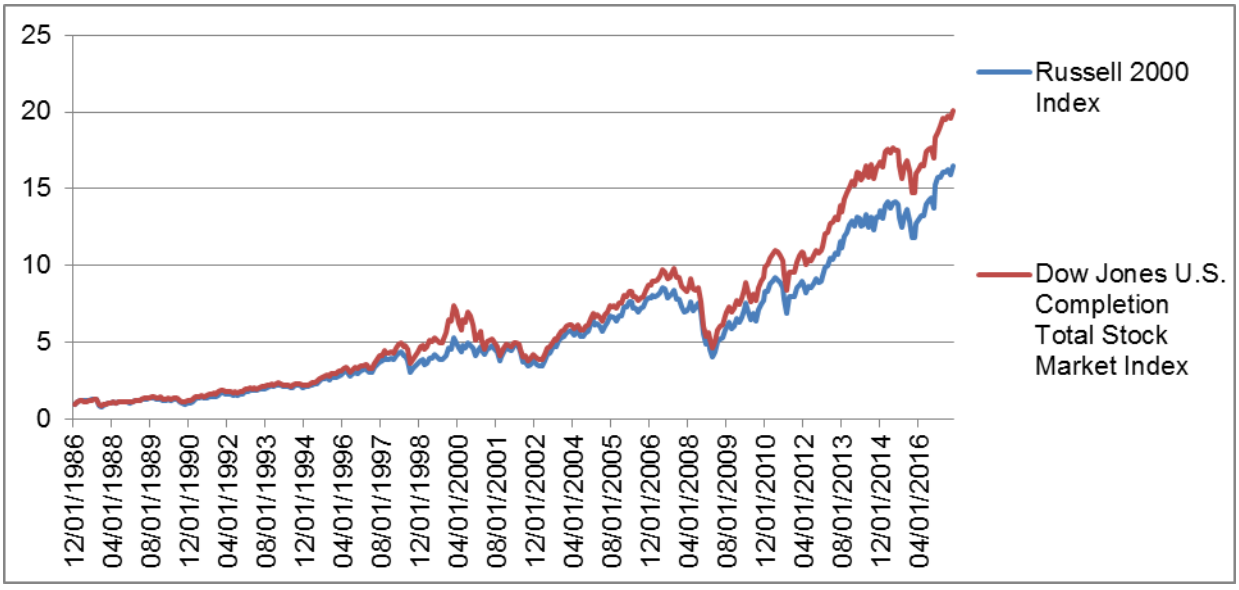
Source: Russell, and DJ Index Service
[1]Float adjusted
[2]As of 12/31/2016

While the Russell 2000 Index provides coverage to only 8% of the U.S. stock market as opposed to 18% by the DJ U.S. Completion Total Stock Market Index, it is more relevant to consider it in combination with the Russell 1000 Index – resulting in 98% coverage of the market. The combination of the S&P 500 Index with the DJ U.S. Completion Total Stock Market Index provides 100% coverage.

Performance

Chart 2 illustrates the growth of $1 invested in each of the indexes over the longest common time period. The DJ U.S. Completion Total Stock Market Index has performed better than the Russell 2000 Index due to the inclusion of more small-cap stocks.

Chart 2



(As of 6/30/2017)	Russell 2000	DJ U.S. Completion TSM Index
Value At The End of 30 Years	**$16.49**	**$20.06**

The correlation between the indexes is shown below in Table 9. As shown, the correlation between the indexes is quite high.

Table 9: Correlation Matrix (As of 6/30/2017)

	Russell 2000	DJ U.S. Total Stock Market Index
Russel 2000	1.00	
DJ TSMI	0.97	1.00

(Longest common time period = 30 years)

The cumulative annualized returns over several trailing historical periods are shown below in Table 10.

Table 10 Return History (As of 6/30/2017)

	Russell 2000	DJ U.S. Completion Total Stock Market Index
1 Year	24.6%	21.4%
3 Years	7.4	6.7
5 Years	13.7	14.0
10 Years	6.9	7.7
15 Years	9.2	10.4
20 Years	8.0	8.6
25 Years	9.9	10.3
30 Years	9.0	9.8

*See appendix for annual returns

Given the substantial differences in market coverage between the two indexes, annual returns tend to differ by relatively large margins. The difference in returns narrows over long periods of time but is still higher than that of large capitalization indexes.

The standard deviation of these benchmarks is shown in Table 11.

Table 11 Annualized Standard Deviation (As of 6/30/2017)

	Russell 2000	DJ U.S. Completion Total Stock Market Index
3 Years	15.4%	13.2%
5 Years	13.9	12.1
10 Years	20.1	18.6
15 Years	19.0	17.0
20 Years	21.1	21.6
25 Years	19.5	19.9
30 Years	20.5	19.8

The DJ U.S. Completion Total Stock Market Index has posted comparable returns over all historical periods at a similar to lower risk levels. The DJ U.S. Completion Total Stock Market Index has a higher Sharpe ratio over most of those periods.

Table 12 Sharpe Ratios (As of 6/30/2017)

	Russell 2000	DJ U.S. Completion Total Stock Market Index
5 Years	0.99	1.14
10 Years	0.41	0.47
15 Years	0.50	0.60
20 Years	0.37	0.40
25 Years	0.46	0.47
30 Years	0.37	0.41

Over the longest common time period, the DJ U.S. Completion Total Stock Market Index has outperformed the Russell 2000 Index on a risk-adjusted basis. However, in combination with the corresponding large capitalization indexes, these differences are diminished.

Investable & Liquidity

Most of the significant players in the index fund management business offer Russell 2000 Index funds and DJ U.S. Completion Total Stock Market Index funds. Managers for the DJ U.S. Completion Total Stock Market Index funds typically hold all the mid-cap stocks, as well as most of the small cap stocks, and optimize the balance of the micro-cap segment. Again, they have shown an ability to do this at reasonable costs and tracking error. Fund managers tend to hold all the stocks in the Russell 2000 Index as part of their investment strategy.

Table 13 below compares the historical tracking errors of institutional index funds managed by BlackRock, SSgA, Bank of New York Mellon and Northern Trust (Vanguard does not manage stand-alone index funds benchmarked to DJ U.S. Completion Total Stock Market). All managers have been successful in earning the returns of the indexes within a reasonable level of tracking error.

Table 13: Index Fund 5-Year Tracking Error (As of 6/30/2017)[1]

	Russell 2000	DJ U.S. Completion Total Stock Market Index
BlackRock	0.04%	0.15%
SSgA	0.08	0.12
Vanguard	0.03	N/A[2]
BNY Mellon	0.05	0.09
Northern Trust	0.03	0.08

Source: BlackRock, SSgA, Vanguard, BNY Mellon and Northern Trust

[1]Stock tracking error is based on the passive providers' ERISA-qualified daily valued institutional index fund. Majority of passive providers used non-securities lending products if they were available.

[2] Vanguard's Small-Cap Index Fund is benchmarked to CRSP U.S. Small Cap Index

Acceptance

An important consideration for index benchmark consideration is the benchmark's acceptance and use among the investment community. The following table displays the value of passively managed assets by the above leading fund managers and benchmarked to each of the two indexes.

Table 14: Assets Indexed to Benchmark (As of 6/30/2017)

	Russell 2000	DJ U.S. Completion Total Stock Market Index
Passive Assets[1]	$28 billion	$83 billion

[1]Assets are based on the passive providers' ERISA-qualified daily valued institutional index fund

Both indexes are accepted passive benchmarks. The assets managed by the above fund managers' account for half of the total passive assets benchmarked to the two indexes. If other fund families and

assets that are part of other mandates are included, the total assets managed to these benchmarks are much larger. For example, the Russell 2000 Index fund could be managed on a stand-alone basis or within the mandate of a Russell 3000 index fund, which has a much larger asset base. The same holds true for the DJ U.S. Completion Total Stock Market Index being managed alone or within the DJ U.S. Total Stock Market Index.

There is also a fairly large level of overlap that exists between the different small capitalization indices at the underlying security level. Given the large overlap in securities between the indices, providers hold and trade most of the same securities that are held in the DJ U.S. Completion Total Stock Market Index as part of their other small capitalization index strategies. As a result, we believe it is appropriate to consider assets managed to indices such as the S&P Completion Index and CRSP U.S. Small Cap Index by the five major providers, in addition to the Russell 2000 Index and the DJ U.S. Completion Total Stock Market Index, when assessing the size of total passive assets benchmarked to the indices discussed above.

Table 15 (As of 6/30/2017)

	Russell 2000	DJ U.S. Completion Total Stock Market Index	S&P Completion Index	CRSP U.S. Small Cap Index	Total U.S. Small Capitalization Stock Indexed
Passive Assets[1]	$28 billion	$83 billion	$57 billion	$77 billion	$245 billion

[1]Assets are based on the passive providers' ERISA-qualified institutional index fund

The greatest amount of assets is passively managed against the DJ U.S. Completion Total Stock Market Index directly.

Benchmark Recommendation for the C and S Funds

There are two combinations of benchmarks that make the most sense for the C and S Funds:

1. The current combination of the S&P 500 Index for the C Fund and the DJ U.S. Completion Total Stock Market Index for the S Fund; and
2. An alternate combination of the Russell 1000 Index for the C Fund and the Russell 2000 Index for the S Fund

Either of these combinations would be consistent with the FERSA provisions. We recommend that the existing benchmarks be maintained for the C and S Funds for the following reasons:

- Total passive assets benchmarked to the S&P 500 and DJ U.S. Completion Total Stock Market Index are about six times of those benchmarked to the combination of Russell 1000 and Russell 2000.[1]

- The costs associated with picking up the bottom 4% of market capitalization have not impacted index fund managers' ability to track the DJ U.S. Completion Total Stock Market Index.
- The S&P 500 Index has high recognition value among non-investment professionals, which constitute the vast majority of the participants.

F FUND

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F Fund

Summary
We have reviewed the Fixed Income Index Investment Fund's (F Fund) legislative guidelines and compared its current benchmark the Bloomberg Barclays U.S. Aggregate Index to other leading fixed income market indices. We recommend the continued use of the Bloomberg Barclays U.S. Aggregate Index for the F Fund.

Legislative Guidelines
FERSA states the following as it relates to the F Fund:

(B) The Board shall establish a Fixed Income Investment Fund under which sums in the Thrift Savings Fund are invested in—
i. insurance contracts
ii. certificate of deposits; or
iii. other instruments or obligations selected by qualified professional asset managers, which return the amount invested and pay interest, at a specified rate or rates, on that amount during a specified period of time.

The guidelines for the eligible instruments in which the F Fund may invest are very general in nature. There is no guidance on whether investments may be made in non-U.S. dollar denominated debt, non-investment grade loans, U.S. dollar-denominated foreign debt, etc.

The legislative guidelines specify that the F Fund may invest in insurance contracts and certificates of deposits. We note that the relative stability in returns provided by insurance contracts and certificates of deposit is already available to participants through the Government Securities Investment Fund (G Fund). Insurance contracts and certificates of deposit are not included in marketable security fixed income benchmarks. As participants have access to an investment option in the G Fund that provides the key elements of insurance contracts and certificates of deposit – return of capital and payment of interest – we believe that it is appropriate to offer participants exposure to a broad array of marketable fixed income securities as the F Fund currently provides. Therefore, we focus our attention on the leading broad-based fixed income indexes that comprise publicly traded fixed income securities.

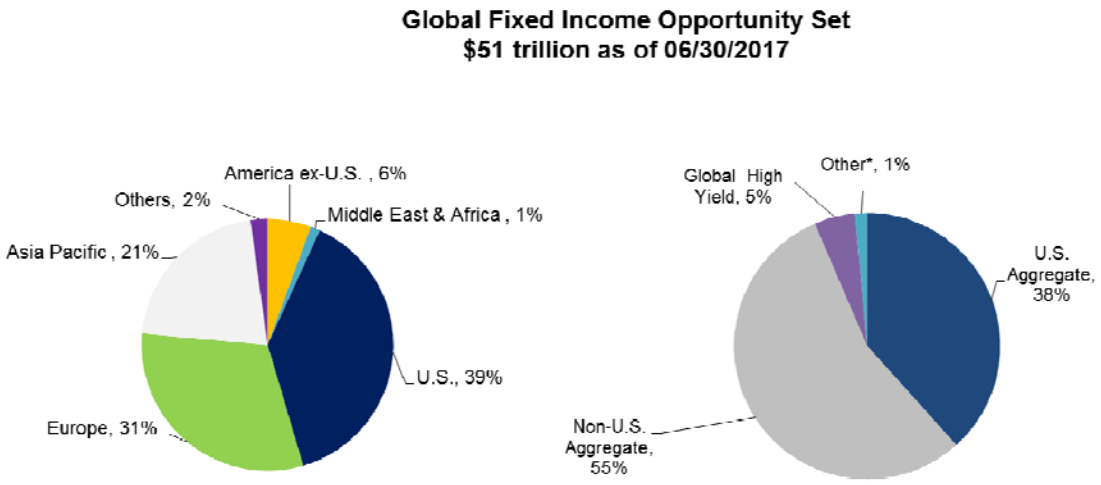
Benchmarks Considered
We initially considered the following indices in our review of reasonable benchmarks for the F Fund:

- Citigroup Broad Investment Grade (BIG) Bond Index
- Citigroup World Government Bond Index
- Bloomberg Barclays U.S Aggregate Index ***(Current Benchmark)***

- Bloomberg Barclays Global Aggregate Index
- Bloomberg Barclays U.S. Universal Index

Chart 3 below provides a representation of the global investable fixed income market. The Bloomberg Barclays U.S. Aggregate Index, the most widely used benchmark by U.S. institutional investors, is broken out as a sub-component of the global fixed income markets.

Chart 3



Source: Barclays Global Investors, Multi-Verse Universe

*Other is comprised of Euro Treasury High Yield and EM Local Currency Govt: Non GLA Eligible

Benchmarks such as the Bloomberg Barclays U.S. Aggregate Index, Citigroup BIG Bond Index, as well as the Bloomberg Barclays U.S. Universal Bond Index, capture only about 40% to 50% of the global fixed income opportunity set. Global fixed income benchmarks, such as the Citigroup World Government Bond Index and Bloomberg Barclays Global Aggregate Bond Index, seem appealing given the broader coverage of the fixed income markets; however, there are little to no passive assets managed to such benchmarks. Additionally, global fixed income benchmarks are exposed to a meaningful amount of volatility associated with foreign currency exchange rate fluctuation and credit risk, which may not be appealing to a U.S. based investor in fixed income seeking stability in returns and principal. Our analysis, therefore, focuses on the Bloomberg Barclays U.S. Aggregate, Bloomberg Barclays U.S. Universal, and the Citigroup BIG indexes.

Table 16

	Bloomberg Barclays U.S. Aggregate	Bloomberg Barclays U.S. Universal	Citigroup BIG
Inclusion criteria	U.S. Investment grade, dollar denominated, non-convertible, fixed-rate instruments. Maturity greater than one year. Includes Treasuries, Agencies, mortgages, asset-backed securities, corporate debt. Minimum outstanding size $250 million.	Barclays U.S. Aggregate + U.S. high yield, Eurodollars,, U.S. dollar denominated emerging market debt, non-ERISA portion of the CMBS index, and the 144A index	Similar to Barclays Aggregate, same minimum size on corporate and asset backed issues, but with higher minimum size requirements for Treasuries, Agencies and mortgage backed issues.
# of securities	9,347	14,844	7,334
Market cap	$19.6 trillion	$23.6 trillion	$18.7 trillion
Coverage of U.S. dollar denominated fixed income opportunity set	83%	100%	80%
Reconstitution frequency	Monthly	Monthly	Monthly

As of 6/30/2017

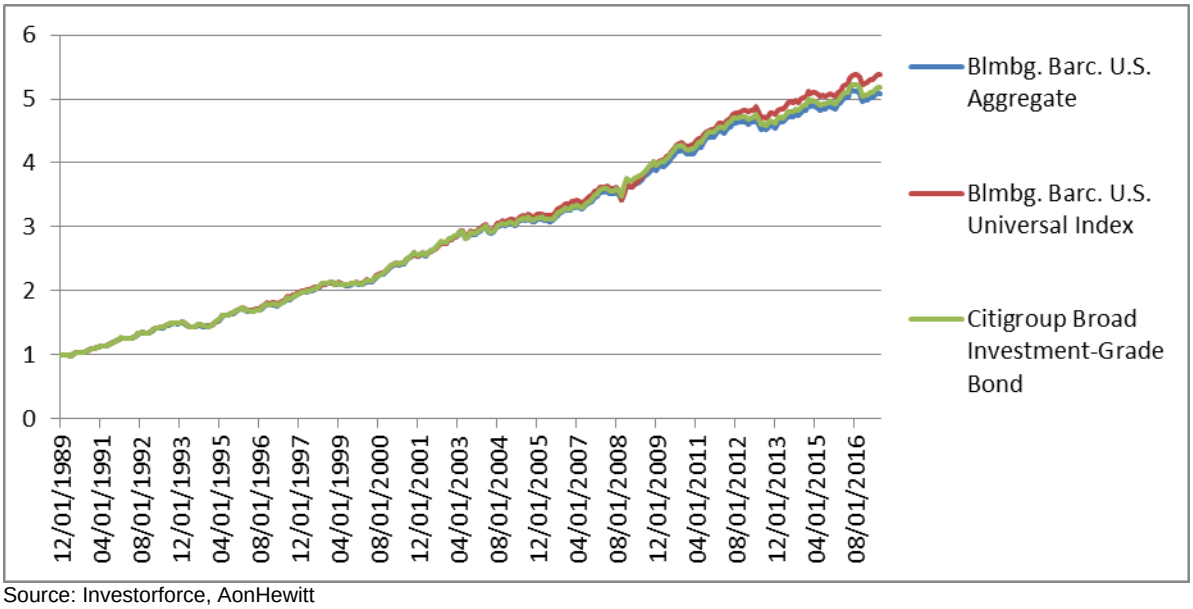
Source: Bloomberg Barclays Global Investors and Citigroup

The Citigroup BIG Index has far fewer securities as compared to both the Bloomberg Barclays U.S. Aggregate Index and the Bloomberg Barclays U.S. Universal Index. The number of securities in the Bloomberg Barclays U.S. Universal Index is about 50% higher than those in the Bloomberg Barclays U.S. Aggregate, although the market capitalization increases by only $4.0 trillion, indicating the relatively small market value of outstanding issues in high yield, dollar denominated emerging market debt, and Eurodollar debt.

Performance

Chart 4 below illustrates the growth of $1 invested in each of the indexes over the longest common time period. All three indexes have performed quite similarly over time.

Chart 4



Source: Investorforce, AonHewitt

(As of 6/30/2017)	Bloomberg Barclays U.S. Aggregate	Bloomberg Barclays U.S. Universal	Citigroup BIG
Value At The End of 28 Years	**$5.09**	**$5.37**	**$5.17**

Table 17 shows the correlation between each of these fixed income indexes, as well as with equities.

Table 17: Correlation Matrix (As of 6/30/2017)

	Barclays U.S. Aggregate	Barclays U.S. Universal	Citigroup BIG	Dow Jones U.S. Total Stock Mkt	MSCI EAFE	MSCI ACWI ex U.S. IMI
Barclays U.S. Aggregate	1.00					
Barclays U.S. Universal	0.98	1.00				
Citigroup BIG	1.00	0.97	1.00			
Dow Jones U.S. Total Stock Mkt	-0.01	0.14	-0.04	1.00		
MSCI EAFE	0.01	0.15	-0.02	0.83	1.00	
MSCI ACWI ex U.S. IMI	0.01	0.16	-0.02	0.84	0.99	1.00

(Longest common time period = 23 years)

As would be expected, all three fixed income indexes have a high correlation with each other. The correlation coefficient of the two investment grade indexes, the Bloomberg Barclays U.S. Aggregate and the Citigroup BIG, with U.S. and international stocks is low, pointing towards the diversification benefit they provide in a portfolio. While the Bloomberg Barclays U.S. Universal also provides a diversification benefit, the benefit is reduced because of a higher correlation due to the inclusion of high yield securities, emerging market debt, etc., which tend to have a modestly higher correlation to equities.

The cumulative annualized returns over several trailing historical periods are shown below in Table 18.

Table 18: Return History (As of 6/30/2017)

	Bloomberg Barclays U.S. Aggregate	Bloomberg Barclays U.S. Universal	Citigroup BIG
1 Year	-0.3%	0.9%	-0.3%
3 Years	2.5	2.8	2.5
5 Years	2.2	2.7	2.2
10 Years	4.5	4.7	4.6
15 Years	4.5	4.9	4.6
20 Years	5.2	5.4	5.3
25 Years	5.6	5.8	5.7
30 Years	6.4	--	6.5
35 Years	7.9	--	7.9

*See appendix for annual returns

The returns of the Bloomberg Barclays U.S. Aggregate Index and the Citigroup BIG Bond Index track each other closely over most annual periods and over trailing annualized periods. The Bloomberg Barclays U.S. Universal differs more on an annual basis, but has generated similar returns as the other two indexes over long periods of time.

Table 19 below shows the volatility (annualized standard deviation) of the indexes over several trailing historical periods; there is little to no difference over long time periods.

Table 19: Annualized Standard Deviation (As of 6/30/2017)

	Bloomberg Barclays U.S. Aggregate	Bloomberg Barclays U.S. Universal	Citigroup BIG
3 Years	2.9%	2.8%	2.9%
5 Years	2.9	2.8	2.9
10 Years	3.3	3.3	3.4
15 Years	3.4	3.4	3.5
20 Years	3.5	3.2	3.6
25 Years	3.8	3.6	3.8
30 Years	4.2	--	4.2
35 Years	5.2	--	5.3

Sharpe ratios for each of the indexes over various periods are shown in Table 20. The Bloomberg Barclays U.S. Universal has a higher Sharpe ratio over the trailing periods referenced below relative to the other benchmarks, indicating slightly better performance on a risk-adjusted basis.

Table 20: Sharpe Ratios (As of 6/30/2017)

	Bloomberg Barclays U.S. Aggregate	Bloomberg Barclays U.S. Universal	Citigroup BIG
5 Years	0.73	0.92	0.73
10 Years	1.21	1.26	1.19
15 Years	0.94	1.05	0.94
20 Years	0.92	1.04	0.91
25 Years	0.82	0.92	0.82
30 Years	0.78	--	0.79
35 Years	0.80	--	0.80

Investable & Liquidity

While the sheer number of securities in the Bloomberg Barclays U.S. Aggregate Index make it almost impossible to replicate the index precisely, index fund managers are able to track the benchmark quite closely by matching the industry, sector, duration, maturity, and quality characteristics of the Index. Passive managers that have assets managed against the Bloomberg Barclays U.S. Aggregate Index have over the years been able to accumulate a greater portion of the securities comprised in the index by investing securities when liquidity opportunities have presented themselves. For example, BlackRock held 7,495 securities to replicate the index, while State Street held 6,633 as of June 30th, 2017.

The major index fund managers do not offer ERISA qualified DC passive funds benchmarked to the Bloomberg Barclays U.S. Universal Bond Index or the Citigroup BIG Bond Index. The high yield segment of the Barclays U.S. Universal can also present some challenges in terms of trading costs and tracking error due to optimization, and can result in higher tracking error.

Table 21 compares the historical tracking error of institutional index funds managed to the Bloomberg Barclays U.S. Aggregate Index by leading index fund providers. Most of managers have been able to track the Bloomberg Barclays U.S. Aggregate Index closely. Vanguard's higher tracking error is primarily attributable to the timing of when the fund's net asset value (NAV) is struck, which is different than that of the index, and the use of a different pricing source than that of the index.

Table 21: Index Fund 5-Year Tracking Error (As of 6/30/2017)

	Bloomberg Barclays U.S. Aggregate	Bloomberg Barclays U.S. Universal	Citigroup BIG
BlackRock	0.11%	--	--
SSgA	0.04	--	--
Vanguard	0.25	--	--
Bank of NY Mellon	0.08	--	--
Northern Trust	0.09	--	--

Source: BlackRock, SSgA, Vanguard, BNY Mellon and Northern Trust
[1]Stock tracking error is based on the passive providers' ERISA qualified daily valued institutional index fund. Majority of passive providers used non-securities lending products if they were available.

Acceptance

Table 22 displays the value of passively managed assets benchmarked to each of the three indexes by five leading index fund providers. As noted previously, the five index managers do not offer products indexed to the Bloomberg Barclays U.S. Universal of Citigroup BIG indices.

Table 22: Assets Indexed to Benchmark (As of 6/30/2017)

	Bloomberg Barclays U.S. Aggregate	Bloomberg Barclays U.S. Universal	Citigroup BIG
Passive Assets[1]	$257 Billion	--	--

[1]Assets are based on the passive providers' ERISA qualified daily valued institutional index fund

The Bloomberg Barclays U.S. Aggregate is a widely-followed performance benchmark that is tracked by hundreds of billions of dollars in institutional assets. It is the most widely used fixed income benchmark by U.S.-based institutional investors. The Bloomberg Barclays U.S. Universal has still not gained acceptance as a passive benchmark, with no ERISA qualified DC products offered by the five major index managers. Similarly, there are no passive assets benchmarked to the Citigroup BIG Index.

Benchmark Recommendation for the F Fund

We recommend that the Bloomberg Barclays U.S. Aggregate Index be maintained as the benchmark for the F Fund. The main reasons for our recommendation are as follows:

- The Bloomberg Barclays U.S. Aggregate Index provides broad coverage to the investment-grade U.S. fixed income market.
- It is the most widely recognized fixed income benchmark in the U.S.
- There are no material benefits associated with a change to the Citigroup BIG Bond Index in addition to the fact that the Citigroup BIG Index is not a commonly used benchmark across the institutional space and there are no ERISA qualified DC products that track to this benchmark across the major passive providers.
- The Bloomberg Barclays U.S. Universal Bond Index provides broader coverage to an investor; however, it includes high yield debt which is more correlated to stocks, reducing the diversification benefit relative to the Bloomberg Barclays U.S. Aggregate.

I FUND

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I Fund

Summary

We have reviewed the International Stock Index Investment Fund's (I Fund) legislative guidelines and compared its current benchmark index, the MSCI EAFE Index, to other leading international equity indexes.

Legislative Guidelines

The legislative guidelines that describe the I Fund are stated below:

(4)(A) The Board shall select an index which is a commonly recognized index comprised of stock the aggregate market value of which is a reasonably complete representation of the international equity markets excluding the United States equity markets.

(B) The International Stock Index Investment Fund shall be invested in a portfolio designed to replicate the performance of the index selected under subparagraph (A). The portfolio shall be designed such that, to the extent practicable, the percentage of the International Stock Index Investment Fund that is invested in each stock is the same as the percentage determined by dividing the aggregate market value of all shares of that stock by the aggregate market value of all shares of all stocks included in such index.

Benchmarks Considered

We initially short-listed the following benchmarks for the I Fund:

- Dow Jones Developed World ex-U.S. Index
- MSCI Europe, Australasia, Far East (EAFE) Index ***(Current Benchmark)***
- MSCI World ex-U.S. Index
- MSCI All Country World ex-U.S. (ACW ex-U.S.) Index
- MSCI All Country World ex-U.S. Investable Market Index (ACW ex-U.S. IMI)
- FTSE All World Developed ex-North America Index (AWD ex-N.A.)
- FTSE All World ex-U.S. Index (AW ex-U.S.)
- S&P/Citigroup Broad Market Index (BMI)

We eliminated the Dow Jones Developed World ex-U.S. Index and the S&P/Citigroup index from further consideration based on the lack of significant passive assets managed to them. None of the major index fund managers offer funds indexed to these benchmarks, either in the U.S. or internationally.

As for the FTSE indexes, Vanguard is the only investment management firm out of the five major index fund providers in the U.S. that has assets benchmarked to FTSE indices. Although assets managed to

FTSE indices through Vanguard index funds are meaningful in size, the benchmark is not common across the rest of the major passive providers. Additionally, competitive bidding would not be feasible if a FTSE index is recommended as the benchmark for the I Fund. Therefore, we excluded both FTSE indexes in further study.

We compare the broad characteristics of each of the remaining benchmarks in Table 23.

Table 23: Benchmark Comparison (As of 6/30/2017)

	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World ex U.S.
Inclusion criteria	Targets 85% market-cap coverage of each country (Large and Mid Cap)	Targets 99% market-cap coverage of each country (Large , Mid and Small Cap)	Same as MSCI EAFE	Same as MSCI EAFE
Country coverage	21 developed market countries	22 developed countries + 24 emerging market countries	22 developed countries + 24 emerging market countries	22 Developed countries (EAFE plus Canada)
Coverage of non-U.S. equity markets	60%	99%	85%	65%
# of securities	927	6,195	1,866	1,021
Market cap[1]	$13.7 trillion	$22.9 trillion	$19.6 trillion	$15.0 trillion
Reconstitution frequency	Quarterly	Quarterly	Quarterly	Quarterly
Turnover[2]	5.2%	6.1%	5.8%	5.1%

[1] Float adjusted
[2] As of 12/31/2016

Table 24 compares the country allocation of each of the indices. Among developed countries, Canada is the fourth-largest country by market capitalization after Japan, United Kingdom, and Germany. Canada comprises 8.6% of the MSCI World ex-U.S. Index, which provides coverage of large and mid-cap stocks across developed countries.

It is also important to note that several emerging market countries have market capitalizations that are greater than several developed countries.

For instance, when evaluating the MSCI All-Country World ex-U.S. Index, which provides coverage of the large and mid-cap stocks across developed and emerging countries, countries such as Brazil, China, India, Korea, South Africa, and Taiwan have market capitalizations that are greater than those of several EAFE countries (Austria, Denmark, Ireland, New Zealand, Norway, Portugal, and Singapore).

Table 24: Country Allocations (As of 6/30/2017)

	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World ex U.S.
Developed Markets				
Australia	7.1%	4.9%	4.9%	6.5%
Austria	0.2	0.2	0.2	0.2
Belgium	1.1	0.9	0.8	1.0
Canada	**--**	**6.6**	**6.6**	**8.6**
Denmark	1.8	1.3	1.3	1.7
Finland	1.0	0.8	0.7	0.9
Israel	0.7	0.6	0.5	0.6
France	10.5	6.7	7.3	9.6
Germany	9.5	6.3	6.6	8.7
Hong Kong	3.5	2.3	2.4	3.2
Ireland	0.5	0.4	0.3	0.4
Italy	2.3	1.8	1.6	2.1
Japan	23.5	17.0	16.3	21.4
Netherlands	3.5	2.3	2.5	3.2
New Zealand	0.2	0.2	0.1	0.2
Norway	0.6	0.5	0.4	0.6
Portugal	0.2	0.1	0.1	0.1
Singapore	1.3	0.9	0.9	1.2
Spain	3.5	2.3	2.4	3.2
Sweden	2.9	2.3	2.0	2.7
Switzerland	8.5	5.6	5.9	7.8
U.K	17.7	12.4	12.3	16.1

	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World ex U.S.
Emerging Markets				
Brazil	--	1.5	1.6	--
Chile	--	0.3	0.3	--
China	--	6.3	6.6	--
Colombia	--	0.1	0.1	--
Czech Rep.	--	0.0	0.0	--
Egypt	--	0.0	0.0	--
Greece	--	0.1	0.1	--
Hungary	--	0.1	0.1	--
India	--	2.2	2.1	--
Indonesia	--	0.6	0.6	--
Korea	--	3.7	3.7	--
Malaysia	--	0.6	0.6	--
Mexico	--	0.9	0.9	--
Pakistan	--	0.1	0.0	--
Peru	--	0.1	0.1	--
Philippines	--	0.3	0.3	--
Poland	--	0.3	0.3	--
Qatar	--	0.2	0.2	--
Russia	--	0.7	0.8	--
South Africa	--	1.5	1.6	--
Taiwan	--	3.1	3.0	--
Thailand	--	0.6	0.5	--
Turkey	--	0.3	0.3	--
UAE	--	0.2	0.2	--
Total Developed	100.0%	76.5%	76.2%	100.0%
Total Emerging	0.0%	23.5%	23.8%	0.0%
Total Index	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: MSCI Index Service

Performance

Chart 5 below represents the growth of $1 invested in each of the indexes over the longest common time period. MSCI World ex U.S. and MSCI EAFE Indexes were launched in 1969, and MSCI ACWI ex U.S. in May 1994. MSCI ACWI ex U.S. IMI, the newest among the four, was launched in 2007.The performance of MSCI ACWI ex U.S. IMI in the following chart is back filled for illustration. Over the past 23 years, the MSCI ACWI ex U.S. Index has outperformed the other three indexes, primarily driven by favorable returns in the emerging markets over the last two decades. Emerging markets also outperformed international small cap, which modestly boosted performance for the MSCI ACWI ex U.S. versus the MSCI ACWI ex U.S. IMI.

Chart 5

(As of 6/30/2017)	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World ex-U.S.
Value At The End of 23 Years	**$3.05**	**$3.17**	**$3.28**	**$3.17**

Table 25 shows the correlation between the indices under consideration. As expected, the correlation between the indices is high.

Table 25: Correlation Matrix (As of 6/30/2017)

	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World ex U.S.
MSCI EAFE	1.00			
MSCI ACWI ex U.S. IMI	0.99	1.00		
MSCI ACWI ex U.S.	0.99	1.00	1.00	
MSCI World ex U.S.	1.00	0.99	0.99	1.00

(Longest common time period = 23 years)

Table 26 compares the correlation for the indices under consideration for the I Fund with those recommended for the C, S, and F Funds.

Table 26: Correlation Matrix (As of 6/30/2017)

	Bloomberg Barclays Aggregate	S&P 500	DJ U.S. Completion	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACW ex U.S.	MSCI World ex U.S.
Bloomberg Barclays Aggregate	1.00						
S&P 500	0.01	1.00					
DJ U.S. Completion	-0.05	0.85	1.00				
MSCI EAFE	0.01	0.83	0.77	1.00			
MSCI ACWI ex U.S. IMI	0.01	0.82	0.80	0.99	1.00		
MSCI ACWI ex U.S.	0.01	0.83	0.79	0.99	1.00	1.00	
MSCI World ex U.S.	0.01	0.83	0.78	1.00	0.99	0.99	1.00

(Longest common time period =23 years)

The cumulative annualized returns over several trailing historical periods are shown below in Table 27. As shown in the table below, the broad non-U.S. stock indices have outperformed the non-U.S. developed index over longer-time periods.

Table 27: Return History (As of 6/30/2017)

	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World ex U.S.
1 Year	20.3%	20.4%	20.5%	19.5%
3 Years	1.1	1.1	0.8	0.7
5 Years	8.7	7.6	7.2	8.1
10 Years	1.0	1.4	1.1	1.0
15 Years	6.3	7.3	6.9	6.4
20 Years	4.3	4.7	4.7	4.4
25 Years	5.9	--	6.3	6.1
30 Years	5.0	--	--	5.1
35 Years	9.4	--	--	9.3
40 Years	9.4	--	--	9.3

*See appendix for annual returns

Table 28 shows the volatility (cumulative annualized standard deviation) of the indexes over several trailing historical periods. The MSCI ACWI ex U.S. Index and the MSCI ACWI ex U.S. IMI indices have exhibited modestly higher volatility over the majority of periods for which comparative data is available as compared to the MSCI EAFE and the MSCI World ex-U.S. indices. The volatility of the MSCI EAFE and the MSCI World ex-U.S. indices are comparable over all time periods.

Table 28: Annualized Standard Deviation (As of 6/30/2017)

	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World ex U.S.
3 Years	12.4%	12.4%	12.4%	12.2%
5 Years	11.7	11.5	11.6	11.5
10 Years	18.6	19.2	19.1	18.6
15 Years	17.0	17.5	17.5	17.0
20 Years	19.2	20.0	19.7	19.2
25 Years	17.6	--	18.0	17.6
30 Years	18.3	--	--	18.1
35 Years	18.9	--	--	18.7
40 Years	18.6	--	--	18.4

The realized Sharpe ratios for each of the indexes are shown in Table 29.

Table 29: Sharpe Ratios (As of 6/30/2017)

	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World ex U.S.
5 Years	0.76	0.68	0.65	0.73
10 Years	0.12	0.14	0.13	0.12
15 Years	0.38	0.42	0.40	0.38
20 Years	0.21	0.23	0.22	0.21
25 Years	0.27	--	0.29	0.28
30 Years	0.19	--	--	0.19
35 Years	0.37	--	--	0.37

The MSCI ACWI ex U.S. index and the MSCI ACWI ex U.S. IMI indices have registered higher Sharpe ratios than the MSCI EAFE and the MSCI World ex U.S. indices over the majority of periods for which comparative data is available. This is attributed to the inclusion of emerging markets and international small cap equities, which have outpaced developed market equities over the last 15 years.

Investable & Liquidity

All the benchmarks under consideration take into account the liquidity of stocks for inclusion in the index. Although some stocks in certain smaller countries can be difficult to trade, index fund managers still hold most, if not all stocks, though they may have a higher tolerance for mis-weights as the benefit from fully replicating the benchmark can be more than offset by transaction costs.

Investors have become increasingly interested in the non-U.S. equity markets over the past decade. Institutional investors have embraced non-U.S. equity as an essential asset class in the asset allocation plan. Liquidity in the non-U.S. equity related index products has increased substantially as a result.

More specifically, liquidity in the markets related to the four indexes has reached sizeable level, as shown in Table 30.

Table 30: Average Daily Trading Volume (ADV) (As of 6/30/2017)

	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World ex U.S.
30 Days	4,299,936,324	37,833,435,795	25,615,107,977	28,048,460,329
3 Months	4,396,403,506	37,457,362,338	23,979,717,683	26,292,377,152

Source: Bloomberg

The five-year tracking errors of institutional index funds managed by four top index fund managers benchmarked to the MSCI family of indexes are shown in Table 31. As shown, most managers have been able to track the indexes quite closely. You will find the indices with the broadest market coverage have

the lowest tracking error. BNY Mellon's tracking error is higher than the rest given it holds ADRs (American Depository Receipts), which are not held in the benchmark.

Table 31: Index Fund 5-Year Tracking Error (As of 6/30/2017)

	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World Ex U.S.
BlackRock	0.12%	0.09%	0.09%	0.11%
SSgA	0.11	0.09	0.09	N/A
BNY Mellon	1.9%	N/A	0.16%	N/A
Northern Trust	0.13%	0.11%	0.12%	0.12%

Source: BlackRock, SSgA, BNY Mellon and Northern Trust
[1]Stock tracking error is based on the passive providers' ERISA-qualified daily valued institutional index fund. Majority of passive providers used non-securities lending products if they were available.

Acceptance

The MSCI indexes are the most widely followed non-U.S. stock indexes for U.S. based institutional investors. Table 32 shows the assets indexed to each of the international MSCI indexes.

Table 32: Assets Indexed to Benchmark (As of 6/30/2017)

	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World Ex U.S.
Passive Assets[1]	$142 billion	$64 billion	$92 billion	$18 billion

[1]Assets are based on the passive providers' ERISA-qualified daily valued institutional index fund

*In the chart above, we illustrate the amount of assets that are benchmarked to the underlying index. This information represents assets indexed to each unique benchmark and does not factor any overlap in indexed assets between the different benchmarks.

While the MSCI EAFE Index has the greatest amount of passive assets benchmarked to it as compared to the other indices, the MSCI World ex-U.S. Index, MSCI ACWI ex U.S. IMI Index and the MSCI All Country World ex-U.S. Index all have considerable passive assets managed against them as well. We also note that the index fund providers that offer an MSCI ACWI ex U.S. strategy use a combination of different country and regional funds to create their offering, or may offer standalone emerging markets funds. Hence assets benchmarked to the MSCI ACWI ex U.S. Index are several times greater than the $92 billion would suggest. Further to that point, while the amount of assets managed to the MSCI World ex-U.S. appears lower than the other benchmarks, the assets within this index are a considerable portion (>50%) of the MSCI ACWI ex U.S. and MSCI ACWI ex U.S. IMI.

The MSCI ACWI ex U.S. IMI provides the broadest coverage of the international opportunity set in that it also includes smaller capitalization stocks across the non-U.S. equity markets that are not included in the MSCI ACWI ex U.S. Index. The MSCI ACWI ex U.S. IMI Index was launched in 2007 and is a commonly used benchmark across large institutional investment programs.

Analysis of International Equity Benchmarks

Modern portfolio theory suggests that the "market portfolio" is the most efficient portfolio (in terms of risk/return trade-off) that an investor can hold. The "market portfolio" is a market-cap weighted sum of all available asset classes/regions/countries. Excluding segments of the market limits investors' opportunities (return and/or diversification potential).

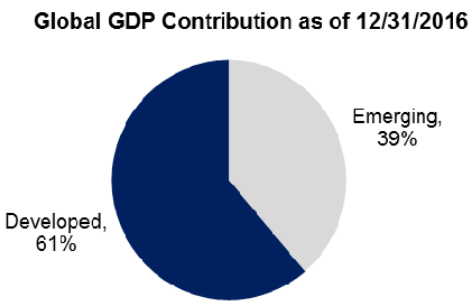
In general, we recommend constructing equity portfolios with the broadest possible market coverage. For instance, we recommend the DJ U.S. Total Stock Market Index, which provides complete coverage of large, mid, and small-cap stocks, as the benchmark for the broad U.S. equity market.

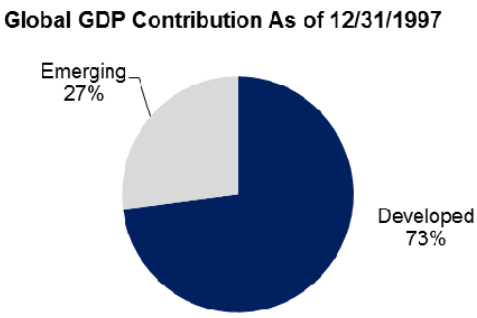
The C and S Fund's recommended benchmarks, the S&P 500 Index and the DJ U.S. Completion Total Stock Market Index, respectively, when combined, provide coverage of the broad U.S. equity opportunity set that is very similar to the coverage provided by the DJ U.S. Total Stock Market Index.

The I Fund's existing benchmark, the MSCI EAFE Index, excludes Canada and the emerging markets. As noted earlier, the Canadian equity market is the fourth-largest equity market outside of the United States and emerging markets represent nearly a fourth of the non-U.S. equity opportunity set. Moreover, emerging markets represent a significant and growing portion of global growth or GDP and an increasingly larger portion of the world equity market capitalization. Over the past two decades, emerging economies, such as Brazil, China, India, Russia and South Africa, have expanded at a much faster pace than developed countries.

Today, emerging markets contribute to 39% of global GDP as compared to 27% in 1997 (shown in Chart 6).

Chart 6: World GDP Breakdown

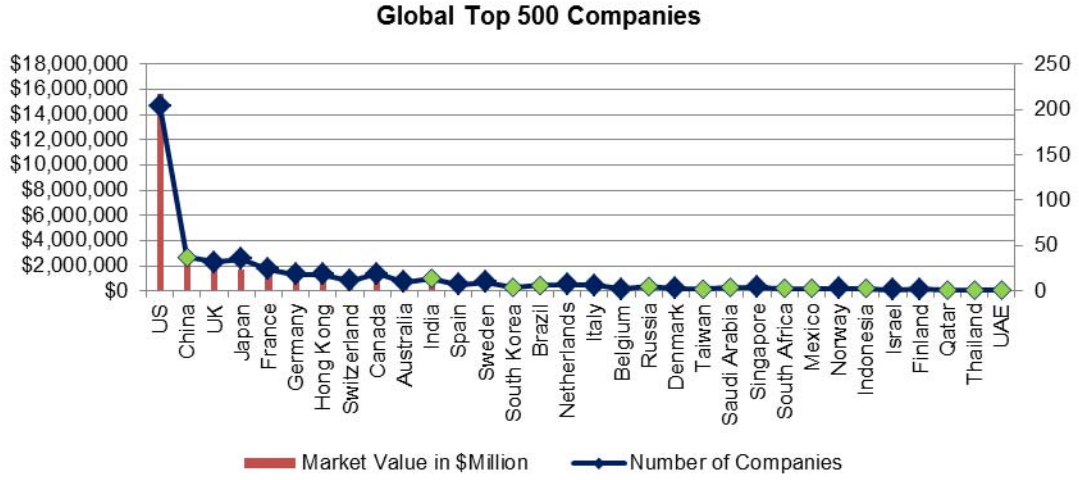




Source: The Conference Board of Global Economic Outlook

With the growth in emerging economies, several of the world's top-500 companies by market capitalization are based in the emerging markets (See Chart 7).

Chart 7: Emerging markets presence in the global capital markets



As of 6/30/2017
Source: Financial Times

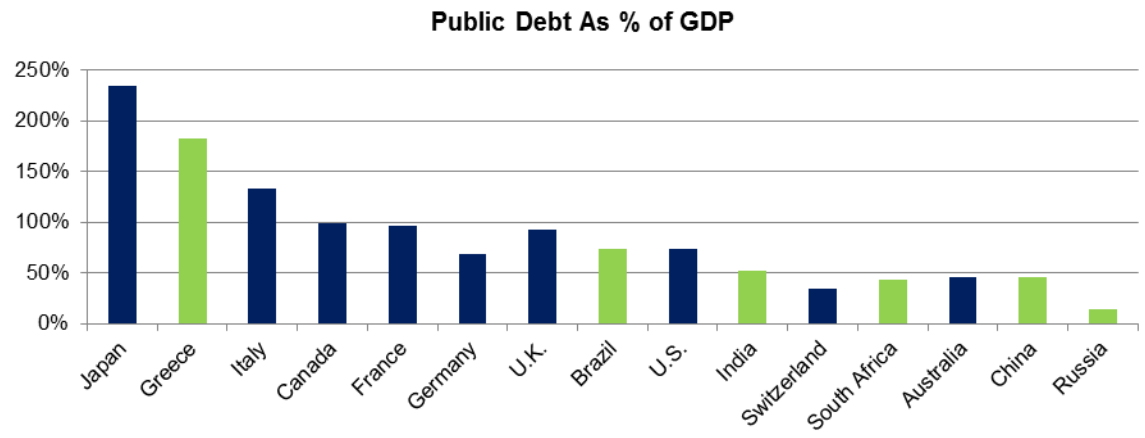
Market participants broadly expect emerging economies to continue to grow at a faster pace than developed economies. Reasons include:

- Favorable demographics and a growing middle class
- Growth in local consumption demand
- Improving economic, legal and regulatory systems

- Disciplined fiscal and monetary policies

Emerging countries today run surplus budgets and are much less burdened by massive amounts of public debt as compared to their developed counterparts (Chart 8). Several emerging market countries have also accumulated massive amounts of foreign currency reserves (Chart 9), which have proven to provide a cushion against external economic shocks. The growth in foreign currency reserves, combined with growth in domestic consumption, helped many emerging economies soften the impact of the global economic downturn.

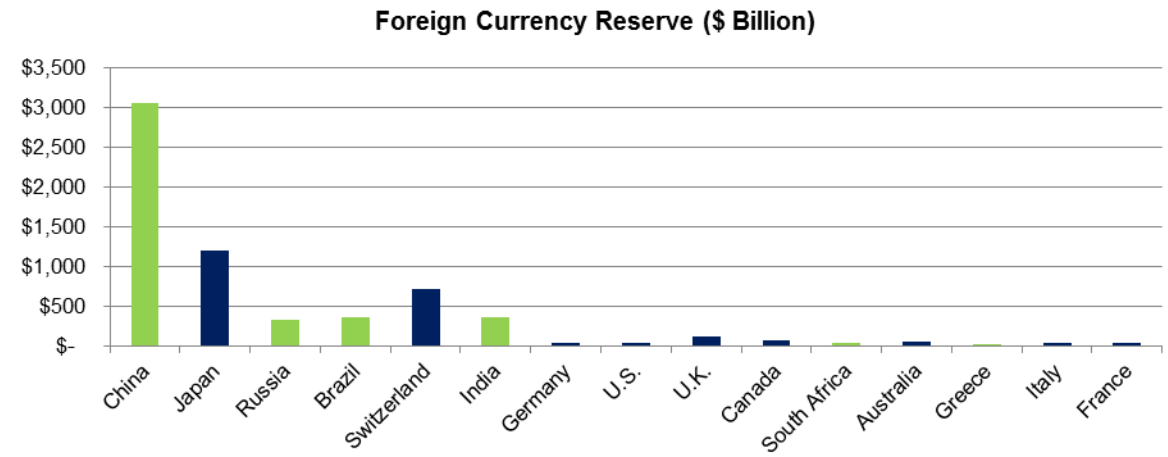
Chart 8



As of 6/30/2017

Source: CIA World Factbook

Chart 9



As of 6/30/2017

Source: IMF

Along with the growing economic power of emerging markets as a whole, the capital markets in several emerging countries have also evolved over the past decade. Data from The World Federation of Exchanges shows that, assessed by total market capitalization and trade value, China's two major stock exchanges, if combined, rank the third-largest in the world after the New York Stock Exchange and NASDAQ. Other emerging countries such as Brazil, India, Korea, and Taiwan also claimed spots within the top-20 stock exchanges at the end of 2016. With the improved liquidity and transparency, lower

transaction costs, and improved property rights and legal protections, institutional investors have become more comfortable investing in emerging markets.

While the case for investing in emerging markets has become more compelling, emerging markets have experienced, and, in our opinion, will experience greater volatility than that of developed markets. Some of the risks in emerging markets include:

- Political risk (rogue regimes, expropriation of assets, etc.)
- Slowing down or a reversal of favorable economic and monetary policies
- A higher willingness based on historical experience to default or devalue their currencies
- Growth that is heavily dependent on or tied to growth in developed markets (exports, commodities, etc.)

While several of these risks are not easily quantified, we do believe investors get compensated for these risks on a risk-adjusted basis. The volatility of emerging markets has been higher than developed markets over the last decade or two, but emerging markets have been able to outperform developed markets on a risk-adjusted basis.

Table 33 shows Aon Hewitt's expected returns and risk (volatility) for developed and emerging markets over the long-term. These represent 30-year forward looking expectations.

Table 33: Aon Hewitt – Capital Market Expectations (Q3 2017)

	Expected Return	Expected Risk
Developed Markets	7.3%	20.0%
Emerging Markets	7.7%	30.0%

As shown, we expect emerging markets to perform favorably as compared to developed markets, but at a materially higher level of risk.

As for non-U.S. small cap stocks, because commonly used benchmarks for international equity, MSCI EAFE and MSCI ACWI ex U.S. indices, do not contain small cap names, we believe that non-U.S. small cap stocks are under-invested relative to their U.S. small cap peers. Additionally, relative to larger peers, smaller companies in the index are covered by a smaller pool of sell-side analysts. This under-investment and lack of analyst coverage may lead to less market efficiency and a greater return potential.

Non-U.S. small cap stocks are also tied more to their local economies than to the global economy. The lack of connection from the global economy should provide lower correlations to the broader equity market. Consequently, we believe that adding non-U.S. small cap exposure will likely improve the Sharpe ratio of the overall non-U.S. equity portfolio.

The broad non-U.S. equity market is of significant market size and index assets under management are large. The broad non-U.S. equity market provides diversification across country, sector, and market capitalization. By broadening the exposure of the I Fund, increases stock coverage by 939 stocks in the case of the MSCI ACWI ex U.S. Index and 5,268 stocks in the case of the MSCI ACWI ex U.S. IMI as of June 30, 2017.

Overall, we favor a benchmark that includes Canada, emerging markets, and international small cap equities as it provides broader coverage of the international equity markets, more fully captures global growth, and provides enhanced diversification of the international equity portfolio. From a theoretical standpoint, we recommend that clients utilize the MSCI ACWI ex U.S. or MSCI ACWI ex U.S. IMI as these indices provide complete coverage of the global equity opportunity set.

However, as we consider an appropriate benchmark for the I Fund, it is important to take into account the Thrift Savings Plan's unique circumstances. These include:

- Need to provide daily-liquidity
- Transition cost and planning
- Securities lending income
- Administrative complexities: coordinating custody account openings in emerging markets, which are generally more complex and time consuming.

Considerations in Expanding the I Fund benchmark to Index Emerging Markets

As we review the I Fund's current benchmark, the MSCI EAFE Index, the case to include Canada is very compelling and obvious given that it is the fourth-largest equity market outside the U.S. and a country that participants should have familiarity with.

The case for the inclusion of emerging markets and international small cap equities, while compelling, we will further investigate within this report. The foremost consideration in expanding the I Fund benchmark to include emerging markets and international small cap equities is the need to provide daily liquidity. A sufficient level of cash must be maintained in the fund to meet participant withdrawal needs. As an example, BlackRock, the existing manager of the I Fund, holds approximately 0-3% of the Fund's assets in cash in order to meet routine liquidity needs. The cash is equitized to the markets using futures contracts. While the use of futures contracts minimizes the cash drag on the portfolio, the futures contracts may not always track the benchmark precisely (if multiple country futures contracts are used to track a benchmark) or may not have adequate levels of liquidity. This could lead to potential sources of tracking error.

Liquidity

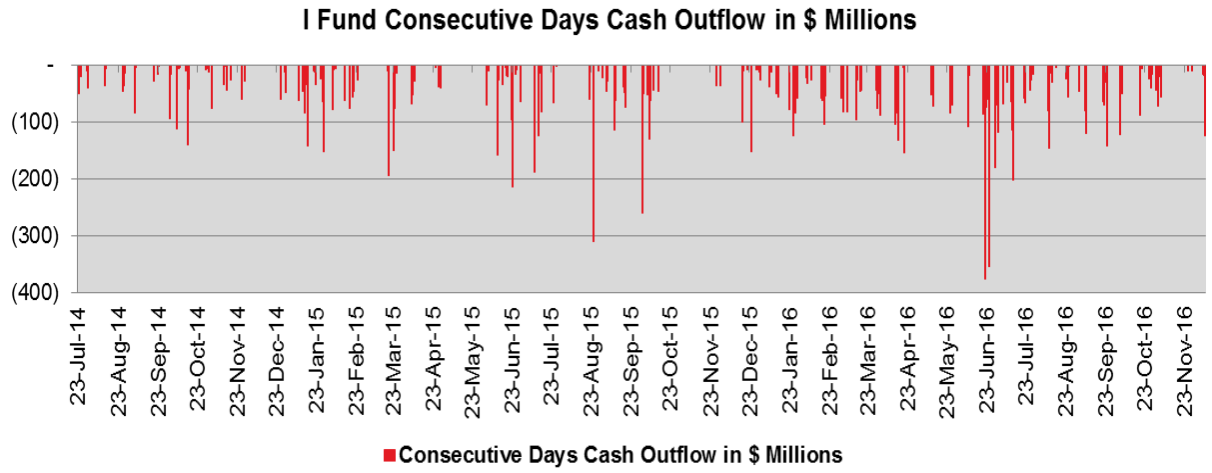
We reviewed the TSP I Fund's daily cash flow activity over the three-year period ending June 30, 2017. As of June 30, 2017, the I Fund's assets stood at $41.8 billion, as compared to $36.2 billion in July 2014 (directly/indirectly through the L Fund). This period was characterized by moderate volatility across most major capital markets, but the emerging markets experienced high volatility.

We focused our attention on withdrawals out of the I Fund over the three-year period in order to assess the ability to provide liquidity on a daily basis to meet participant redemption requests. The average daily withdrawal over the period was $55 million, which on an asset base of $42 billion represents about 0.13% of assets. The largest single cash withdrawal out of the I Fund was $376 million, which occurred on June 21st, 2016. This cash flow represented 1.1% of the I Fund's assets as of that day. While the data shown on the following page does not include 2008, we do note that in January 2008 there were four consecutive days where the total net cash flow equaled approximately $1.4 billion, illustrating an extreme outcome that should be noted and considered when evaluating the cash flow needs of the TSP.

While the average daily cash withdrawal and the largest single day withdrawal are well within the cash buffer that it maintained to meet ongoing liquidity, as mentioned earlier, withdrawals tend to spike around periods of poor market performance. We reviewed aggregate cash flows over consecutive days of withdrawals out of the I Fund over a three year period. There were 24 instances when aggregate withdrawals over consecutive days exceeded $200 million over this period and 10 instances when aggregate withdrawals over consecutive days exceeded $300 million. Chart 10 shows the trend in aggregate withdrawals over consecutive days over the three-year period.

There has been one instance where cash flows over multiple days equaled approximately $950 million (which occurred between June 20th, 2016 and June 24th, 2016), illustrating an extreme outcome that should be noted and considered when evaluating the cash flow needs of the TSP.

Chart 10

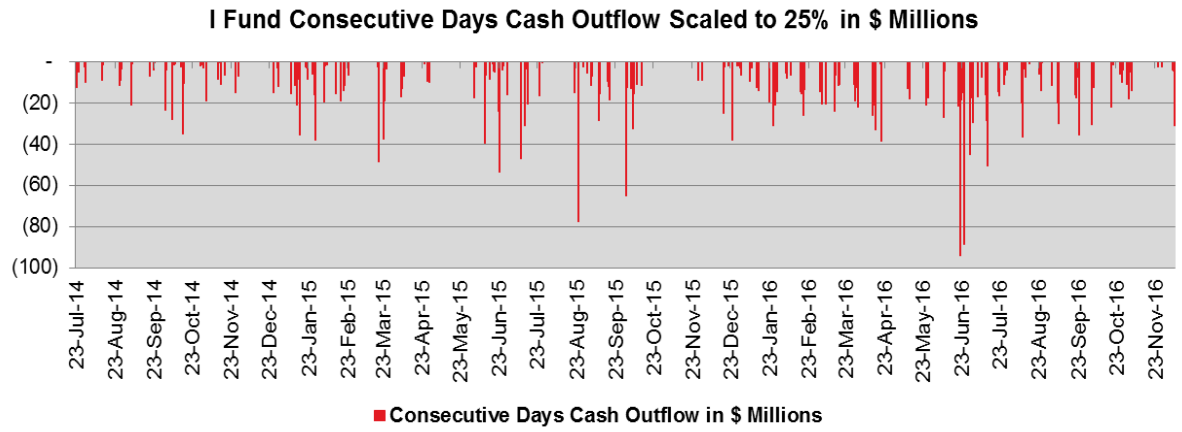


As we think about the inclusion of emerging markets into the benchmark for the I Fund, it is critical to take into consideration the liquidity needs of the TSP. While the liquidity in emerging markets has generally improved, we typically see a flight to quality from emerging markets (and other riskier markets) in times of market stress. Liquidity can be adversely impacted in times of market stress.

Based on discussions with index fund managers, they indicate that they are normally able to trade about $200 million to $300 million in emerging market flow on a daily basis through the use of futures contracts, without impacting the prices of securities adversely.

Chart 11 shows the withdrawals over consecutive days for the I Fund at 25% of the actual cash flow. Emerging markets represent approximately 25% of non-U.S. equity markets and hence this analysis gives us a sense for the potential extent of emerging market flows.

Chart 11



While the average cash outflow (from the I Fund scaled to 25%) over this period appears to be well within the $200 - $300 million range that managers indicate that they are able to comfortably trade in emerging markets, there is one instance where the cash flows over consecutive days aggregated within the $200 - $300 million range (which occurred between June 20th, 2016 and June 24th, 2016).

Further, it is important to note that these cash flows represent I Fund (developed market) cash flows scaled to 25%. The inclusion of emerging markets in the I Fund benchmark could result in a higher level of cash withdrawals in times of market stress given the higher volatility of emerging markets.

We have taken in consideration the projected increase of inflows to the TSP program, which is driven by the expected growth in the number of participants compounded by the upcoming addition of military personnel to the TSP program. The expected growth is projected to be about $1-1.5 billion in net inflows into the I Fund (directly/indirectly through the L Fund) annually over the next ten years. During periods of large flows, futures can be used to quickly gain or divest exposure. When expanding the coverage of the I Fund to track to the ACWI ex U.S. IMI, the investment strategy is to fully replicate the benchmark by owning the majority of the names in the benchmark, if not all. However due to liquidity challenges in certain markets, the small cap portion may be optimized at any given time. Since the small cap segment of the index represents 14%, the impact on tracking error is expected to be marginal. Overall, liquidity is managed through the use of the I Fund's cash buffer and other tools such as optimization and derivatives.

Derivatives play a role in managing I Fund liquidity during time periods where local foreign markets are closed. The existence of a liquid market for emerging market futures contracts also allows index fund managers to manage cash flows more efficiently, resulting in tighter tracking of the Index. Derivatives also

mitigate daily tracking error since futures contracts are traded during U.S. market hours and incorporate fair value pricing (FVP). FVP is an adjustment made by passive providers to align the closing price or NAV of a passive fund with the current value of that Fund's underlying holdings. FVP is typically used in international equity funds that are priced at the U.S. market close. Therefore, there may be price adjustments made to foreign securities from the local market close to the U.S. market close due to events or news that impacted the securities' price after the local market close. In order to mitigate tracking error, U.S. index managers typically trade closer to the U.S. market close. Since international local markets are generally closed by then, the manager will utilize futures contracts to get exposure to the equity market or can close out of future contracts in the event liquidity is needed. Over time, the index manager will close out of futures contracts and rebalance the portfolio through physical securities. Therefore, the liquidity of the derivatives market for emerging markets is critical in this analysis. In August 2017, emerging market futures contracts traded approximately $2.8 billion a day. Futures exposure is not available for international small cap exposure; therefore small cap exposure would be obtained through physical securities and potentially ETF instruments to assist in cash management needs. The daily tracking error when not owning international small cap is estimated to be between 2 to 3 bps a day. We believe the inclusion of emerging markets and international small cap equities to the I Fund will not hinder the ability to meet the TSP's daily liquidity needs. The TSP's historical daily cash flow activity over the last three years have been at reasonable levels where the activity can be traded in emerging markets without adversely impacting the prices of securities. As mentioned earlier, the trading would likely be conducted through derivatives, a market with ample liquidity. In the event cash flow activity is above the $200-$300 million trade size for emerging markets, the index manager may have to trade futures contracts across a longer time period than trading at the market close, which may increase the tracking error of the mandate.

Transaction Costs & Planning

Table 34 details the estimated costs involved in transitioning the Fund's benchmark from the MSCI EAFE Index to the indexes under review. The estimated cost in dollars is based on expected trading costs and the asset value of the I Fund as of June 30, 2017, which was $42 billion.

Table 34: Trading Costs for Multi-Tranche Transition

	MSCI ACWI ex U.S. IMI		MSCI ACWI ex U.S.		MSCI World ex U.S.	
	bps	**$**	**bps**	**$**	**bps**	**$**
Commissions	2.0	9,086,743	2.0	8,174,568	0.0	1,346,824
Taxes	3.0	12,432,423	2.0	7,195,272	0.0	162,293
Bid/Ask Spread	3.0	13,851,323	2.0	8,535,685	0.0	1,233,350
Market Impact	3.0	12,988,306	2.0	10,127,249	0.0	1,403,012
FX Cost	2.0	9,130,495	2.0	9,052,494	0.0	1,955,712
Mean Expected Cost	**13.0**	**$ 57,489,291**	**10.0**	**$43,085,267**	**1.0**	**$6,101,190**
Opportunity cost	+/-15.0	+/-$65,077,507	+/-15.0	+/-$63,786,286	+/-7.0	+/-$28,037,955

Source: BlackRock

I Fund

The transaction cost associated with transitioning the I Fund's benchmark from the MSCI EAFE Index to the MSCI ACWI ex U.S. IMI is expected to be about 13 basis points or approximately $57 million on average. Depending on market activity at the time of the transition, we would expect the actual cost of transition to range between a cost of 28 bps ($122.6 million) or a gain of 2 bps ($7.6 million) about 67% of the time. We believe that these transition costs are reasonable given the overall shift from developed markets to emerging markets as well as into international small cap.

We recommend that the transition be conducted in a phased, methodical manner over a period of time as liquidity opportunities present themselves, as opposed to a transition in a day or a few days. To rebalance from MSCI EAFE to MSCI ACWI ex U.S. IMI, will result in approximately a 59% overlap between the legacy and target portfolios. To help lower bid/ask spread and market impact costs associated with the transition, it is expected that 10 to 12 trading tranches will be required to achieve 99% of the rebalance. The residual 1% is expected to take an additional few weeks to reach 100% completion. The tranches will occur every 2 to 5 days over the span of 1 to 2.5 months. Each tranche would be built to match the composition of the target index. Tranche size will depend on the liquidity of the required rebalance trade with an expected size of $3.6 billion.

The analysis assumed the transition trading will be executed at the same commission levels that the TSP currently pays to execute global equity trades. Therefore, the analysis assumed the TSP will not pay additional commissions over what they generally would incur.

We recommend using a transition account to build each tranche; therefore assets for each tranche will be transferred out of the legacy account to the transition account. Once the tranche is built to match the composition of the target index, assets are transferred to the target portfolio account. Performance will be tracked separately for the legacy, target, and transition accounts and participants will experience the return of all three accounts as the performance of all three accounts will be rolled up into a composite return. In this fashion, the historical return stream of the legacy I Fund may be maintained and not impacted by the transition. The legacy portfolio will continue to track the MSCI EAFE Index and the target portfolio will track the new target benchmark. This is feasible since the transition will be done in multiple tranches and each tranche will be rebalanced in the transition account and then transferred to the target portfolio. This approach is also cleaner from a portfolio management stand point, since the portfolio manager will manage the legacy and target portfolio accounts while the transition management team will manage the transition account. Please note securities lending would be occurring in the legacy and target portfolio accounts and would also need to be setup in the transition account in order to not impact securities lending revenue. Since the legacy portfolio has almost 60% overlap with the target portfolio, each tranche in the transition account will have the same level of overlap. Since not all securities are lent out at a given time, securities out on loan that are transferred to the transition account will be maintained throughout the transition event and any loans opened on emerging market stocks will be transferred to the target portfolio once tranche is rebalanced. The setup process for securities lending can be done with rest of the transition setup and would not be expected to delay transition start date.

In this scenario, the performance benchmark during the transition period would generally be daily asset weighted between MSCI EAFE Index and the target benchmark. The legacy portfolio will be benchmarked against the MSCI EAFE Index and the transition and target portfolio accounts would be benchmarked against the target benchmark. The tracking error between the I Fund's performance and the custom benchmark would be due to the transaction costs associated with the benchmark change.

The main considerations in this scenario are the setup of securities lending for an additional account (transition account) and the additional operational step in the movement of assets as securities will need to be moved to the transition account and then to the target portfolio. We believe the benefits outweigh the considerations given the portfolio manager accounts are isolated from the transition account, performance benchmarking can be easily tracked, and historical MSCI EAFE return stream should not be impacted by the transition.

Another option is to conduct the rebalancing in the legacy account where the existing portfolio is rebalanced over multiple tranches and each tranche will be transferred to the target portfolio as they are completed. Having two accounts instead of three may result in less operational work given assets will only need to be transferred to the target portfolio. If the rebalance takes place in the legacy portfolio, transition related performance is not easily tracked and historical strategy performance for the I Fund can be impacted. It will also not be as clean for the portfolio manager to manage the legacy assets and transition team to manage the transition when all assets will be held in the same legacy account until each tranche is completed.

Performance benchmarking in this scenario would not be as clean given the legacy assets are being managed in the same account as the transition is taking place. Therefore, the legacy account including the transition assets would be benchmarked against the MSCI EAFE Index and the target portfolio would be benchmarked against the target benchmark.

A benefit of this scenario relative to the first scenario is not having to setup securities lending in the transition account. Another benefit is fewer custodial asset movements. We believe the considerations outweigh the benefits largely due to the potential for heightened operational risk given that the portfolio manager and transition team are managing assets in the same account. However, major passive providers typically have the capabilities to conduct the transition in the legacy account if desired. Additionally, the transition assets would not be benchmarked against the target benchmark since the assets would be held in the legacy account.

Securities lending

The market demand for lending emerging markets and international small-cap equity is generally greater than developed large and mid-cap names. The higher demand is primarily driven by the lack of supply of small capitalization securities available for lending. The same reason applies to emerging markets, although demand is not as prominent. Other reasons for the higher demand for these two segments are the higher volatility associated with these two markets and less public information compared to developed large and mid-cap names.

The following tables outline the expected yield and utilization changes as a result of a move from the EAFE to either ACWI ex U.S. or ACWI ex U.S. IMI. The yields for EAFE listed below are actual yields that the TSP has experienced as part of the I Fund. The yields referenced below incorporate both intrinsic and reinvestment yield and only account for the net yield to the TSP. The ACWI ex U.S. IMI generated the highest expected yield and percentage out on loan. We applied the average daily market value of the I Fund to the below estimated yields in order to derive the estimated yield in dollars. The following table illustrates that across each of the last three calendar years, the income to the TSP is estimated to have been at least 1.5x more if the I Fund tracked the MSCI ACWI ex U.S. IMI instead of the MSCI EAFE index.

Table 34: Securities Lending Yield Estimates

Yield to TSP (bps)			
	EAFE	ACWI ex U.S.	ACWI ex U.S. IMI
2014	7.1	7.3	9.3
2015	8.1	8.8	12.6
2016	8.1	9.6	14.8
2017 (YTD)*	5.7	6.6	10.7
Yield to TSP ($ millions)			
	EAFE	ACWI ex U.S.	ACWI ex U.S. IMI
2014	$24	$25	$32
2015	28	31	44
2016	27	32	50
2017 (YTD)*	22	25	41
On-Loan %			
	EAFE	ACWI ex U.S.	ACWI ex U.S. IMI
2014	3.4%	3.5%	4.4%
2015	3.2%	3.6%	4.9%
2016	3.9%	4.8%	6.2%
2017 (YTD)*	3.2%	4.2%	5.5%

Source: BlackRock
* 2017 YTD is annualized using data through 7/31/2017

Operational Considerations

Please note the following custody considerations apply to international strategies managed in separate accounts. Most of the world's largest custodians do not have custody operations in every country, requiring these organizations to contract with a local custodian that does have these local capabilities. Requiring global custody services introduces additional risks including:

- Failure or default of sub-custodian that could result in losses if proper segregation of securities and cash is not in place
- Lack of contingency planning and/or sufficient contractual protection by main custodian for adverse organizational events
- Settlement and other operational-related risks if the sub-custodian does not have strong controls & processes in place

We believe the above risks are generally mitigated across the world's largest custodians since the custodian is responsible for selecting the foreign custodian (sub-custodian), which is typically based on a very robust, in depth, and complex due diligence process. Custodians also monitor their sub-custodian relationships on an ongoing basis to ensure financial stability, monitor changes in personnel, and identify any changes to the business (technology, client service structure, etc.) that warrants a change.

Settlement Risk

Settlement cycles vary across market; settlements tend to range from T+1 to T+5. This can cause out of market balances, overdrafts, or leverage. Passive managers may use broker-facilitated short settlements and their FX trading desk to ensure settlement cycles match up.

Local Account Openings

Majority of market accounts are expected to take no longer than 8 weeks to open with an exception to India that is projected to take 6 months to open. During the 6 months, passive managers can obtain exposure to the Indian market by using ADRs/GDRs, ETFs, derivatives, and potentially omitting. This can cause potential for delays in a full replication strategy and also potential for higher tracking error.

Transferability of Stocks

In emerging markets, a number of countries do not allow for shares to be transferred between accounts nor do they allow for change of beneficial ownership. If the market does allow assets to be transferred, there is generally an associated charge around exchange fees, stamp taxes, registration fees, etc.

Restricted Currencies

There are emerging market currencies that are restricted, which means currency trades can only be traded by the local sub-custodian whereas in developed markets, currency trades can be auctioned to a number of banks in order to receive the most favorable rate. Restricted currencies can result in higher tracking error. Major passive providers tend to have a rigorous due diligence framework before utilizing local FX agents. They also conduct ongoing monitoring and review of FX executions.

Local tax advisor

The client is generally responsible for hiring local tax advisors in some emerging markets such as Pakistan, Taiwan, and India. Passive providers may assist the TSP in hiring a local tax advisor in these countries depending on the account structure the TSP has in place. Given the TSP's existing account

structure, the passive manager would generally provide meaningful amount of assistance in hiring a local tax advisor in these countries.

Foreign ownership limits

International companies may impose foreign ownership limits on their stock. Passive managers tend to optimize around foreign ownership limits. Foreign ownership limitations can result in potential higher tracking error.

Repatriation issues

In markets where repatriation issues exist such as Egypt, custodial standing instructions may be used to begin the repatriation process. Passive managers may also choose to reduce the size of the fund's exposure to such a country to mitigate the risk of delayed repatriation. This can result in potential delay in receiving proceeds in USD and thus can result in potential higher tracking error.

Political Risk

Political risk is managed on a case-by-case basis, in consultation with passive provider. Passive managers may use various strategies to mitigate emerging market political risk to the extent possible. One example is shifting exposure from local currency names to depository receipts to mitigate liquidity risk in a market that may be at risk for capital restrictions/sanctions.

Potential for Higher Custody Cost

Custody costs for the safekeeping of international assets could potentially be higher than current fees given the exposure to less developed markets. We list below the typical range for asset based custody fees by benchmark.

- MSCI EAFE: 0.65 bps – 1.20 bps
- MSCI ACWI ex U.S. IMI: 1.65 bps – 2.75 bps
- MSCI Emerging Markets: 3.75bps – 7.20 bps

As for transaction fees, these fees are charged each time a security is bought or sold and are used to cover the costs associated with clearing and settlement. The actual transaction fee in any given year can vary based on trading volume. Per trade cost typically range from $20 per trade to $100 per trade based on emerging market country. The average per trade cost across the countries that make up the MSCI Emerging Market index is approximately $50. Please note custody fees vary and are highly dependent on specific client size, composition, and other circumstances.

Source: BlackRock

Account Timeline and Documentation

Table 35 lists the estimated time frame of the account opening process for each country. Majority of market accounts are expected to take no longer than 8 weeks to open with an exception to India that is projected to take 6 months to open.

Table 35: Custody Account Timeline

Global Market	Acct Open Timeframe
BRAZIL	1-4 weeks
CHILE	4-5 weeks
CHINA	2-4 weeks
COLOMBIA	2-4 weeks
CZECH REPUBLIC	5-7 weeks
EGYPT	3-6 weeks
GREECE	5-10 days
HUNGARY	2-10 days
INDIA	6-12 months
INDONESIA	2-5 days
MALAYSIA	2 weeks
MEXICO	2-5 days
PAKISTAN	8-12 weeks
PERU	5-10 days
PHILIPPINES	2-5 days
POLAND	5-7 weeks
QATAR	4-8 weeks
RUSSIA	5-8 weeks
SOUTH AFRICA	2-5 days
SOUTH KOREA	3-5 weeks
TAIWAN	5-6 weeks
THAILAND	1-2 weeks
TURKEY	5-7 weeks
UAE	5-7 weeks

Source: BlackRock

Country specific custodial documentation is required in order to trade in international markets. The table on the following page outlines the required documentation for registration by emerging market country. Given the TSP's existing account structure, the TSP's responsibility should be reduced as the passive manager would generally take on some of the market opening responsibilities. It is anticipated that the TSP would be responsible primarily for attestation letters and 8802 forms.

Listed on table 36 is a list of documents required by country and the TSP's role in providing documentation.

Table 36: Documentation Requirements

Market	Documents for Registration	Version	Need from Client?
Brazil	TBD - Brazil requirements changing	TBD	TBD
Chile	Authorized Signatory List (ASL)	Copy	No, on file
	Attestation of True Copy for Authorized Signers List	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
	EIN Letter (SS4) or Certificate of Residency (COR)	Copy	Yes - Provide completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of EIN or COR	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
China (HK)	No additional client documentation required	N/A	China A shares will be added to ACWI Index May of 2018 - Will trade via Stock Connect, may require additional client docs
Colombia	No additional client documentation required	N/A	N/A
Czech Republic	No additional client documentation required	N/A	N/A
Egypt	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
Greece	No additional client documentation required	N/A	N/A
Hungary	No additional client documentation required	N/A	N/A
India	Authorized Signatory List (ASL)	Copy	No, on file
	CRS Forms / FATCA	Copy	Yes - May need CRS form
	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
Indonesia	No additional client documentation required	N/A	N/A
Malaysia	Attestation Letter, declaring the beneficial owner of securities in the account	Original	TBD - Passive Manager may complete, if not, may need on client letterhead

Market	Documents for Registration	Version	Need from Client?
	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
Mexico	No additional client documentation required	N/A	N/A
Pakistan	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
Peru	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
Philippines	No additional client documentation required	N/A	N/A
Poland	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
Qatar	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
Russia	No additional client documentation required	N/A	N/A
South Africa	No additional client documentation required	N/A	N/A
South Korea	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
Taiwan	Broker Accounts Request	Original	TBD - Passive Manager will complete, may need supporting client docs
	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
Thailand	No additional client documentation required	N/A	N/A

Market	Documents for Registration	Version	Need from Client?
Turkey	Client Attestation and/or Certification Letter (Tax ID or Address)	Original	Yes - Provide completed 8802 (SSB obtain 6166)
	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
UAE	Authorized Signatory List (ASL)	Copy	No, on file
	Attestation of True Copy for Authorized Signers List	Original	TBD - Passive Manager may complete, if not, may need on client letterhead
	Proof of Legal Existence and/or Constitutive Document	Copy	Yes - Provide Formation document or completed 8802 (SSB obtain 6166)
	Attestation of True Copy for Proof of Legal Existence and/or Constitutive Documents	Original	TBD - Passive Manager may complete, if not, may need on client letterhead

Source: BlackRock

Table 37 on the following page outlines the account structures that would be used to open the emerging market accounts for the I Fund. Regardless of the account structure, the TSP would always be considered the legal and beneficial owner of the assets. However, in the case where the account structure is an omnibus account, the TSP's existing manager may be the registered owner of the assets on the local exchange. The third column of the table highlights which party is the registered owner. We have also outlined which securities are permitted to be transferred in-kind to another account held in the name of the TSP in the event the TSP were to move to an independent custodian in the future. There are conditions to consider that are country specific and may include increased documentation, disclosure to the local regulator, pre-approval to trade, and fees. Please note the account structure and registered owner of assets may change upon the existing manager's planned custody conversion.

Table 37: Account Structure

Market	Acct Structure	Legal/Registered Owner	In-Kind Permitted
Brazil	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Chile	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
China (HK)	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	No
Colombia	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Czech Republic	Omnibus	Current Manager	Yes
Egypt	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	No
Greece	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Hungary	Omnibus (Umbrella)	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes
India	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Indonesia	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Malaysia	Omnibus	Current Manager	Yes – conditions apply
Mexico	Omnibus	Current Manager	Yes
Pakistan	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Peru	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Philippines	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Poland	Omnibus (Umbrella)	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Qatar	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Russia	Omnibus (Umbrella)	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
South Africa	Omni	Current Manager	Yes – conditions apply
South Korea	Omnibus (Umbrella)	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Taiwan	Omnibus (Umbrella)	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
Thailand	Omnibus	Current Manager	Yes
Turkey	Omnibus (Umbrella)	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply
UAE	Segregated	Federal Retirement Thrift Investment Board - Thrift Savings Plan	Yes – conditions apply

Source: BlackRock

Benchmark Recommendation for the I Fund

We recommend replacing the I Fund's benchmark, which is currently the MSCI EAFE Index with the MSCI All Country World ex-U.S. Investable Market Index.

Our recommendation is based on the following reasons:

- The MSCI indices remain the most popular indices for U.S. based institutional investors investing in overseas equity markets.
- The transition costs associated with the change in the I Fund benchmark are reasonable.
- Market Exposure:
  - Canada is the fourth-largest equity market in the world, representing 6.6% of the developed non-U.S. equity opportunity set.
  - Emerging Markets represents 23.5% of the international non-U.S. equity investable universe.
- Liquidity:
  - We believe the inclusion of emerging markets and international small cap equities to the I Fund will not hinder the ability to meet the TSP's daily liquidity needs.
  - Overall, liquidity is managed through the use of the I Fund's cash buffer and other tools such as optimization and derivatives.
  - Additionally, historical daily cash flow assessment scaled to 25% illustrates cash flow activity was at reasonable levels to be traded in emerging markets without adversely impacting the prices of securities.
- Securities Lending:
  - The ACWI ex U.S. IMI generated the highest expected yield and percentage out on loan.
  - Across each of the last three calendar years, the income to the TSP is estimated to have been at least 1.5x more if the I Fund tracked the MSCI ACWI ex U.S. IMI instead of the MSCI EAFE index.

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APPENDIX

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Appendix

The below table outlines some of the transfer restrictions that apply across emerging market countries. The table also lists which countries have restricted currencies.

Global Market	Change of Beneficial Owner (CBO) Movement	FX Considerations
BRAZIL	Client Cross Market	Restricted Market - Agent FX
CHILE	Client Cross Market	Restricted Market - Agent FX
CHINA	--	Settled against HKD on SHENZHEN exchange
COLOMBIA	No Free movement with No Change of Beneficial Owner (NCBO) or CBO	Restricted Market - Agent FX
CZECH REPUBLIC	--	--
EGYPT	Client Cross Market	Restricted Market - Agent FX Sells settle T+2 from day of clearing funds (trade settlement). Buys can settle same day. Cannot be executed on a greater than Spot (T+2) basis.
GREECE	Client Cross Market	--
HUNGARY	--	--
INDIA	Client Cross Market / NCBO Free of Payment (FOP) = client must have SEBI (Indian Exchange) Approval for FOP. Must write letter to SEBI requesting approval, takes from a few days to a few weeks.	Restricted Market - Agent FX
INDONESIA	--	Restricted Market - Agent FX
MALAYSIA	Client Cross Market	Restricted Market - Agent FX Transfers of MYR can only be done as NCBO.
MEXICO	Client must make determination of NCBO (No Costs) or CBO. If CBO, the official procedure per local securities laws would require crossing thru a broker. However, this can be achieved without crossing as long as the client understands they bear the risk of any repercussions which might result from not following the official procedures.	--
PAKISTAN	Shares can be moved Free of Payment	Restricted Market - Agent FX
PERU	Client Cross Market	
PHILIPPINES	Client Cross Market	Restricted Market - Agent FX
POLAND	--	--
QATAR	Client Cross Market	Restricted Market - Agent FX
RUSSIA	Agent Registration Fees	USD Settlement
SOUTH AFRICA	--	--

Global Market	Change of Beneficial Owner (CBO) Movement	FX Considerations
SOUTH KOREA	Client Cross Market	Restricted Market - Agent FX
TAIWAN	Client Cross Market	Can only net currencies if trades are done with the same broker
THAILAND	--	Restricted Market - Agent FX -2 account structure: NRBS for trading activity & NRBA for free cash moves). Cannot transfer cash between acct structures.
TURKEY	FOP is allowed, however for tax purposes the client should provide details of the underlying purchase/sale price they agree upon. BlackRock will handle on TSP's behalf.	--
UAE	Client Cross Market. Securities must be moved/held in a Designated Trading account in order to execute trades at broker.	--

Descriptions: CBO is Change in Beneficial Owner. NCBO is No Change in Beneficial Owner. If a transfer is CBO, all assets are re-registered to the new owner. Any stamp tax required for market trades are applied. For an NCBO, no stamp tax is due. Client Cross Market means that currency can move between accounts that the client holds. Currency cannot move from a commingled fund to a separate account.

Source: BlackRock

Return History

Table below details the annual return histories of the following indices.

	S&P 500	Russell 1000	Russell 3000	DJ U.S. Total Stock Market Index
1971	14.3%	--	--	--
1972	19.0	--	--	--
1973	-14.7	--	--	--
1974	-26.5	--	--	--
1975	37.2	--	--	--
1976	23.9	--	--	--
1977	-7.2	--	--	--
1978	6.6	--	--	--
1979	18.6	22.3%	24.1%	--
1980	32.5	31.9	32.5	--
1981	-4.9	-5.1	-4.4	--
1982	21.5	20.3	20.7	--
1983	22.6	22.1	22.7	--
1984	6.3	4.7	3.4	--
1985	31.7	32.3	32.2	--
1986	18.7	17.9	16.7	--
1987	5.3	2.9	1.9	2.3%
1988	16.6	17.2	17.8	17.9
1989	31.7	30.4	29.3	29.2
1990	-3.1	-4.2	-5.1	-6.2
1991	30.5	33.0	33.7	34.2
1992	7.6	9.0	9.7	9.0
1993	10.1	10.2	10.9	11.3
1994	1.3	0.4	0.2	-0.1
1995	37.6	37.8	36.8	36.4
1996	23.0	22.4	21.8	21.2
1997	33.4	32.9	31.8	31.3
1998	28.6	27.0	24.1	23.4
1999	21.0	20.9	20.9	23.6
2000	-9.1	-7.8	-7.5	-10.9
2001	-11.9	-12.5	-11.5	-11.0
2002	-22.1	-21.7	-21.5	-20.9
2003	28.7	29.9	31.1	31.6
2004	10.9	11.4	11.9	12.5
2005	4.9	6.3	6.1	6.4
2006	15.8	15.5	15.7	15.8
2007	5.5	5.8	5.1	5.6
2008	-37.0	-37.6	-37.3	-37.2
2009	26.5	28.4	28.3	28.6
2010	15.1	16.1	16.9	17.5
2011	2.1	1.5	1.0	1.1
2012	16.0	16.4	16.4	16.4
2013	32.4	33.1	33.6	33.5
2014	13.7	13.2	12.6	12.5
2015	1.4	0.9	0.5	0.4
2016	12.0	12.1	12.7	12.6

Return History

Table below details the annual return histories of the following indices.

	Russell 2000	DJ U.S. Completion Total Stock Market Index
1979	43.1%	--
1980	38.6	--
1981	2.0	--
1982	24.9	--
1983	29.1	--
1984	-7.3	--
1985	31.1	--
1986	5.7	--
1987	-8.8	-3.5%
1988	24.9	20.5
1989	16.2	23.9
1990	-19.5	-13.5
1991	46.1	43.4
1992	18.4	11.9
1993	18.9	14.6
1994	-1.8	-2.7
1995	28.4	33.5
1996	16.5	17.2
1997	22.4	25.7
1998	-2.5	8.6
1999	21.3	35.5
2000	-3.0	-15.8
2001	2.5	-9.3
2002	-20.5	-17.8
2003	47.3	43.8
2004	18.3	18.1
2005	4.6	10.0
2006	18.4	15.3
2007	-1.6	5.4
2008	-33.8	-39.0
2009	27.2	37.4
2010	26.9	28.6
2011	-4.2	-3.8
2012	16.3	17.9
2013	38.8	38.1
2014	4.9	7.6
2015	-4.4	-3.4
2016	21.3	15.7

Return History

Table below details the annual return histories of the following indices.

	Bloomberg Barclays U.S. Aggregate	Bloomberg Barclays U.S. Universal	Citigroup BIG
1976	15.6%	--	--
1977	3.0	--	--
1978	1.4	--	--
1979	1.9	--	--
1980	2.7	--	2.8%
1981	6.3	--	6.5
1982	32.6	--	31.8
1983	8.4	--	8.2
1984	15.2	--	15.0
1985	22.1	--	22.3
1986	15.3	--	15.4
1987	2.8	--	2.6
1988	7.9	--	8.0
1989	14.5	--	14.4
1990	8.9	8.6%	9.1
1991	16.0	16.4	16.0
1992	7.4	7.5	7.6
1993	9.8	10.4	9.9
1994	-2.9	-3.1	-2.8
1995	18.5	18.5	18.5
1996	3.6	4.5	3.6
1997	9.7	9.8	9.6
1998	8.7	7.3	8.7
1999	-0.8	0.2	-0.8
2000	11.6	10.8	11.6
2001	8.4	8.1	8.5
2002	10.3	9.8	10.1
2003	4.1	5.8	4.2
2004	4.3	5.0	4.5
2005	2.4	2.7	2.6
2006	4.3	5.0	4.3
2007	7.0	6.5	7.2
2008	5.2	2.4	7.0
2009	5.9	8.6	5.1
2010	6.5	7.2	6.3
2011	7.8	7.4	7.9
2012	4.2	5.5	4.2
2013	-2.0	-1.3	-2.0
2014	6.0	5.6	5.9
2015	0.5	0.4	0.5
2016	2.6	3.9	2.7

Return History

Table below details the annual return histories of the following indices.

	MSCI EAFE	MSCI ACWI ex U.S. IMI	MSCI ACWI ex U.S.	MSCI World ex U.S.
1970	-11.7%	--	--	-14.4%
1971	29.6	--	--	31.8
1972	36.3	--	--	39.1
1973	-14.9	--	--	-11.4
1974	-23.2	--	--	-19.6
1975	35.4	--	--	31.0
1976	2.5	--	--	2.3
1977	18.1	--	--	16.1
1978	32.6	--	--	31.4
1979	4.8	--	--	9.4
1980	22.6	--	--	23.5
1981	-2.3	--	--	-3.9
1982	-1.9	--	--	-1.3
1983	23.7	--	--	23.8
1984	7.4	--	--	2.9
1985	56.2	--	--	50.8
1986	69.4	--	--	65.3
1987	24.6	--	--	24.2
1988	28.3	--	27.6%	27.5
1989	10.5	--	11.8	11.1
1990	-23.4	--	-23.0	-23.1
1991	12.1	--	13.6	12.0
1992	-12.2	--	-11.3	-12.3
1993	32.6	--	34.5	32.2
1994	7.8	--	6.4	7.3
1995	11.2	7.5%	9.6	11.4
1996	6.0	5.1	6.4	6.9
1997	1.8	-3.3	2.0	2.3
1998	20.0	12.0	14.5	18.8
1999	27.0	37.7	30.9	27.9
2000	-14.2	-19.4	-15.1	-13.4
2001	-21.4	-19.8	-19.7	-21.4
2002	-15.9	-12.9	-14.9	-15.8
2003	38.6	42.3	40.8	39.4
2004	20.2	21.9	20.9	20.4
2005	13.5	17.7	16.6	14.5
2006	26.3	26.5	26.7	25.7
2007	11.2	16.1	16.7	12.4
2008	-43.4	-46.0	-45.5	-43.6
2009	31.8	43.6	41.4	33.7
2010	7.8	12.7	11.2	8.9
2011	-12.1	-14.3	-13.7	-12.2
2012	17.3	17.0	16.8	16.4
2013	22.8	15.8	15.3	21.0
2014	-4.9	-3.9	-3.9	-4.3
2015	-0.8	-4.6	-5.7	-3.0
2016	1.0	4.4	4.5	2.7

APPENDIX