The Global Market Portfolio

Gregory Gadzinski, Markus Schuller, and Andrea Vacchino

Gregory Gadzinski
is an associate professor at the International University of Monaco and INSEEC Research Center in Monaco.
ggadzinski@monaco.edu

Markus Schuller
is the CEO of Panthera Solutions in Monaco.
mhschuller@panthera.mc

Andrea Vacchino
is a senior consultant at Panthera Solutions in Monaco.
avacchino@panthera.mc

KEY FINDINGS

- The authors provide two global market portfolio benchmarks, for retail and institutional investors, based on a measurable global capital stock, which include 87 existing indices within 11 asset classes.
- Their investable global market portfolio is built with ETFs only, therefore transparent and systematic. The total return index realizes a compounded annual average return of 4.7%, with a standard deviation of 10.1% during the period 2005 Q1–2020 Q2.
- Their non-investable global market portfolio realizes a compounded average return of 5.9%, with a standard deviation of 6.3% and a maximum cumulative drawdown of 20%. Thanks to a better allocation of resources toward real assets, diversification is then achieved and makes their total return index an efficient long-term portfolio benchmark.

ABSTRACT

Two years after the global capital stock of Gadzinski, Schuller, and Vacchino (2018) and 36 years after the world market wealth portfolio of Ibbotson, Siegel, and Love (1985), investors still lack a global composite portfolio benchmark that includes a broad spectrum of assets with weights in line with a fair representation of the stock of capital for each asset class. Despite ample evidence of the substantial use of alternatives and real assets in institutional portfolios, the authors argue that existing academic and practitioner attempts are still unable to provide a satisfactory approximation of the "true" global market portfolio. The authors fill this gap and provide two benchmarks: one for retail investors constrained by liquidity needs and one for institutional investors who have access to illiquid assets.

TOPICS

Portfolio construction, real assets/alternative investments/private equity, global markets, performance measurement*

This article provides an update on our previous report on the global capital stock (Gadzinski, Schuller, and Vacchino 2018) and offers a global market portfolio with a list of total return indexes covering a broad array of assets worldwide and their corresponding weights. More precisely, we provide monthly and quarterly returns of two versions of the global market portfolio, one investable and one non-investable, using a unique dataset encompassing financial and real assets. Until recently, most benchmark solutions for multi-asset strategies have typically focused on traditional financial assets, and the consequence is a partial picture of asset holdings. Therefore, our global total return indexes could serve as natural benchmarks of a growing number of multi-asset funds that diversify away from traditional portfolios.

*All articles are now categorized by topics and subtopics. View at PM-Research.com.

Although an accurate representation of the global market portfolio should use a market value–weighted mix of all tradable assets, the practical implementation of such a policy portfolio is far from straightforward. Market capitalization weighting is the crux of the problem, and too many previous articles have fallen short of the challenge of finding fair-value weights. Notably, the existing approximations of the global market portfolio still underrepresent real estate and private businesses and their historical evolution vis-à-vis traditional assets. Recently, Doeswijk, Lam, and Swinkels (2019) updated their former measure of the invested global multi-asset portfolio by considering a larger investment universe. The new additions include private equity, high-yield bonds, leveraged loans, inflation-linked bonds, and emerging market debt. However, their focus remains on the invested world, with the portfolio's weights determined by the market capitalizations for each asset class. However, market values based on the size of investable indexes (wrongly) imply that the weights of real estate and private corporations are much lower than their actual shares in global wealth. Moreover, these estimates are lower than the actual weights of these two asset classes in portfolios of major institutional investors. Many leading endowments have constantly increased their exposure to non-financial assets over the years. In 2019, the Yale endowment fund, which has been diversifying away from equity and bonds since 1985, allocated more than 60% of its funds to private equity, real estate, and natural resources. Our previous article provides less biased estimates of the stock of non-financial assets (Gadzinski, Schuller, and Vacchino 2018). At the time, we presented an estimation of the global capital stock that involved all identifiable and measurable financial and non-financial assets in the world economy.

As supported by the academic community (see Geczy 2014), real assets have become attractive to an increasing number of portfolio managers who pursue greater returns amid a lower-yield environment. Jordà et al. (2017) even claimed that housing has enjoyed equity-like returns with less risk, making it the best-performing asset class historically. However, Dimson, Marsh, and Staunton (2018) argued that this outcome may be spurious because of an underestimation of housing risk and an overestimation for stocks. Moreover, the authors highlighted that rental incomes are both difficult to predict and match to price indexes with the same properties consistently. Similar problems arise with private corporations, whereby their valuations are prone to many estimation errors (see Damodaran 2006).

Given that liquid and illiquid assets are difficult to compare, their inclusion in the same benchmark portfolio is another challenge. An easy-to-implement solution, well suited for our purpose, involves the use of liquid alternatives (Roll 2013). On one hand, there is a growing range of exchange-traded products (exchange-traded funds [ETFs]) available for real assets, and several articles have already underscored the wealth of choices for investors who want to harvest risk premiums by building multi-asset portfolios of ETFs (see Agrrawal 2013). On the other hand, diversification in multi-asset strategies can still be illusory if all constituents are highly correlated and equally exposed to extreme market downturns. Given that many investors look to international markets and alternative investments specifically for diversification benefits, it is incumbent upon the academic community to construct global portfolios that are more resistant to volatility spikes and major unwelcome economic shocks. Our global market portfolio should therefore be consistent with the principle of diversification, which is the cornerstone of modern portfolio theory. Markowitz famously called diversification "the only 'free lunch' in finance." Hence, a global market portfolio should aim to protect against growth shocks while retaining the possibility of substantial upswings (Podkaminer, Tollette, and Siegel 2019). Equity-based alternative ETFs may be contaminated by traditional asset classes during bear markets, thereby failing to provide diversification when it is needed the most. Non-investable indexes may be immune to those biases, enjoying lower volatility owing to smoothing returns while earning an illiquidity premium (see Linder 2018).

The rest of the article goes into detail on the assumptions and computations of the global market portfolio. We first update the global capital stock data of Gadzinski, Schuller, and Vacchino (2018). Next, we offer a list of investable and non-investable indexes to serve as a proxy for the global market portfolio, allowing for as much granularity as possible, from indexes of global asset classes to regional subasset classes. Finally, we report on aggregate returns and risk measures for our two versions of the global market portfolio.

THE GLOBAL CAPITAL STOCK UPDATED

Few articles have attempted to establish the market value of the international stock of capital worldwide. Our aim is to offer a global market portfolio for investors based on a measurable global capital stock that includes both physical and financial capital that could be traded in the market, regardless of whether these assets are used. Although the sizes of financial assets are publicly available, it is less trivial to determine the weights of non-financial assets. We use data from the most reliable public international sources from 2005 onward to minimize the data precision gaps between traditional and alternative assets, thus offering a more accurate picture of the relative weights of each asset class at one point in time. Our global market portfolio is made for investors who would invest in equity and debt by including all financial assets, and then further diversify by adding the stock of non-financial assets and cash-related instruments that have not been implicitly accounted for. More precisely, our global passive investor would add private businesses, the equity value of (noncorporation) land and real estate, and (noncorporation) cash instruments. Exhibits 1 and 2 display the net global capital stock per asset class from 2005 to 2019, expressed in trillions of USD and as percentages, respectively. The total value reaches $667 trillion in 2019, up from $602 trillion in 2018. The amount of non-financial assets adds up to $288 trillion in 2019, representing 43% of the aggregated value.

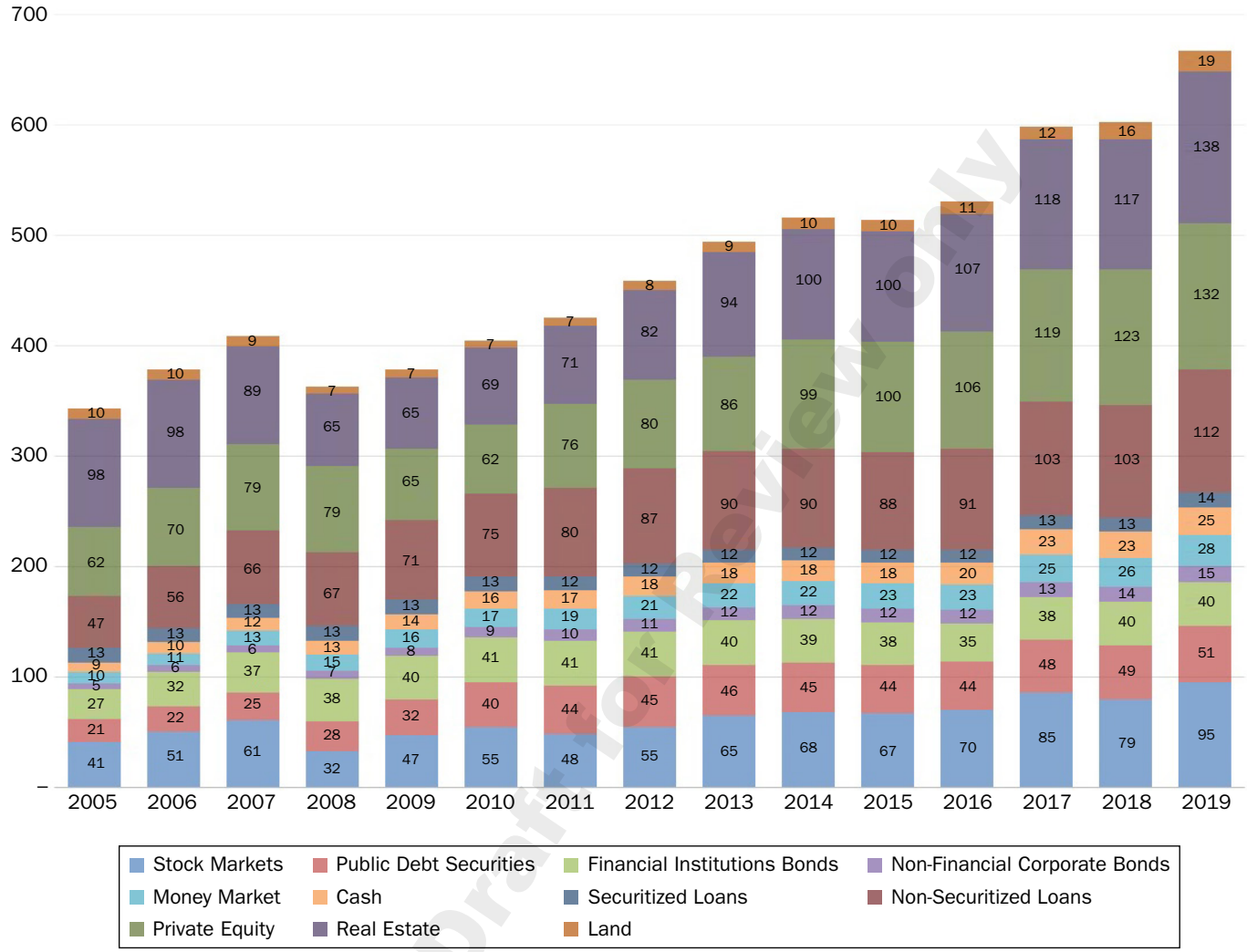
To build a diversified global market portfolio, we must construct a portfolio that allows for as much granularity as possible within each asset class. Existing major broad indexes are notably heavily biased toward the United States. For instance, the weight of the US equity markets in the World MSCI Index is above 60%, which is well above relative market capitalizations.[1] Thus, instead of choosing global indexes for each asset class, we selected subindexes for different regions and different maturities as much as existing data allowed. We focused on liquid indexes of major monetary zones (the United States, the Eurozone, China, Japan, the United Kingdom) for which estimates of market capitalizations for equities and notional amounts of outstanding bonds (with different maturities) and loans were available. Needless to say, granularity is easier to achieve with traditional assets, notably with equities. For the latter asset class, 47 countries were selected, representing more than 90% of the world's equity market capitalization. Global bonds were broken down into five maturities for the United States and the Eurozone and represented with only one aggregate index because of a lack of more options for China, Japan, the United Kingdom, and Canada. Non-securitized loans have been growing without interruption since 2005, with markets such as that of China increasing exponentially. The latter, as well as the United States, Europe, and Japan, is also included. However, securitized loans data are only available for Europe and the United States. Cash and cash-related instruments focus on the four biggest monetary zones.

To estimate total returns on housing, one needs to add rental incomes to capital gains. Knoll, Schularick, and Steger (2017) and Dimson, Marsh, and Staunton

[1] The US market is estimated to comprise 40% of the world's market capitalization, according to data from the World Federation of Exchanges.

EXHIBIT 1

Net Global Capital Stock in Trillions of USD

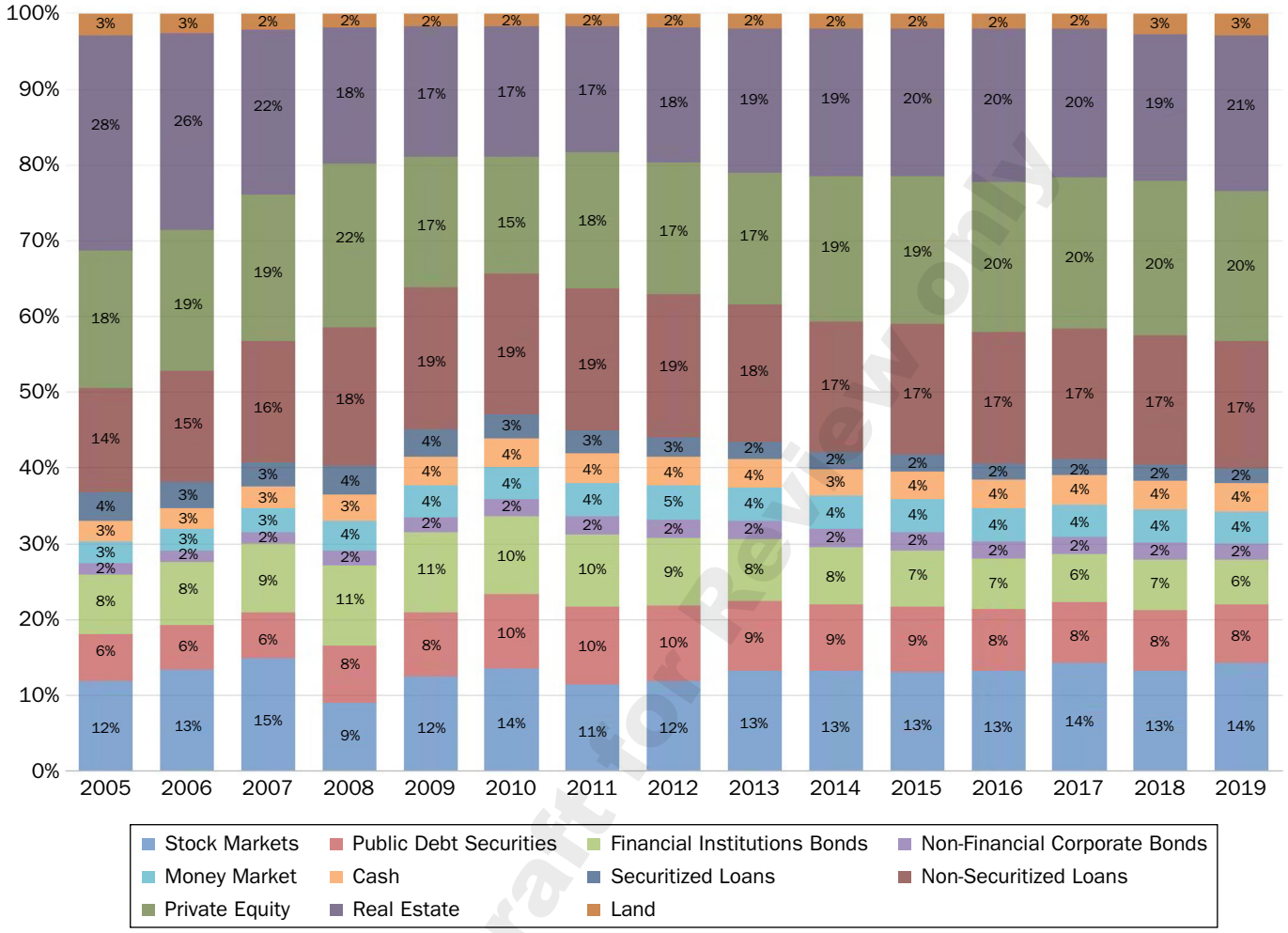


(2018) have assembled long-run records of real estate performance for different countries. However, given the uncertainties surrounding historical rental incomes and the crudeness of the adjustments of historical indexes, the latter authors argued that it is impossible to provide a definitive measure of historical returns for housing. Indeed, the measures computed by Knoll, Schularick, and Steger (2017) might not represent an adequate estimation of what a typical global investor could earn. The same argument applies to private companies. Therefore, one needs a more adequate measure of the global average return for those two asset classes. Some global indexes do exist (and are already well known by investors) and embed the granularity directly in their construction; thus, international diversification is already considered within each index.

Overall, 87 indexes are selected. Each individual's weight is determined by its market capitalization relative to all other components within the same asset class, multiplied by the weight of the asset class determined by the global capital stock. The latter weights are updated semiannually following the biannual updates of the global capital stock (at the end of June and December). The weights of the individual components are updated monthly based on the evolution of the previous month's total return index. Next, we describe in more detail the investable global market portfolio index.

EXHIBIT 2

Net Global Capital Stock in Percentages



THE INVESTABLE GLOBAL MARKET PORTFOLIO

Our main objective is to select total return indexes and construct a global market portfolio benchmark that is immune to biases. Lo (2016) defined an index as being transparent, systematic, and investable. ETFs are seen as efficient investment vehicles listed on exchanges that offer transparent, liquid, and low-cost exposure to an underlying benchmark index. Although benchmark-tracking error is an important consideration when choosing an ETF, for some asset classes (and especially the most exotic ones), a search for specific products may lead to only a few providers. Notably, Japanese ETFs for bonds and securitized loans have become rare or even nonexistent because of the lack of interest in the negative yields offered by these bonds. The same argument applies to Japanese loans; therefore, Japanese ETFs for bonds and securitized loans are both replaced by money market ETFs. Interestingly, alternative ETFs are not necessarily more difficult to match with their corresponding asset classes. However, if an increasing number of ETFs based on real assets are available, the caveat is that they do not always have a long history. For instance, the iShares Global Property Index, which tracks the FTSE EPRA NAREIT Global Real Estate Index and is recognized as one of the most widely used real estate benchmarks

(see Baker and Filbeck 2013), only started in July 2014.[2] Another option is the S&P Global Property Index, which differs in terms of eligibility criteria and geographic coverage, having a broader range of small- and mid-cap companies and a bigger exposure to Asia. However, although the index has existed since 1992, no ETF is currently tracking it. Notwithstanding, the performance of the two benchmarks over the last five years is similar.

One may argue that publicly listed real estate investment trusts (REITs) should not be compared with direct or core real estate investments because REITs invest not only in core properties (e.g., apartments, offices, and retail businesses) but also in real estate services and speculative development strategies. Nonetheless, Hoesli and Oikarinen (2016) argued that long-term REIT market performance is more closely tied to the direct real estate market than to the general stock market. Consequently, although the returns for global real estate funds are typically inclusive of leverage, thus magnifying the volatility of returns, REITs and direct real estate should be relatively fair substitutes in a long-horizon investment portfolio. Similarly, we use two ETFs for our "land" asset class: the iShares Global Timber and Forestry Index and the iShares MSCI Global Agriculture Producers ETF. The former seeks to track the S&P Global Timber & Forestry Index, which is composed of global equities related to the timber and forestry industry, and focuses on managing forestland or producing timber-related products. The latter seeks exposure to companies that are primarily engaged in the business of agriculture. In both cases, the companies also include REITs.[3]

Stocks of private corporations are by definition illiquid. The average investor can gain exposure to liquid indexes related to private companies in two ways. First, one may assume that private businesses are small firms and that their dynamic mimics that of small listed companies.[4] Private equity funds in particular use small-cap indexes as benchmarks for comparison purposes. Phalippou et al. (2018) showed that the average buyout fund return is similar to that of a typical small-cap index, making the latter a reasonable choice for a private businesses index.[5]

The alternative option is to invest in listed private equity indexes. However, global private equity indexes have a small history, spanning only a few years. Moreover, with only a small sample of companies included, private equity indexes might not truly capture the private equity index beta, thus departing from the concept of passive investing, which is intrinsic to the market portfolio.[6] Their features have also contributed to the higher volatility and drawdown seen in times of crisis, which makes them less suitable to be representative of the total private equity market.[7] Hence, we refrain from using those indexes and choose the SPDR MSCI World Small Cap ETF as our liquid private equity benchmark.

Overall, allowing for maximal granularity under the availability constraint, traditional asset classes consist of 83 ETFs, and alternative asset classes are represented by four global ETF indexes, all displayed in Exhibit 3. The ETF indexes are computed as a gross total return index, assuming that the gross dividends paid by its constituents are reinvested in the index. Exhibit 4 shows the compounded

[2] This index uses transaction data, making it more representative of real estate market values.

[3] We assume that those indexes mimic the returns of individual-/family-owned farmland and timberland.

[4] However, small listed companies have sizes (sales, employees) that are larger on average than a typical small- to medium-sized enterprise.

[5] Although the author argued that international small-cap value indexes may be a better fit, there is no such global ETF.

[6] The listed private equity universe is estimated to cover only 10% of the total private equity market.

[7] Only one private equity index has a long history starting in 2007, with a cumulative return of –25% from inception to today.

EXHIBIT 3
List of ETFs

Equities	Public Debt (Gov)
iShares Russel 3000 ETF	iShares 1–3 Yr Treasury ETF
iShares MSCI China ETF	iShares 3–7 Yr Treasury ETF
iShares MSCI Japan ETF	iShares 7–10 Yr Treasury ETF
iShares MSCI UK ETF	iShares 10–20 Yr Treasury ETF
iShares MSCI Hong Kong ETF	iShares +20 Yr Treasury ETF
iShares MSCI Canada ETF	iShares Can Gov Bond ETF
iShares MSCI France ETF	iShares Euro Gov 1–3 Yr ETF
iShares MSCI Germany ETF	iShares Euro Gov 3–5 Yr ETF
iShares MSCI Switzerland ETF	iShares Euro Gov 7–10 Yr ETF
iShares MSCI Australia ETF	iShares Euro Gov 15–30 Yr ETF
iShares MSCI S Korea ETF	Vanguard UK Gov Bond ETF
iShares MSCI Taiwan ETF	FX Currency ETF
iShares MSCI S Africa ETF	iShares EM Gov ETF
iShares MSCI India ETF	CSOP China 5-Year Treasury ETF
iShares MSCI Spain ETF	**Financial Bonds**
iShares MSCI Netherland ETF	iShares Bond Euro Financial ETF
iShares MSCI Sweden ETF	iShares iBoxx investment grade ETF
iShares MSCI Brazil ETF	iShares UK corporate £ Bond ETF
iShares MSCI Italy ETF	**Non-Financial Bonds**
iShares MSCI Russia ETF	iShares US iBoxx Investment grade Corp ETF
iShares MSCI Thailand ETF	iShares US iBoxx HY Corp ETF
iShares MSCI Singapore ETF	iShares Bond Euroex-Financial ETF
iShares MSCI Belgium ETF	iShares Corporate Bond UK ex-Financials ETF
iShares MSCI Indonesia ETF	iShares $ Emerging Markets Corporate ETF
iShares MSCI Denmark ETF	**Securitized Loans**
iShares MSCI Mexico ETF	iShares Euro Covered Bond ETF
iShares MSCI Malaysia ETF	iShares MBS ETF
iShares MSCI Finland ETF	**Non-Securitized Loans**
iShares MSCI Norway ETF	DSUM-Power Shares Chinese Yuan Dim Sum Bond Portfolio ETF
iShares MSCI New Zealand ETF	iShares iBoxx US High Yield Corporate Bond ETF
iShares MSCI Philippine ETF	iShares Euro High Yield Corporate Bond ETF
iShares MSCI Turkey ETF	FX Currency ETF
iShares MSCI Ireland ETF	**Cash Equivalents**
iShares MSCI Chile ETF	iShares 1–3 Yr Treasury ETF
iShares MSCI Israel ETF	iShares Euro Gov 1–3 Yr ETF
iShares MSCI Qatar ETF	Japan Currency ETF
Global X MSCI Argentina	CSOP China Ultra Short-Term Bond ETF
iShares MSCI Poland ETF	**Cash**
iShares MSCI Colombia ETF	CNY
iShares MSCI Peru ETF	EUR
iShares MSCI Austria ETF	JPY
Global X MSCI Pakistan	USD
Global X MSCI Nigeria	**Alternatives**
Market Vectors Vietnam	SPDR MSCI World Small Cap UCITS ETF
Global X MSCI Greece	iShares Global REIT ETF
Market Vectors Egypt ETF	iShares Global Timber and Forestry ETF
Global X FTSE 20 Portugal ETF	iShares Global Agriculture Index ETF

EXHIBIT 4

Evolution of the Investable Global Market Portfolio

monthly performance of the investable global market portfolio between March 2005 and June 2020.[8]

The investable global market portfolio realizes a compounded annual average return of 4.7%, with a standard deviation of 10.1%. The maximum cumulative drawdown is 35%, which occurred during the global recession of 2007–2009. During the same period, the investable global market portfolio underperformed a traditional 60/40 global portfolio, consisting of the MSCI world equities and FTSE world bond market total return indexes, respectively.[9] Although the correlation between stocks and bonds was negative enough to provide portfolio diversity, this simple asset allocation approach paid off because of the flight to safety during the great financial crisis, and the stocks rebound from 2009. However, taking a historical perspective on portfolio allocation spanning more than one decade would have highlighted the dangers of recency bias; in short, one could not expect this outperformance and the advantageous correlation dynamics between stocks and bonds to last. One should never stop emphasizing the need to prepare for economic shocks through diversification into a larger asset universe, despite the strong recent performance of equities and debt. That said, a global market portfolio useful for benchmarking should be better positioned to weather large market gyrations—even during shorter periods—or institutional investors might not use it. We now turn to present the non-investable version of the global market portfolio.

[8] When the ETF is not available, its benchmark index is used for backtesting.

[9] The annual average return of the 60/40 rebalanced portfolio is 5.8%, with a standard deviation of 10.0%.

THE NON-INVESTABLE GLOBAL MARKET PORTFOLIO

The investable global market portfolio is suitable for investors who have regulatory constraints or need to liquidate some or all of their shares on relatively short notice. However, publicly listed securities are only part of the investment canvas. Currently, illiquid assets include a variety of products.[10] However, transaction and custody costs can still be large compared to traded financial assets. This means that in order to earn the so-called market premium, the investment horizon required from investors may be longer than the one for liquid assets. Whereas certain types of investors are effectively precluded from holding illiquid assets, other investors (notably institutional investors) are endowed with such illiquid assets and are able and willing to pay the costs associated with them.

Randl, Westerkamp, and Zechner (2018) analyzed the equilibrium effects of nontradable assets on optimal policy portfolios. They found that the existence of nontradable assets implies that investors do not hold the global investable market portfolio. They argued that investors with (without) access to nontradable assets tilt their portfolios away from (toward) assets to which nontradable assets exhibit positive betas. In summary, investors without access to illiquid assets would lean toward the investable global portfolio introduced earlier, whereas those who have access to illiquid assets (in the search for diversification) might actually turn away from traditional assets and tilt their portfolio toward a global market portfolio consisting of both traditional investable securities and illiquid alternative assets. Interestingly, allocations of endowments are usually underweighted in classical assets and overweighed in alternatives compared to the global capital stock allocation presented previously.[11]

Given that these institutional investors own private funds invested in alternatives or directly in real assets, we need alternative indexes derived from net asset values (NAVs) or annual financial statements of funds or companies. The Cambridge Associates' Private Investments Database is one collection of institutional, high-quality private fund performances.[12] Their appraised value-based indexes employ the underlying cash flows and NAVs of each fund and portfolio company to build a pooled horizon internal rate of returns. The Cambridge Associates' Global Real Estate index is compiled from more than 1,000 funds focusing on core, value-added, and opportunistic strategies (synonymous with value and growth strategies, respectively, in the equity world). Core private real estate funds typically operate with significantly less leverage than listed REITs and are less correlated with the general stock market. Delfim and Hoesli (2019) argued that open-ended core funds reproduce well the behavior of direct real estate and are thus the best substitutes in a long-term portfolio. Moreover, the authors demonstrated that nonlisted real estate had a lower negative impact on a portfolio's performance than an investment in listed real estate during the global financial crisis of 2008.

The Cambridge Associates' Private Equity benchmarks include buyout and growth equity funds, excluding the riskier venture capital funds and allowing for satisfactory market coverage. Moreover, these indexes are likely to reflect the average returns received by private equity investors, from both balance sheet and performance measurement perspectives.

The NCREIF Farmland and Timberland indexes are the longest indexes representing the agricultural and forestry asset classes. Although these two indexes exclusively

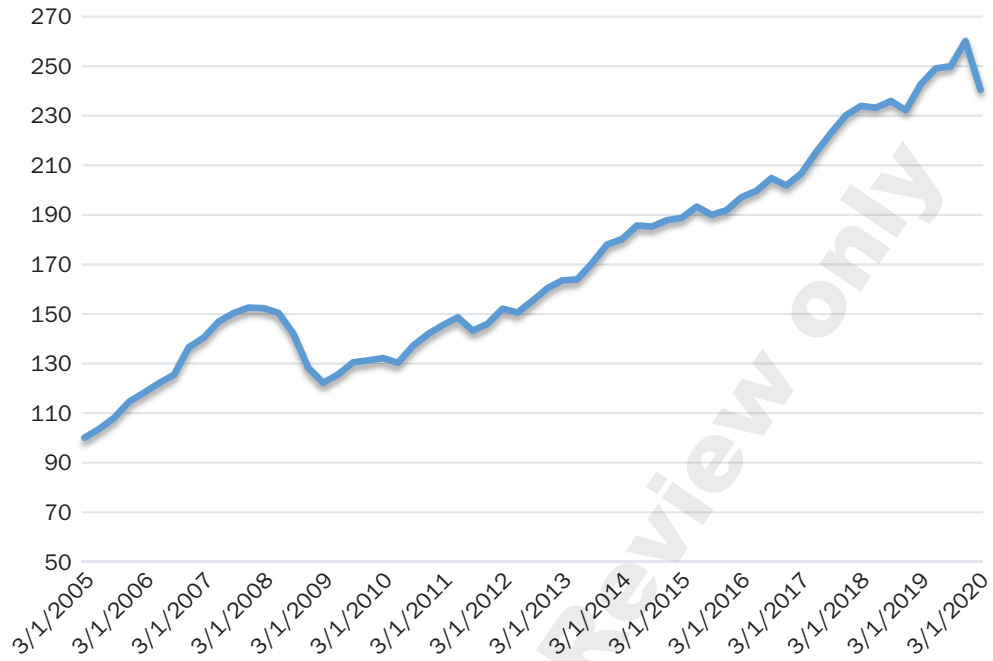
[10] Some of the indexes used (especially alternatives) are actually non-investable, hence the name of our benchmark.

[11] As stated in the introduction, the Yale endowment fund allocates more than 60% of its funds to private equity, real estate, and natural resources.

[12] The Cambridge Associates indexes serve as benchmarks for the Yale and Harvard endowments.

EXHIBIT 5

Evolution of the Non-Investable Global Market Portfolio



focus on US assets, they are often regarded as the best existing global benchmarks.[13] They include investment managers and plan sponsors who own or manage farmland and timber properties for investment purposes, mostly on behalf of pension funds.[14]

Exhibit 5 shows the monthly compounded performance of the non-investable global market portfolio between 2005-Q1 and 2020-Q2.

The non-investable global market portfolio realizes a compounded average return of 5.9%, with a standard deviation of 6.3%.[15] The maximum cumulative drawdown is 20%, which occurred during the global financial crisis, a large improvement over its investable counterpart. The significant decrease in the portfolio's volatility is a direct consequence of appraisal-based valuation, which is well known to generate smoother returns (Getmansky, Lo, and Makarov 2004). Although some of our asset classes are represented by indexes that are nontradable, our non-investable proposal still seems highly relevant for institutional investors with access to limited resources, excluding exotic alternatives. The transformation of this non-investable portfolio into an equivalent illiquid investable portfolio may then be achieved through careful selection of alternatives products.

However, one should not forget that investing in illiquid assets also introduces additional risks. For example, the Harvard University endowment, in need of cash in 2008 and willing to sell part of its private equity investments, faced a 50% discount in the secondary market before finally borrowing to solve its liquidity problems (see Ang 2014). Given the intrinsic hidden risks, this last example cautions against having too large a part of a short-term portfolio invested in illiquid assets. Thus, one should not hastily conclude that the difference in average returns and volatilities of our two

[13] As stated on the NCREIF website.

[14] Although Delfim and Hoesli (2019) considered the NCREIF Property Index to be a direct investment, it is an appraisal-based index.

[15] The illiquidity premium is estimated to be 1.2% per annum during this period.

EXHIBIT 6

Comparison of the Global Capital Stock with Peers

	ISL	DLS	GSV
Equities	21%	36%	14%
Bonds	24%	55%	16%
Securitized/Non-Securitized loans	0%	0%	18%
Real estate and land	37%	5%	21% + 3%
Private equity	0%	4%	20%
Commodities	15%	0%	0%
Cash	4%	0%	8%

NOTES: DLS: Doeswijk, Lam, and Swinkels; GCS: Gadzinski, Schuller, and Vacchino; ISL: Ibbotson, Siegel, and Love.

benchmarks (investable and non-investable) violates the relationship between return and risk.

Moreover, previous studies have argued that one could possibly achieve the performance of non-investable indexes by using leverage or a more active management strategy. By analyzing historical returns of private equity, venture capital, and real estate, Anson (2013) showed that lagged risk factors can explain the risk premium generated by illiquid assets so that one could theoretically achieve the same level of risk-adjusted return by investing in beta factors. Similarly, Kouzmenko et al. (2015) and Marchel and Markarian (2019) demonstrated how small asset owners can build liquid real estate and private equity portfolios, respectively, by carefully selecting securities and varying the degree of leverage. As asserted by Lo (2016), "by applying active risk management overlays to static indices, one can begin to harvest the benefits of smart beta without also suffering the consequences of dumb sigma." In summary, being able to invest in illiquid assets for long periods or to invest smartly in liquid assets should lead any investor, small or big, toward a portfolio that enjoys the benefits of bull markets and avoids too much fear during bear markets.

COMPARISON WITH PREVIOUS WORK

Exhibit 6 compares our global capital stock allocations with the world market portfolios presented earlier in the literature. The estimate provided by Ibbotson, Siegel, and Love (1985)—which is closer to our measure because the authors also attempted to gauge the world's capital stock—is dominated by residential real estate, highlighting a world economy that was not yet financialized at the time. On the other hand, Doeswijk, Lam, and Swinkels (2019) captured the rise of public financial markets and the massive debt issuance over the last 35 years, with bonds weighting more than 55% of all currently investable assets.

Our calculations lean more toward an equally weighted portfolio, with private businesses, real estate, private loans, and debt securities having similar percentages. Only public equity lags behind at 14%, and cash and cash equivalents achieve a higher share of 8% compared to their counterparts.

Given that private businesses, private real estate, and private loans amount to nearly 60%, one might argue that our benchmark is too extreme for any kind of investor. However, Delfim and Hoesli (2019) found allocations similar to our global capital stock using the optimization framework of Campbell and Viceira (2002), which adjusts modern portfolio theory with horizon-dependent expected returns, volatilities, and correlations. In their article, for long investment horizons, real estate and private equity have their allocations converging toward 16.6% and 18%, respectively (Delfim and Hoesli 2019). This last outcome makes our global market portfolio closer to an efficient, passive, long-term portfolio benchmark. Finally, our measure of the global capital stock—including both physical and financial capital—has been relatively stable over the past 15 years (Exhibit 1). That said, with the exponential increase in data resources, it is likely that more asset classes will populate the capital stock universe in the future. Things that seem exotic (e.g., cryptocurrencies) or unmeasurable (e.g., intellectual property rights, human capital) now might eventually become asset classes of their own in the same manner that real estate and private equity have made their way into current institutional portfolios.

CONCLUSION

No individual or even institutional investor holds the "true" global market portfolio. However, although each active manager owns a portfolio that diverges from a market-cap-weighted passive benchmark, all managers in aggregate represent the market, as stated in "The Arithmetic of Active Management" by Sharpe (1991) and more recently by Haghani (2019). We offer two versions of the global market portfolio to retail and institutional investors that will enable them to compare their performance against that of their aggregate peers. They will then be better equipped to prove or disprove William Sharpe's quote: "In any event, it pays to be very skeptical indeed of schemes that purport to be able to 'beat the market.'"

A large body of research using a variety of methodologies documents the virtues of international multi-asset diversification. The key benefit of global diversification comes from the inherent time-varying nature of correlations and their asymmetries, which makes the occurrence of free lunches in finance difficult to capture (see Chua, Kritzman, and Page 2009). The recent hype around tactical and strategic asset allocations is well studied by Arnott et al. (2019), who argued that factor-based portfolio diversification mitigates the occasional (albeit severe) drawdowns but fails to entirely solve the problem. As we advocated in this article, diversification in asset classes might not be dead if one looks toward real assets, which may eventually lead to a better allocation of resources and performance. However, we must emphasize that this article's contribution is only the starting point. Over the last 30 years, the Black–Litterman model (Black and Litterman 1992) has been providing a theoretical platform for portfolio optimization and asset allocation, combining an equilibrium state with forward-looking strategic views. By providing a better initial global multi-asset benchmark portfolio (as we hope we have done), and by combining it with better risk measures expectations, as well as liquidity and leverage management layers, adaptive optimization models could serve as powerful tools for practical portfolio applications.

REFERENCES

Agrrawal, P. 2013. "Using Index ETFs for Multi-Asset-Class Investing: Shifting the Efficient Frontier Up." *The Journal of Index Investing* 4 (2): 83–94.

Ang, A. *Asset Management: A Systematic Approach to Factor Investing*, Oxford University Press, 2014.

Anson, M. 2013. "Performance Measurement in Private Equity: Another Look at the Lagged Beta Effect." *The Journal of Private Equity* 17 (1): 29–44.

Arnott, R., R. H. Campbell, V. Kalesnik, and J. Linnainmaa. 2019. "Alice's Adventures in Factorland: Three Blunders That Plague Factor Investing." *The Journal of Portfolio Management* 45 (4): 18–36.

Baker, H. K., and G. Filbeck. *Portfolio Theory and Management*. Oxford, UK: Oxford University Press, 2013.

Black, F., and R. Litterman. 1992. "Global Portfolio Optimization." *Financial Analysts Journal* 48 (5): 28–43.

Campbell, J. Y., and L. M. Viceira. *Strategic Asset Allocation*. Oxford, UK: Oxford University Press, 2002.

Chua, D., M. Kritzman, and S. Page. 2009. "The Myth of Diversification." *The Journal of Portfolio Management* 36 (1): 26–35.

Damodaran, A. *Damodaran on Valuation*, 2nd edition. New York: John Wiley and Sons, 2006.

Delfim, J. C., and M. Hoesli. 2019. "Real Estate in Mixed-Asset Portfolios for Various Investment Horizons." *The Journal of Portfolio Management* 45 (7): 141–158.

Dimson, E., P. Marsh, and M. Staunton. *Credit Suisse Global Investment Returns Yearbook 2018*. Zurich: Credit Suisse Research Institute, 2018.

Doeswijk, R. Q, T. W. Lam, and L. Swinkels. 2019. "Historical Returns of the Market Portfolio." *The Review of Asset Pricing Studies* 10 (3): 521–567.

Gadzinski, G., M. Schuller, and A. Vacchino. 2018. "The Global Capital Stock: Finding a Proxy for the Unobservable Global Market Portfolio." *The Journal of Portfolio Management* 44 (7): 12–23.

Geczy, C. 2014. "The New Diversification: Open Your Eyes to Alternatives." *The Journal of Portfolio Management* 40 (5): 146–155.

Getmansky, M., A. W. Lo, and I. Makarov. 2004. "An Econometric Model of Serial Correlation and Illiquidity in Hedge Funds Returns." *Journal of Financial Economics* 74 (3): 529–609.

Haghani, V. 2019. "Do Index Buyers Make Overvalued Stocks More Overvalued?" *The Journal of Portfolio Management* 43 (2): 2–5.

Hoesli, M., and E. Oikarinen. 2016. "Are Public and Private Asset Returns and Risks the Same? Evidence from Real Estate Data." *Journal of Real Estate Portfolio Management* 22 (2): 179–198.

Ibbotson, R. G., L. B. Siegel, and K. S. Love. 1985. "World Wealth: Market Values and Returns." *The Journal of Portfolio Management* 12 (1): 4–23.

Jordà, O., M. Schularick, and A. M. Taylor. "Macrofinancial History and the New Business Cycle Facts." In *NBER Macroeconomics Annual*, Volume 31 2017, edited by Martin Eichenbaum and Jonathan A. Parker, pp. 213–263. Chicago: University of Chicago Press, 2017.

Knoll, K. "Our Home in Days Gone By: Housing Markets in Advanced Economies in Historical Perspective." Ph.D. thesis, Free University of Berlin, 2017.

Kouzmenko, K., B. Reid, M. Clacy-Jones, and B. Teuben. 2015. "A Liquid Benchmark for Private Real Estate." *The Journal of Index Investing* 6 (2): 99–107.

Linder, J. 2018. "Rebalancing-Diversification Return: The Opportunity Cost of Illiquid Investments." *The Journal of Investing* 27 (2): 57–65.

Lo, A. 2016. "What Is an Index?" *The Journal of Portfolio Management* 42 (2): 21–36.

Marchel, K., and G. Markarian. 2019. "Why Invest in Private Equity? A Comparison of Private Equity and Stock Market Returns." *The Journal of Alternative Investments* 22 (1): 20–36.

Phalippou, L., C. Rauch, and M. Umber. 2018. "Private Equity Portfolio Company Fees." *Journal of Financial Economics* 129 (3): 559–585.

Podkaminer, E., W. Tollette, and L. Siegel. 2019. "Preparing a Multi-Asset Class Portfolio for Shocks to Economic Growth." *The Journal of Portfolio Management* 45 (2): 106–116.

Randl, O., A. Westerkamp, and J. Zechner. "Equilibrium Policy Portfolios When Some Assets Are Non-Tradable." Working paper, 2018.

Roll, R. 2013. "Volatility, Correlation, and Diversification in a Multi-Factor World." *The Journal of Portfolio Management* 39 (2): 11–18.

Sharpe, W. F. 1991. "The Arithmetic of Active Management." *Financial Analysts Journal* 47 (1): 7–9.