Global Markets

STATE STREET.

Private Equity Insights

TWENTY-FOURTH EDITION | Q4 2021

CURRENT QUARTER PERFORMANCE SUMMARY

The State Street® Private Equity Index (SSPEI) posted an overall return of 5.74 percent in the fourth quarter of 2021, a slight decrease from the 6.25 percent in 2021Q3. Buyout funds led the group with 6.05 percent, followed by 5.86 percent return from Venture Capital funds and 3.13 percent return from Private Debt funds (Exhibit 1).

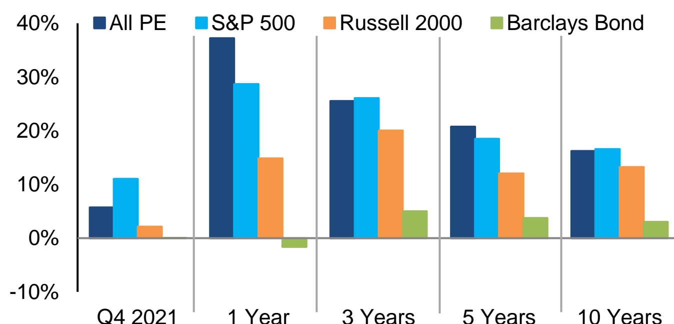
Exhibit 1. Private Equity Performance by Strategy

Column1	All PE	Buyout	VC	Private Debt
2021 Q4	5.74%	6.05%	5.86%	3.13%
2021 Q3	6.25%	6.04%	7.59%	3.91%
2021 Q2	11.08%	11.69%	11.23%	5.96%
2021 Q1	9.76%	8.45%	14.93%	5.95%
YTD	37.22%	36.59%	45.71%	21.06%

Source: State Street®, as of Q4 2021.

As shown in Exhibit 2, SSPEI outperformed the US bond market (proxied by Bloomberg Barclays US Aggregated Bond Index) and small-cap stocks (proxied by Russell 2000) at all time periods. Compared to the US public equity market (proxied by S&P 500), SSPEI exceeded in 1-year and 5-year horizons but underperformed S&P500 over quarterly, 3-year and longer 10-year horizons.

Exhibit 2. Investment Horizon Returns



Source: State Street®, DataStream, Bloomberg Barclays US Aggregate Bond Index (total returns as of Q4 2021).

Continued on page 5.

CAN PUBLIC MARKETS REPLICATE PRIVATE EQUITY?

Insights from Harvard University and the Private Capital Research Institute

By Leslie Jeng and Josh Lerner

Private equity is an asset class that has provided attractive returns over the past several decades and has been a key element in the portfolio of university endowments, sovereign funds, and large pension. Most investors, however, lack access to private equity, especially to the upper echelon of funds that have been true outperformers.

Given these access issues, many investors have been intrigued by the notion of replicating private equity returns with public securities. Moreover, if replication strategies were to truly become successful (i.e., were able to match PE performance at a modest cost) and were scalable, this strategy might be attractive to all LPs, even those that already have PE access. According to The Economist magazine, a few firms have attempted to provide these private equity replicating funds with seemingly some success.[1] However, the demand for such a strategy has not yet gained the strong momentum that some expected.

On January 18, 2022, a panel of academic researchers and practitioners met to discuss the notion that private equity returns could be replicated in the public markets. This discussion, organized by the Private Capital Research Institute and the Private Capital Project at Harvard Business School. explored both the science and practice of replicating private equity and provided some insight into how profound an impact

[1] "Private Equity Returns Can be Replicated with Public Shares," August 26, 2017, The Economist, https://www-economist-com.ezp-prod1.hul.harvard.edu/finance-and-economics/2017/08/24/private-equity-returns-can-be-replicated-with-public-shares.

Continued on page 2.

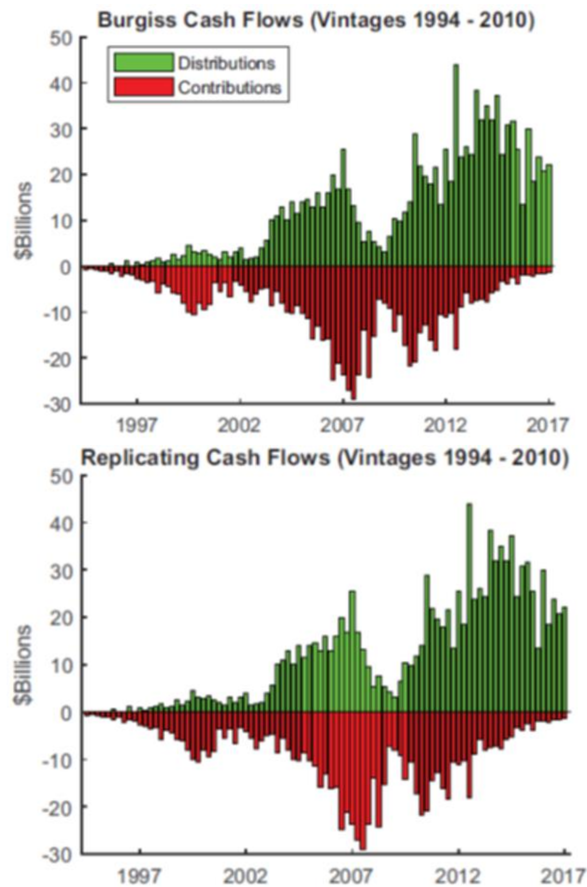
these efforts would have on the industry. The panelists were Rich Carson (Cambridge Associates), Peter Cornelius (AlpInvest), and Erik Stafford (Harvard Business School). The discussion was moderated by Victoria Ivashina (Harvard Business School).

In his academic research,[2] Erik Stafford at the Harvard Business School explores the basic idea of private equity replication. Stafford devises an investment strategy using a set of buyouts from 1994 to 2010 and creating a comparable set of publicly traded companies that are assumed to have the same asset risk as the set of buyout firms. His estimation of risk is made using the covariance of returns with respect to the various factors—or return determinants—of the market portfolio. Stafford explains that what investors really care about is the risk of private investments relative to public investments, because that is the trade-off they are making in asset allocation decisions.

Next, following the pattern of cashflows invested and distributed in the buyout sample, investments are made in a publicly traded portfolio with the same risk factors (see Exhibit 3). The chart on the left side shows the actual cash flows from the buyout sample using data provided by Burgiss. In the replicating portfolio, on the right side of the figure, investors hold the replicating public market portfolio for a similar amount of time as buyouts. As the graphs show, the cash flows are perfectly replicated. In addition, the replicating portfolio uses a similar amount of incremental leverage as a typical LBO, about one to one and half times leverage.

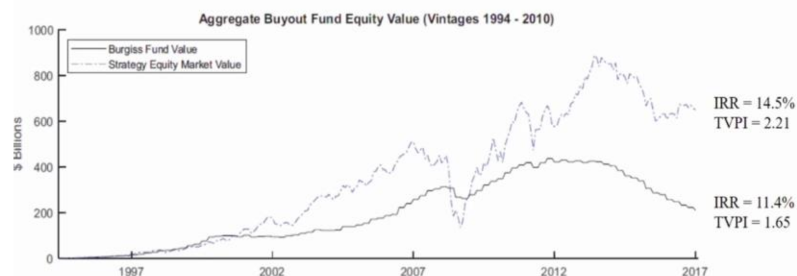
The results of Stafford's replication strategy are shown in Exhibit 4. The smoother line is the reported values of the actual private equity funds, and the more volatile line is the replicating strategy. Stafford finds that the replicating strategy yields a higher internal rate of return (IRR), albeit with higher measured risk. The IRR of the replicating portfolio is 14.5% vs. the buyout IRR of 11.4%. One interpretation of this result is that the extra fees of private equity are lowering the returns to private equity. The results suggest that a replicating portfolio could be an attractive alternative to private equity for many investors, regardless of access constraints.

Exhibit 3. Actual Private Equity Cash Flows versus Replicating Cash flows



Source: Stafford, Erik, "Replicating Private Equity with Value Investing, Homemade Leverage, and Hold-to-Maturity Accounting," The Review of Financial Studies, (November 2020).

Exhibit 4. Aggregate Buyout Fund Equity Value



Source: Stafford, Erik, "Replicating Private Equity with Value Investing, Homemade Leverage, and Hold-to-Maturity Accounting," The Review of Financial Studies, November 2020.

[2] Stafford, Erik, "Replicating Private Equity with Value Investing, Homemade Leverage, and Hold-to-Maturity Accounting," The Review of Financial Studies, November 2020.

Obstacles in the Market for Replicating Portfolios

While these research findings were undoubtedly striking, panelists in the discussion raised some challenges that could potentially hinder the growth of replication strategies.

Investors' objectives

An essential challenge in this arena is that private equity funds vary tremendously in their returns. The dispersion of returns (measured by median return vs. the top fifth percentile return) in public markets and even hedge funds is 6% or less. In contrast, the corresponding range is 33% for private equity and 40% for venture capital. [3]

One potential reason for the slow acceptance of replicating portfolios is that investors, especially in the private markets, are almost always focused on beating the benchmark rather than just achieving average returns. This perspective corresponds to one of the critical questions about demand for products that try to replicate the average returns of the industry: Would investors be satisfied with industry average returns, or instead, are they structuring their organizations and allocating their money to more active strategies so that they can take advantage of the huge dispersion of private equity and venture capital?

Achieving a truly comparable set of publicly traded companies

The replication strategy hinges on correctly matching risks. This is particularly challenging, as PE firms reveal the risks of their portfolios in a highly imperfect manner. PE portfolios are not marked-to-market on a frequent basis that is observable to the public. Thus, correctly matching risks can be difficult.

Another issue is matching transaction types and sizes. The buyouts used in the research project are biased towards large buyout transactions, whereas private equity investments, in general, are more focused on small cap and mid cap transactions. (The buyouts in Stafford's study represent about 5% of all transactions, but 25 to 30% of the value of investments.) Furthermore, it is important to match by industry sectors because the sectors backed by private equity tend to deviate significantly from the public markets, as captured in indexes such as the S&P 500. Over the past twenty years, private equity firms focused on the technology, healthcare, consumer discretionary, and industrial sectors and underweighted energy and consumer staples.

Lastly, there was concern expressed over the use of leverage and its role in replication strategies. In the buyout industry, the use of leverage declined significantly over the sample period of Stafford's study. Moreover, deleveraging has played little, if any, in the role of some of the most successful recent deals. Rather than focusing on deleveraging over the holding period of a portfolio company, boosting earnings through growth appears to be an increasing area of concentration for many private equity groups.

The emergence of new private equity strategies

Thus, in some cases, investing directly in private equity may be superior. Managers can create value in ways that the replication strategy, which focuses primarily on asset allocation and leverage, cannot. New direct private equity strategies that minimize fees are rapidly growing. For instance, co-investments, where an LP invests alongside the GP, are becoming more prevalent.

In addition, the secondary market for private equity has grown in importance, along with the emergence of continuation funds. In general, partner-led secondaries, investors can achieve liquidity and, at the same time, allow GPs to hold onto assets that they like with longer and longer holding periods (10 years or longer vs. the historical 4 to 5 years). We can anticipate that general partners will continue to innovate to help create differentiated strategies.

Opportunities for the Replication Strategy

Despite these concerns, there was a consensus among the panelists that public market replicating strategies are likely to grow in popularity. Here are some instances in which replication may offer a good solution:

Private equity exposure for resource-constrained investors

Certain types of investors do not have the capabilities, size of staff, or ability to select and monitor managers that can do the kind of active management to take advantage of the high dispersion of returns in private equity. Thus, a replication strategy may be good when an investor lacks this sophistication.

---

[3] Rich Carson, Cambridge Associates, Presentation to the Asset Management Advisory Committee, U.S. Securities and Exchange Commission, September 16, 2020, https://www.sec.gov/files/amac-9-16-20-minutes.pdf.

Liquidity management

Investors who have a need for liquidity for all or some of their portfolio, but still want to have private equity-like returns, may want to embrace these replication products.

One such application is likely to be for undrawn capital commitments. Since private capital groups can take long periods to fully draw down funds, limited partners may have substantial pools of capital earmarked for these funds that they are reluctant to place in illiquid assets. In these instances, a replication strategy can be used as a vehicle to "park" committed uncalled capital until it is ready to be invested directly. At the same time, this could help investors ramp up to a target asset allocation more quickly.

Final thoughts

While the results clearly indicate that replication strategies do produce attractive returns, there are still obstacles to the growth of this market. Success in the market will hinge on the low cost, speed of deployment, and the ability to scale. The industry may well be at the point where it is large enough and sophisticated enough that investors see this as a valuable tool to manage increasingly large and complex portfolios.

Josh Lerner is Director of the Private Capital Research Institute and Jacob H. Schiff Professor of Investment Banking and Head of the Entrepreneurial Management Unit at Harvard Business School.

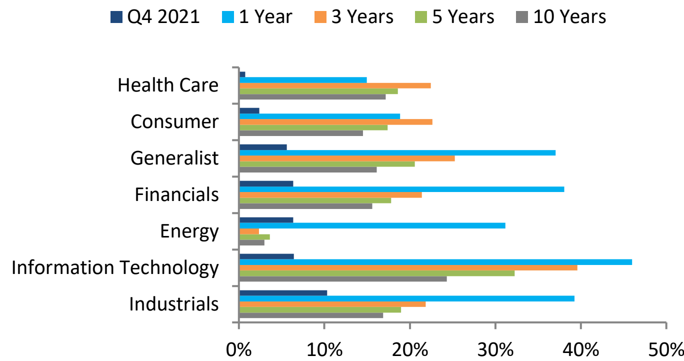
Leslie Jeng is Director of Research of the Private Capital Research Institute.

The Private Capital Research Institute is a not-for-profit 501(c)(3) corporation formed to further the understanding of private capital and its global economic impact through a commitment to the ongoing development of a comprehensive database of private capital fund and transaction-level activity supplied by industry participants. The PCRI, which grew out of a multi-year research initiative with the World Economic Forum, also sponsors policy forums.

CURRENT QUARTER PERFORMANCE SUMMARY – CONTINUED FROM PAGE 1

Among sectors, Industrials funds continued to outperform all other sectors with a 10.33% quarterly return, followed by Information technology funds with a quarterly return of 6.42%. Energy funds rallied to the top third sector posting 6.37% quarterly return. Healthcare funds, however, dipped further from 2.22% in Q3 to 0.73% in Q4, the lowest quarterly return since the COVID crisis in 2020Q1 (see Exhibit 5).

Exhibit 5. Returns of Sector Focused Private Equity Funds



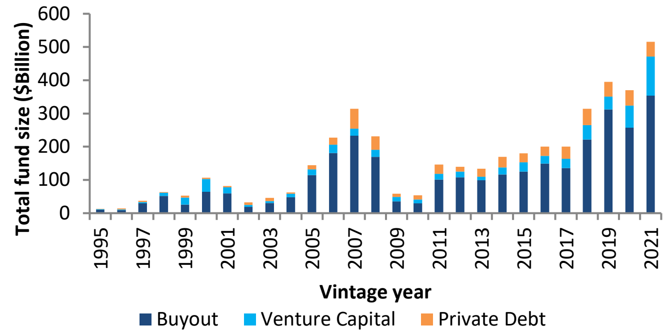
Source: State Street®, as of Q4 2021.

Fund Raising and Dry Powder

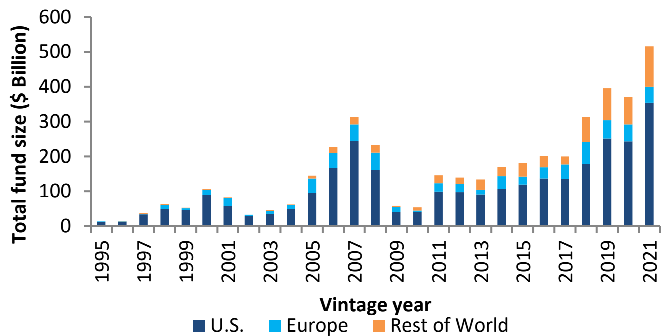
The total capital raised in 2021 surpassed the previous peak in 2019, recording a new all-time high with $516 billion. Overall the capital raising in 2021 increased 39% compared to 2020. However, not every strategy grew at the same pace. Venture Capital funds and Buyout funds raised 78% and 37% more capital in 2021, while Private Debt received 4% less capital than 2020 (see Exhibit 6(A)). Across regions, US and Rest of World funds collected $354 billion and $115 billion respectively, which are 46% and 49% more than the total capital raised in the previous year. Europe funds received $46 billion in 2021, 6% less capital than 2020 (see Exhibit6(B)).

The average fund size continued to rise for Buyout and Venture Capital funds. As of the end of 2021, both Buyout and Venture Capital funds posted their highest records of $3.28 billion and $0.87 billion respectively. Average fund size of Private Debt funds was $1.41 billion, marginally lower than $1.40 billion in 2020 (see Exhibit 7).

Exhibit 6. Total Fund Size (USD Billion)
(A) By Strategy

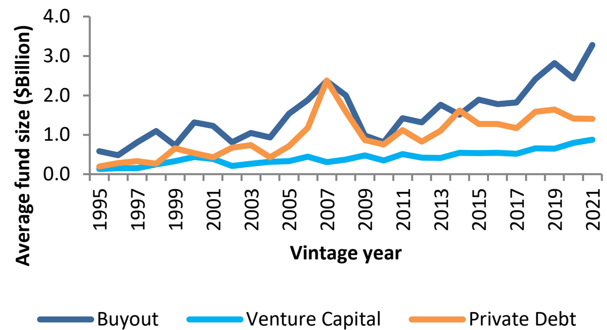


(B) by Region



Source: State Street®, as of Q4 2021.

Exhibit 7. Average Fund Size (USD Billion)



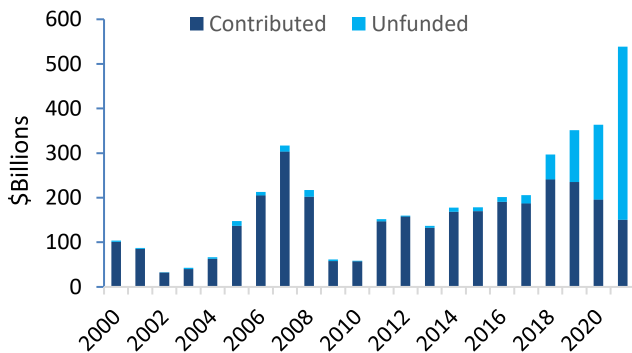
Source: State Street®, as of Q4 2021.

Dry powder is the part of the fund's committed capital that has not yet been called by the fund manager. It represents the amount of capital that can be used for future investment opportunities. As of the end of 2021, SSPEI posted a dry powder of $861 billion, increased from $817 billion in Q3 2021. Exhibit 8(A) shows that majority of the committed capital from earlier vintage year funds has been called, while funds from recent four vintage years contributed to the most of current

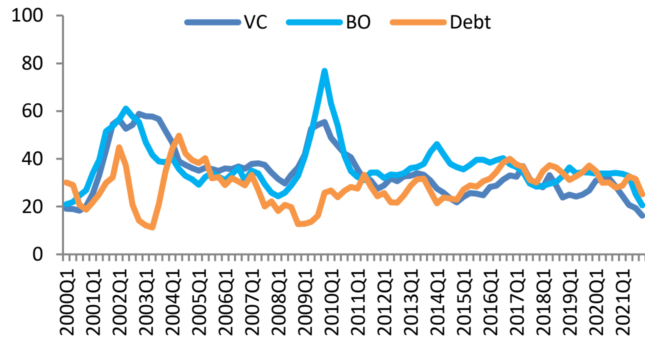
unfunded dry powder. Although the dollar amount of dry powder continued to increase, quarterly dry powder normalized by the average contribution of the past 12 months, which measures how long the current dry powder inventory can last at the recent average capital call rate without new fund raising activities, continued its downward trend for all three strategies in Q4 2021. The dry powder inventory of Buyout and Venture Capital posted all-time lows of 21 months and 16 months respectively (see Exhibit 8(B)).

Exhibit 8. Dry Powder

(A) Dry Powder by Vintage Years (2000 – 2021)



(B) Quarterly Dry Powder Normalized by Average Contribution



Source: State Street ®, as of Q4 2021.

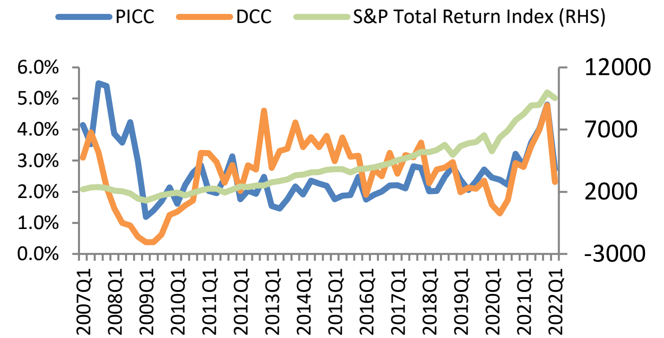
Cash Flow Activity

Exhibit 9(A) indicates the environment has changed considerably in the beginning of 2022. Both the quarterly Distribution over Committed Capital (DCC) and quarterly Paid-in Capital over Committed Capital (PICC) for overall PE turned down in Q1 2022. Besides the periodic pattern of slowdown in the beginning of the year, PE cash flows were impacted by the broader market condition in Q1 2022 as well. After six quarters of upward trend, S&P500 total return index declined 5% in Q1. The co-cyclicality between PE cash flows and the broader market conditions has been documented by Robinson and Sensoy (2016)[4]. Capital distribution is more sensitive to the market condition and decreased further than capital contribution, resulting in a negative net cash flow of -0.41% of All PE in Q1 2022.

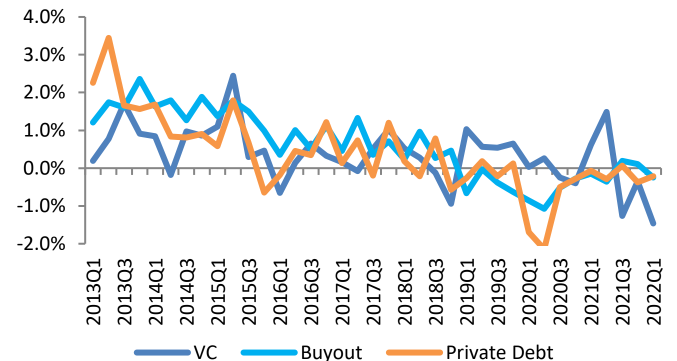
Exhibit 9(B) provides a closer look of the net cash flow among strategies. The net cashflow of Buyout swung back to negative at -0.2%, and the net cash flow of Venture Capital and Private Debt funds stayed in negative territory of -1.5% and -0.2% respectively.

Exhibit 9. Quarterly Cash Flow Ratios Normalized by Commitment (2013Q1 – 2022Q1)

(A) Contribution and Distribution for All PE



(B) Net Cash Flow By Strategy



Source: State Street ®, as of Q4 2021.

[4] Robinson, David T., Sensoy, Berk A. "Cyclicality, performance measurement, and cash flow liquidity in private equity" Journal of Financial Economics, Volume 122, Issue 3, December 2016, 521-543

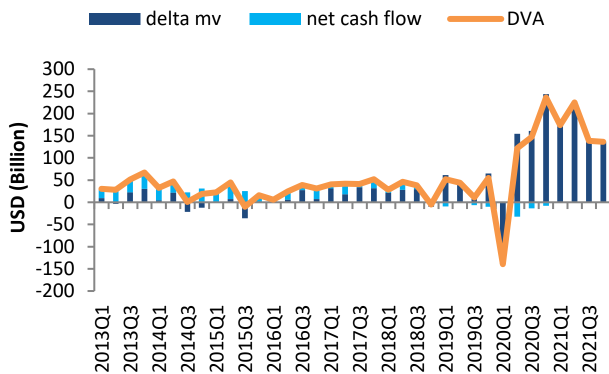
Valuations

The Dollar Value Added (DVA) is the sum of NAV changes and net cash flows. It measures the realized and unrealized gain and loss in dollar amounts.

$$DVA = EndingNAV - BeginningNAV + Distribution - Contribution$$

In Q4 2021, quarterly DVA of overall PE remained positive at $136 billion, slightly decreasing from $139 billion in Q3 2021. This positive DVA continued to be driven almost entirely by valuation increases, while attribution from net cash flow for PE remained marginal (see Exhibit 10).

Exhibit 10. Dollar Value Added for All PE



Source: State Street ®, as of Q4 2021.

NEXT QUARTER PERFORMANCE FORECAST

Nowcasting

Inspired by the concept of Nowcasting, SSPEI research team developed a model, aspiring to estimate the concurrent performance of private equity market, of which the reporting is otherwise delayed at least by one quarter. We hereby only share the model predictions for Q1 2022 without going into theoretical background. For model details, please refer to State Street Private Equity Insights Q3 2021 publication[5]. Nowcasting results are out-of-sample predictions based on the regression coefficients from the past 5 year rolling window and the observed public market returns and private market cash flows.

Now that State Street Private Equity Index has become available for Q4 2021, from a retrospective view, we are able to evaluate the accuracy of the nowcasting predictions. It shows in Exhibit 11, the actual Q4 2021 returns are 5.74%, 6.05%, 5.86%, 3.13% respectively for all PE, Buyout, Venture Capital and Private Debt. Correspondingly, the nowcasting predictions were 4.09%, 2.41%, 6.07%, 1.76% from last quarter. The overall PE market performance in Q4 2021 exceeded the predictions by 1.65% but still fell into the 95% confidence interval suggested by the model. The nowcasting was able to accurately predict the Q4 performance of Venture capital with only 2 bps off; the Buyout and Private Debt strategy largely exceeded the predictions by 3.45% and 1.37% respectively, falling slightly outside of upper bounds of their 95% confidence intervals. Given the public market decline in Q4, our nowcasting model suggested smaller gains than previous quarter in all strategies of private equity; however, Buyout held strong and even beat its Q3 return. Moreover, with a few quarters' deviation from nowcasting predictions since Covid recovery, interestingly, the private equity performance is showing a reversion pattern closer to the model predictions, indicating the relationship between private equity and public market is likely adjusting back to its long-term dynamic.

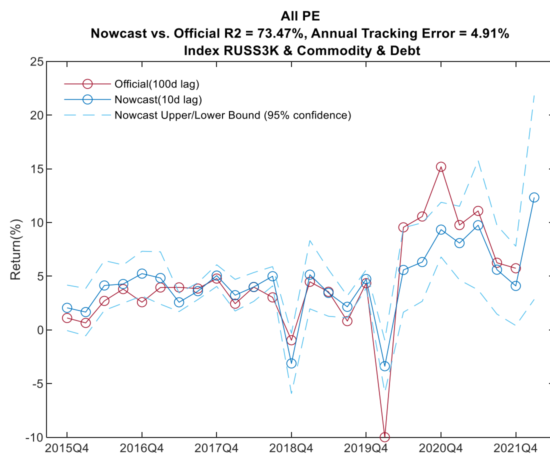
Looking forward, for Q1 2022, the model predicted IRRs for all PE, Buyout and Private Debt strategy all increased to 12.33%, 13.76%, 7.83% respectively; whereas Venture Capital return is suggested to see a drop to the negative zone of -0.17%. These modelling results are seemingly counterintuitive to what we have experienced in Q1 market, but are comprehensible. According to NASDAQ.com, the S&P500 returned -4.6% in Q1, Bloomberg Commodity Index was up 25.6%, and the United States Oil Fund LP (USO) has gone up by 36.4%[6]. Driven by the oil price and inflation, the commodity price surged in Q1 2022, which is a shared model input variable for all PE, Buyout and Private Debt. The commodity price surge counter balanced the negative impact from public equity to Buyout and Private Debt returns in this model. On the other hand, Venture Capital prediction took a dip largely affected by the Nasdaq composite index, the sole factor in nowcasting model, which fell 8.95% in Q1 2022 in response to the market sentiment that investors were concerned about high inflation, FED raising interest rates and US economy potentially going into recession.

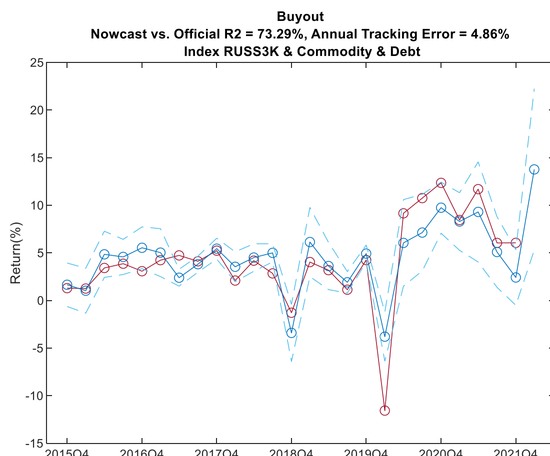
---

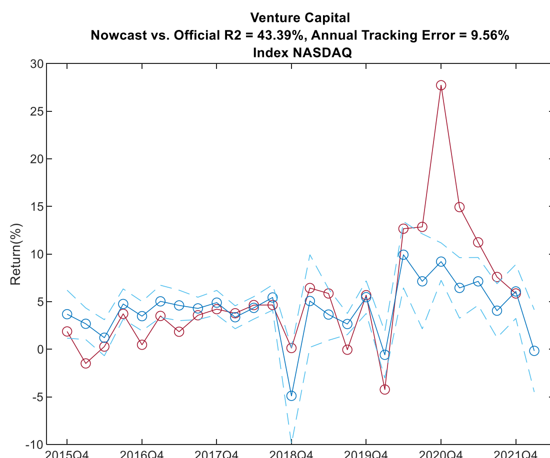
[5] State Street Private Equity Insights Q3 2021
https://globalmarkets.statestreet.com/portal/peindex/pe-insights/

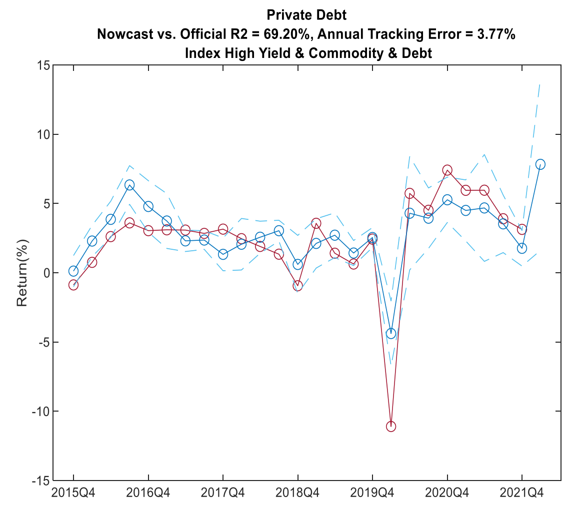
[6] What Happened in Q1 2022?, APR 4, 2022, NASDAQ.
(https://www.nasdaq.com/articles/what-happened-in-q1-2022)

Exhibit 11. Actual vs. Out-of-sample Nowcast IRRs









Source: State Street ®, as of Q4 2021.

DISCUSSION – GROWTH OF GROWTH EQUITY

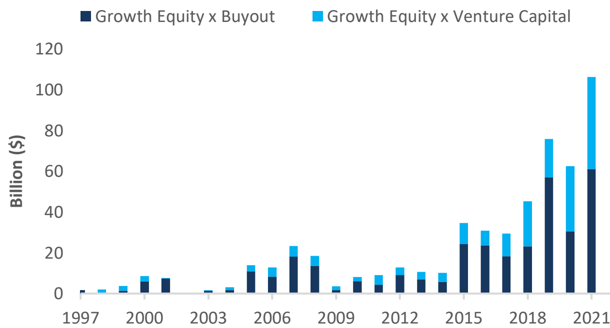
Growth Equity has become one of the hottest and highly sought-after PE strategies in recent years as PE firms continue to offer more diversified investment choices to investors. In this section, we will take a look at Growth Equity using SSPEI dataset and compare it with traditional Buyout and Venture Capital strategies.

Often referred to as growth or expansion capital, Growth Equity strategy seeks to invest in later-stage companies exhibiting high growth and relatively established business models but still need additional capital to reach the next level. Growth equity can either take majority or minority stake in the investments. Typically, these funds make large minority investments.

Buyout funds often invests in more established public or private companies, with control stake and change of the ownership of targeted companies. Venture Capital strategy seeks long-term appreciation by investing in early- through late-stage companies in return for an equity stake and therefore partial control. Growth Equity resides in a "middle-ground", where it targets companies that past the early stage, seen in Venture Capital, while still retain substantial upside potential before they reach mature stage, common in Buyout investments. Here in State Street Private Equity Index, we consider Growth Equity as a standalone category, parallel to other traditional PE strategies, selected from a pool of Buyout and VC funds, based on the type of equity instruments invested.

The SSPEI data (Exhibit 12) shows cyclical fundraising activity for Growth Equity, with the largest cycle being the most recent one started since 2015. In 2021 alone, total $106 billion was raised for Growth Equity strategy, doubled the size in just 4 years, and was ten times larger than the total capital committed in year 2014. While Growth Equity strategy with Buyout type of investments was stunt in fundraising in 2020, Growth Equity with Venture Capital focus continued to attract more capital during Covid-19 crisis. In 2021, Growth Equity funds with Buyout and Venture Capital focus each raised $61 billion and $45 billion, breaking their all-time fundraising records.

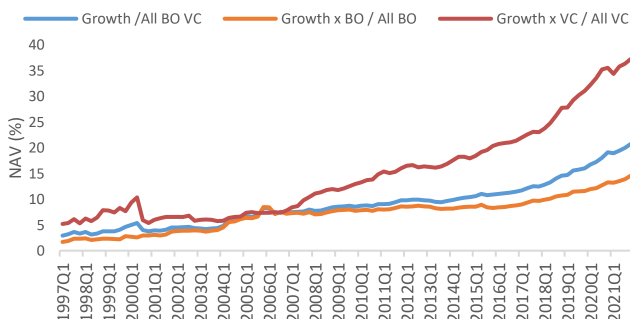
Exhibit 12. Growth Equity Fund Size by Vintage Year



Source: State Street ®, as of Q4 2021.

In addition to fund size, the net asset value also tells the story that the capital has been flooding into Growth Equity. Two decades ago, the NAV of Growth Equity funds only contributed less than 5% of the total NAV, whereas nowadays, that number has risen up to as much as 20% today (Exhibit 13, blue line). Moreover, the NAV percentage of Growth Equity in Venture Capital is seen historically higher compared to that of the Growth Equity in Buyout, and has been on an accelerated growth trajectory since 2008.

Exhibit 13. Rolling NAV Percentage of Growth Equity to Buyout and Venture Capital Funds



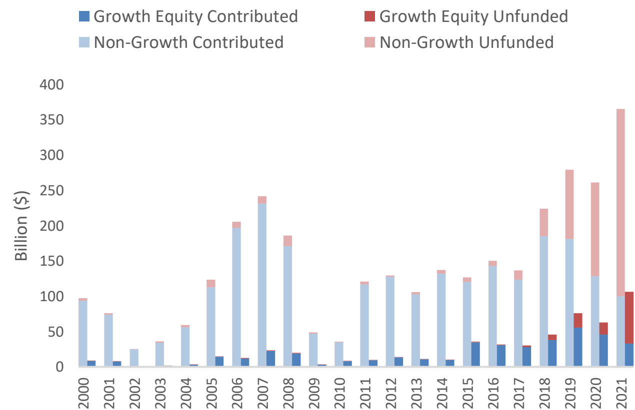
Source: State Street ®, as of Q4 2021.

As of Q4 2021, according to SSPEI data, there is $127.56 billion total unfunded capital in Growth Equity funds, and $641.77 billion dry powder in other non-Growth focused Buyout and Venture Capital funds. Considering that SSPEI represents an estimated 50% of total private equity market, the total amount of Growth Equity dry powder could be around $250 billion, which translates to future investment opportunities.

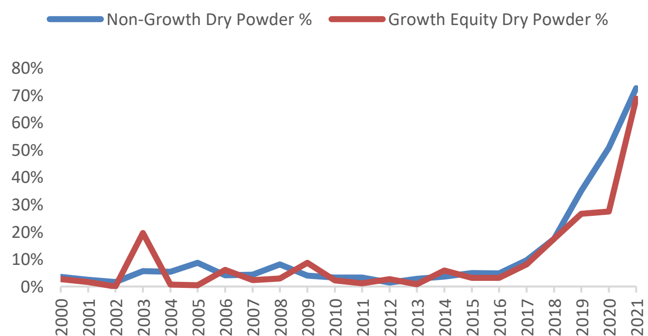
As seen in Exhibit 14, majority of the capital has been called in funds older than 2018 for both Growth Equity and overall Private Equity. In younger funds with vintage year 2019-2021, the percentage of dry powder relative to fund size (Exhibit 14 (B)) for Growth Equity is a few percent less than that of non-Growth focused Buyout/Venture Capital, indicating that Growth Equity funds are deploying their dry powder faster than non-Growth funds, and potentially had more investment opportunities in the past few years.

Exhibit 14. Dry Powder by Vintage Year of Growth vs Non-Growth Buyout and Venture Capital

(A) Contributed vs. Dry Powder in USD



(B) Percentage of Dry Powder to Fund Size



Source: State Street ®, as of Q4 2021.

Growth Equity funds appear to outperform non-Growth funds. Venture Capital Growth Equity funds posted 23.31% since inception IRR and 2.23 TVPI; while Venture Capital non-Growth funds had 15.01% since inception IRR and 2.16 TVPI. In Buyout strategy, Growth Equity funds posted 1.77 TVPI and 14.78% since inception IRR relative to non-Growth's 1.65 TVPI and 13.49% since inception IRR (see Exhibit 15 A).

Since funds of different vintage years can experience very different market conditions, KS-PME (Kaplan and Schoar Public Market Equivalent[7]) offers a better measure of fund managers' skill after controlling market environment differences. Exhibit 15 B shows Venture Capital Growth Equity funds significantly outperformed Venture Capital non-Growth funds with pooled KS-PME 1.38 (Growth) vs 1.17 (non-Growth) and median KS-PME 1.16 (Growth) vs 0.97 (non-Growth); Buyout Growth Equity funds only slightly outperformed Buyout non-Growth funds with pooled KS-PME 1.15 (Growth) vs 1.12 (non-Growth) and median KS-PME 1.04 (Growth) vs 1.03 (non-Growth). It is worth noting that Buyout Growth Equity funds also have smaller cross-sectional dispersion than non-Growth funds (see 25%-75% in Exhibit 15 B).

Exhibit 15. Growth Equity Fund Performance

(A) TVPI and IRR

		# Funds	TVPI	IRR
VC	Non-G	1181	2.16	15.01
	Growth	229	2.23	23.31
BO	Non-G	1549	1.65	13.49
	Growth	234	1.77	14.78

(B) Public Market Equivalent (vs. S&P500)

		KS-PME	25%	50%	75%
VC	Non-G	1.17	1.36	0.97	0.67
	Growth	1.38	1.54	1.16	0.91
BO	Non-G	1.12	1.32	1.03	0.83
	Growth	1.15	1.24	1.04	0.88

Source: State Street ®, as of Q4 2021.

In summary, Growth Equity has become inarguably one of the hottest corners in private equity. Its unique strategy focus has led to a different return profile than other traditional strategies, and in turn attracting new sources of capital from the market.

ABOUT THE STATE STREET PRIVATE EQUITY INDEX

Participants in private capital markets need a reliable source of information for performance and analytics. Given the non-public nature of the private equity industry, collecting comprehensive and unbiased data for investment analysis can be difficult. The State Street Private Equity Index ("SSPEI") helps address the critical need for accurate and representative insight into private equity performance.

Derived from actual cash flow data of our Limited Partner clients who make commitments to private equity funds, SSPEI is based on one of the most detailed and accurate private equity data sets in the industry today. These cash flows received as part of our custodial and administrative service offerings are aggregated to produce quarterly Index results. Because the SSPEI does not depend on voluntary reporting of information, it is less exposed to biases common among other industry indexes. The result is an index that reflects reliable and consistent client data, and a product that provides analytical insight into an otherwise opaque asset class.

- Currently comprises more than 3,600 funds representing more than $4.35 trillion in capital commitments as of Q4 2021
- Global daily cash-flow data back to 1980.
- The Index has generated quarterly results since Q3 2004.
- Published approximately 100 days after quarter-end.

AUTHORS

Maggie Miao, CFA qmiao@statestreet.com

Yaoyun Zhang Yzhang50@statestreet.com

Nan R. Zhang, CFA, PhD nzhang2@statestreet.com

[7] Kaplan, Steven and Antoinette Schoar (2005) "Private Equity Performance: Returns, Persistence, and Capital Flows," Journal of Finance, 60, 1791–1823.

Disclaimers and Important Risk Information

State Street Global Markets® is the business name and a registered trademark of State Street Corporation® and is used for its financial markets business and that of its affiliates. State Street Associates® is a registered trademark of State Street Corporation, and the analytics and research arm of State Street Global Markets.

The products and services outlined herein are only offered to professional clients or eligible counterparties through State Street Bank and Trust Company, authorized and regulated by the Federal Reserve Board. State Street Bank and Trust Company is registered with the Commodity Futures Trading Commission as a Swap Dealer and is a member of the National Futures Association. Please note that certain foreign exchange business, including spot and certain forward transactions, are not regulated.

This document is a communication intended for general marketing purposes, and the information contained herein has not been prepared in accordance with legal requirements designed to promote the independence of investment research. It is for clients to determine whether they are permitted to receive research of any nature. It is not intended to suggest or recommend any transaction, investment, or investment strategy, does not constitute investment research, nor does it purport to be comprehensive or intended to replace the exercise of an investor's own careful independent review and judgment regarding any investment decision.

This communication is not intended for retail clients, nor for distribution to, and may not be relied upon by, any person or entity in any jurisdiction or country where such distribution or use would be contrary to applicable law or regulation. This communication and the information herein does not constitute investment, legal, or tax advice and is not a solicitation to buy or sell securities or any financial instrument nor is it intended to constitute a binding contractual arrangement or commitment by State Street of any kind. The information provided does not take into account any particular investment objectives, strategies, investment horizon or tax status. This communication or any portion hereof may not be reprinted, sold or redistributed without the prior written consent of State Street Global Markets.

The views expressed herein are the views of State Street Global Markets as of the date specified and are subject to change, without notice, based on market and other conditions. The information provided herein has been obtained from sources believed to be reliable at the time of publication, nonetheless, we make no representations or assurances that the information is complete or accurate, and you should not place any reliance on said information. State Street Global Markets hereby disclaims any warranty and all liability, whether arising in contract, tort or otherwise, for any losses, liabilities, damages, expenses or costs, either direct, indirect, consequential, special, or punitive, arising from or in connection with any use of this document and/or the information herein.

State Street Global Markets may from time to time, as principal or agent, for its own account or for those of its clients, have positions in and/or actively trade in financial instruments or other products identical to or economically related to those discussed in this communication. State Street Global Markets may have a commercial relationship with issuers of financial instruments or other products discussed in this communication.

This document may contain statements deemed to be forward-looking statements. These statements are based on assumptions, analyses and expectations of State Street Global Markets in light of its experience and perception of historical trends, current conditions, expected future developments and other factors it believes appropriate under the circumstances. All information is subject to change without notice. Clients should be aware of the risks trading foreign exchange, equities, fixed income or derivative instruments or in investments in non-liquid or emerging markets. Derivatives generally involve leverage and are therefore more volatile than their underlying cash investments. Past performance is no guarantee of future results.

The products and services outlined in this document are generally offered in the **United States and Latin America** by State Street Bank and Trust Company. This communication is made available in **Japan** by State Street Bank and Trust Company, Tokyo Branch, which is regulated by the Financial Services Agency of Japan and is licensed under Article 47 of the Banking Act. **EMEA**: (i) State Street Bank and Trust Company, London Branch, authorised and regulated by Federal Reserve Board, authorised by the Prudential Regulation Authority, subject to regulation by the Financial Conduct Authority and limited regulation by the Prudential Regulation Authority. Details about the extent of regulation by the Prudential Regulation Authority are available upon request; and/or (ii) State Street Bank International GmbH, authorised by Deutsche Bundesbank and the German Federal Financial Supervisory Authority and, in respect of State Street Bank International GmbH, London Branch, subject to limited regulation by the Financial Conduct Authority and Prudential Regulation Authority. Details about the extent of regulation by the Financial Conduct Authority and Prudential Regulation Authority are available upon request. **Brazil:** The products in this marketing material have not been and will not be registered with the Comissão de Valores Mobiliários - the Brazilian Securities and Exchange Commission ("CVM"), and any offer of such products is not directed to the general public within the Federative Republic of Brazil ("Brazil"). The information contained in this marketing material is not provided for the purpose of soliciting investments from investors residing in Brazil and no information in this marketing material should be construed as a public offering or unauthorized distribution of the products within Brazil, pursuant to applicable Brazilian law and regulations. The products and services outlined in this document are generally offered in **Canada** by State Street Bank and Trust Company. This communication is made available in **Hong Kong** by State Street Bank and Trust Company which accepts responsibility for its contents, and is intended for distribution to professional investors only (as defined in the Securities and Futures Ordinance). This communication is made available in **Australia** by State Street Bank and Trust Company ABN 70 062 819 630, AFSL 239679 and is intended only for wholesale clients, as defined in the Corporations Act 2001. This communication is made available in **Singapore** by State Street Bank and Trust Company, Singapore Branch ("SSBTS"), which holds a wholesale bank license by the Monetary Authority of Singapore. In Singapore, this communication is only distributed to accredited, institutional investors as defined in the Singapore Financial Advisers Act ("FAA"). Note that SSBTS is exempt from Sections 27 and 36 of the FAA. When this communication is distributed to overseas investors as defined in the FAA, note that SSBTS is exempt from Sections 26, 27, 29 and 36 of the FAA. This advertisement has not been reviewed by the Monetary Authority of Singapore. The products and services outlined in this document are made available in **South Africa** through State Street

Bank and Trust Company, which is authorized in South Africa under the Financial Advisory and Intermediary Services Act, 2002 as a Category I Financial Services Provider; FSP No. 42671. This communication is made available in **Israel** by State Street Bank and Trust Company, which is not licensed under Israel's Regulation of Investment Advice, Investment Marketing and Portfolio Management Law, 1995. This communication may only be distributed to or used by investors in Israel which are "eligible clients" as listed in the First Schedule to Israel's Regulation of Investment Advice, Investment Marketing and Portfolio Management Law 1995. This communication is made available in **Qatar** by State Street Bank and Trust Company and its affiliates. The information in this communication has not been reviewed or approved by the Qatar Central Bank, the Qatar Financial Markets Authority or the Qatar Financial Centre Regulatory Authority, or any other relevant Qatari regulatory body. This communication is made available in **Malaysia** by State Street Bank and Trust Company, which is authorized and regulated by the Federal Reserve Board. State Street Bank and Trust Company is not licensed within or doing business within Malaysia and the activities that are being discussed are carried out off-shore. The written materials do not constitute, and should not be construed as constituting: 1) an offer or invitation to subscribe for or purchase securities or futures in Malaysia or the making available of securities or futures for purchase or subscription in Malaysia; 2) the provision of investment advice concerning securities or futures; or 3) an undertaking by State Street Bank and Trust Company to manage the portfolio of securities or futures contracts on behalf of other persons. This communication is made available in **Turkey** by State Street Bank and Trust Company and its affiliates. The information included herein is not investment advice. Investment advisory services are provided by portfolio management companies, brokers and banks without deposit collection licenses within the scope of the investment advisory agreements to be executed with clients. Any opinions and statements included herein are based on the personal opinions of the commentators and authors. These opinions may not be suitable to your financial status and your risk and return preferences. Therefore, an investment decision based solely on the information herein may not be appropriate to your expectations. This communication is made available in **United Arab Emirates** by State Street Bank and Trust Company and its affiliates. This communication does not, and is not intended to, constitute an offer of securities anywhere in the United Arab Emirates and accordingly should not be construed as such. Nor does the addressing of this communication to you constitute, or is intended to constitute, the carrying on or engagement in banking, financial and/or investment consultation business in the United Arab Emirates under the rules and regulations made by the Central Bank of the United Arab Emirates, the Emirates Securities and Commodities Authority or the United Arab Emirates Ministry of Economy. Any public offer of securities in the United Arab Emirates, if made, will be made pursuant to one or more separate documents and only in accordance with the applicable laws and regulations. Nothing contained in this communication is intended to endorse or recommend a particular course of action or to constitute investment, legal, tax, accounting or other professional advice. Prospective investors should consult with an appropriate professional for specific advice rendered on the basis of their situation. Further, the information contained within this communication is not intended to lead to the conclusion of any contract of whatsoever nature within the territory of the United Arab Emirates. This communication has been forwarded to you solely for your information, and may not be reproduced or passed on, directly or indirectly, to any other person or published, in whole or in part, for any purpose. This communication is addressed only to persons who are professional, institutional or otherwise sophisticated investors. This communication is made available in **Saudi Arabia** by State Street Bank and Trust Company and its affiliates. The information contained in this communication is not intended to invite or induce any person to engage in securities activities nor does it constitute an offer to sell securities or the solicitation of an offer to buy, or recommendation for investment in, any securities within the Kingdom of Saudi Arabia or any other jurisdiction. The information in this communication is not intended as financial advice. Moreover, this communication is not intended as a prospectus within the meaning of the applicable laws and regulations of the Kingdom of Saudi Arabia or any other jurisdiction and this communication is not directed to any person in any country in which the distribution of such communication is unlawful. This communication provides general information only. The information and opinions in this communication are stated as at the date indicated. The information may therefore not be accurate or current. The information and opinions contained in this communication have been compiled or arrived at from sources believed to be reliable in good faith, but no representation or warranty, express or implied, is made by State Street Bank and Trust Company and its affiliates as to their accuracy, completeness or correctness. This communication is made available in **South Korea** by State Street Bank and Trust Company and its affiliates, which accept responsibility for its contents, and is intended for distribution to professional investors only. State Street Bank and Trust Company is not licensed to undertake securities business within South Korea, and any activities related to the content hereof will be carried out off-shore and only in relation to off-shore non-South Korea securities. This communication is made available in **Indonesia** by State Street Bank and Trust Company and its affiliates. Neither this communication nor any copy hereof may be distributed in Indonesia or to any Indonesian citizens wherever they are domiciled or to Indonesian residents except in compliance with applicable Indonesian capital market laws and regulations. This communication is not an offer of securities in Indonesia. Any securities referred to in this communication have not been registered with the Capital Market and Financial Institutions Supervisory Agency (BAPEPAM-LK) pursuant to relevant capital market laws and regulations, and may not be offered or sold within the territory of the Republic of Indonesia or to Indonesian citizens through a public offering or in circumstances which constitute an offer within the meaning of the Indonesian capital market law and regulations. This communication is made available in **Oman** by State Street Bank and Trust Company and its affiliates. The information contained in this communication is for information purposes and does not constitute an offer for the sale of foreign securities in Oman or an invitation to an offer for the sale of foreign securities. State Street Bank and Trust Company is neither a bank nor financial services provider registered to undertake business in Oman and is neither regulated by the Central Bank of Oman nor the Capital Market Authority. Nothing contained in this communication report is intended to constitute Omani investment, legal, tax, accounting, investment or other professional advice. This communication is made available in **Taiwan** by State Street Bank and Trust Company and its affiliates, which accept responsibility for its contents, and is intended for distribution to professional investors only. State Street Bank and Trust Company is not licensed to undertake securities business within Taiwan, and any activities related to the content hereof will be carried out off-shore and only in relation to off-shore non-Taiwan securities. **Peoples Republic of China ("PRC").** This communication is being distributed by State Street Bank and Trust Company. State Street Bank and Trust Company is not licensed or carrying on business in the PRC in respect of any activities described herein and any such activities it does carry out are conducted outside of the PRC. These written materials

do not constitute, and should not be construed as constituting: 1) an offer or invitation to subscribe for or purchase securities or futures in PRC or the making available of securities or futures for purchase or subscription in PRC; 2) the provision of investment advice concerning securities or futures; or 3) an undertaking by State Street Bank and Trust Company to manage the portfolio of securities or futures contracts on behalf of other persons.

Products and services may not be available in all jurisdictions. Please contact your State Street representative for further information. SSA MMD 2022-01

To learn how State Street looks after your personal data, visit: http://www.statestreet.com/utility/data-processing-and-privacy-notice.html

© 2022 State Street Corporation – All Rights Reserved