2024 BEST IDEAS

RETHINKING RESILIENCY AND RISK

CONTENTS

INTRODUCTION

A 2023 that kicked off with rampant recession talk and a near-calamitous bank crisis ended in remarkable relative stability, at least in the financial arena. Stronger-than-expected economic growth in the face of higher interest rates, coupled with technological innovation around AI, helped risk assets turn the corner.

Meanwhile, central banks around the world have begun to step back from their aggressive fight against inflation, adding fresh optimism that financial markets and the broader economy are on steady footing.

That resiliency now has investors hoping that the good cheer will continue, but every year brings with it a new set of challenges, and 2024 is sure to be no different.

- The Fed may be done, but what about the soft landing? – While calls for a 2023 recession in the US were premature, it's likely that investors will need to get comfortable with a prolonged higher rate environment, and digest what this means for opportunities across asset classes.

- An election for the ages – Regardless of the outcome, what's sure to be a contentious contest will ultimately have implications for spending, taxes, and regulation.

- AI and all that comes with it – The explosion of AI has captured the global imagination with what the technology might enable, but there are also less obvious corners of the market – such as data centers and cloud vendors – which have been overlooked and may offer opportunity.

- Disturbing geopolitics – From Ukraine, the Middle East, and China, geopolitical considerations are increasingly becoming a major driver of investment decisions and capital flows.

The tumultuous and unexpected path of 2023 yet again underscores the importance of assessing the impact that a rapidly changing world will have on the way asset managers and investors construct their portfolios. An environment of potentially higher interest rates and inflation, growth in private markets, and idiosyncratic risks that are giving new meaning to resiliency all have broad implications for financial markets and asset allocation strategies.

In our latest edition of PGIM's Annual Best Ideas, we delve into these and other topics of interest to our clients. As always, the ideas presented here are not intended to predict the future, but rather to shine a light on the areas where we believe investors will find promising opportunities, buoyed by PGIM's distinct depth of expertise and focused experience.

PGIM PORTFOLIO ADVISORY

THE EVOLVING LANDSCAPE OF INSURANCE AND PRIVATE CAPITAL

The insurance industry is in the midst of a profound transformation, marked by the integration of insurance, asset management and private capital. This shift has led to strategic acquisitions and collaborations that are reshaping traditional dynamics in the insurance and reinsurance industry. Strategic investors are coming together in partnerships that deliver value by bringing together world-class insurance, reinsurance and asset management capability behind life and annuity business. Of late, this has meant partnerships between asset managers (especially of illiquid and alternative assets) with insurers, reinsurers and investors to get the right combination of assets and liabilities to add as much value as possible. The benefits of this approach are multifaceted, including bringing new sources of capital to fund growth in the insurance industry to meet demand for life and annuity protection from individuals, and to provide attractive risk-adjusted returns to investors.

PRIVATE CAPITAL IN THE INSURANCE ARENA

Life and annuities companies are attracting private capital to the insurance market to support the robust asset portfolios on their balance sheets (to meet future payout liabilities). Until the actual payout occurs, these assets must be strategically invested to yield returns, all the while backed by investor capital. Typically, the cost of servicing these liabilities is less than the potential investment gains, delivering attractive spread margin to investors.

Insurers also present significant potential for scale. McKinsey & Company estimates that across Europe, traditional life liabilities amount to €4.5 trillion. In the US, life and annuity insurers manage $4.5 trillion in assets in their general accounts, with $1.5 trillion in separate variable-annuity liabilities, and an additional $3 trillion in defined-benefit liabilities.

Figure 1: Three Types of Reinsurance Platforms Attracting Private Capital

| PE Firms with Insurers | Insurers with Asset Management Partners | Asset Manager-Insurer Combinations |

In 2021, private investors announced deals to acquire or reinsure more than $200 billion of liabilities in the US. Today, platforms backed by these investors manage approximately $600 billion in life and annuity assets in the US. Still, the growth potential is immense, estimated to be nearly $4 trillion of in-force liabilities and new business inflows.[1]
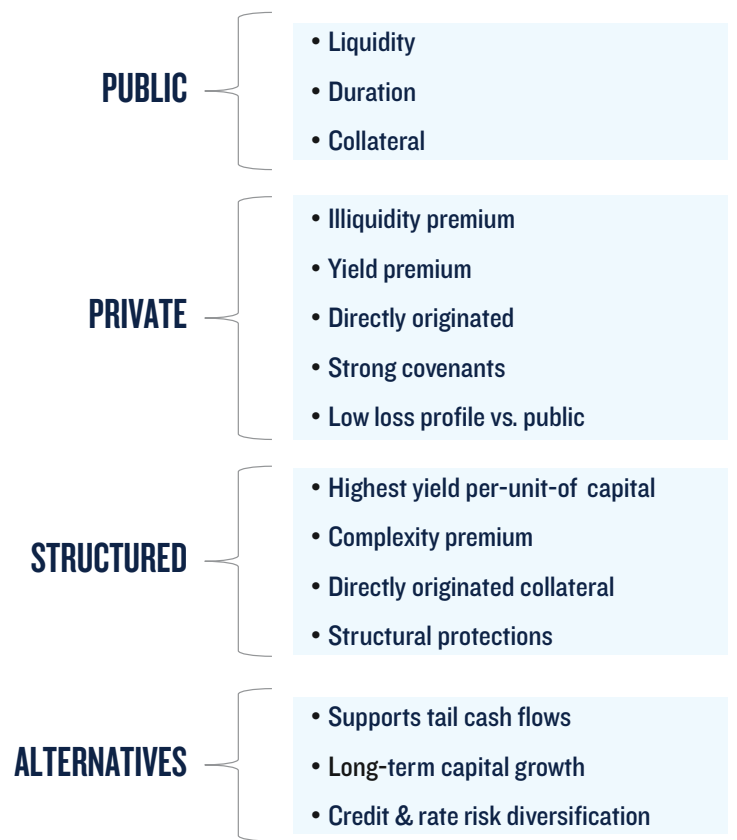
The platforms attracting private capital can be categorized into three segments: alternative asset management firms with insurers, insurers with asset management partners, and asset manager-insurer combinations. These partnerships often revolve around core capabilities in asset management, liability origination, and asset-liability management. Firms with expertise in these areas present attractive opportunities for strategic partners to invest and gain accelerated scale (See Figure 1).

THE LAUNCH OF PRISMIC

Helping to define the trend of asset manager-insurer combinations, in September 2023, Prudential Financial, Inc. (PFI), Warburg Pincus, and a small group of global institutional investors launched Prismic Life Reinsurance Ltd. ("Prismic"), a growth-oriented platform that aims to create long-term value potential for cedants and investors, with $1 billion in equity.[2] Alongside the ambition to grow its reinsurance relationship with PFI materially in years to come, Prismic aims to build partnerships with other insurers globally seeking third-party reinsurance as well.

PGIM Portfolio Advisory (PPA), a multi-asset solutions provider offering strategic asset allocation services and portfolio management, delivers the asset management services for Prismic.

Figure 2: Four Key Portfolio Sleeves of Prismic's Balance Sheet

PUBLIC
- Liquidity
- Duration
- Collateral

PRIVATE
- Illiquidity premium
- Yield premium
- Directly originated
- Strong covenants
- Low loss profile vs. public

STRUCTURED
- Highest yield per-unit-of capital
- Complexity premium
- Directly originated collateral
- Structural protections

ALTERNATIVES
- Supports tail cash flows
- Long-term capital growth
- Credit & rate risk diversification

1 Insurance investors: Priorities and opportunities. https://www.mckinsey.com/industries/financial-services/our-insights/insurance-investors-priorities-and-opportunities

2 Prudential Financial, Inc. and Warburg Pincus Announce Launch of Prismic Life Re. https://news.prudential.com/latest-news/prudential-news/prudential-news-details/2023/Prudential-Financial-Inc--and-Warburg-Pincus-announce-launch-of-Prismic-Life-Re-09-07-2023/default.aspx

PPA brings together portfolio analytics and portfolio management capabilities to optimize a strategic asset allocation that will position Prismic to meet its long-term liabilities. Additionally, on an ongoing basis, PPA optimizes the portfolio and identifies tactical allocation opportunities to capture additional relative value (See Figure 2).

Combining asset-liability management, portfolio strategy, asset allocation, and asset management expertise to develop integrated solutions, PPA is an ideal partner to address the challenges and opportunities faced by Prismic. Access to PGIM's strategies across public and private assets, including proprietary asset origination capabilities, allows PPA to leverage expertise in active management, including credit and risk management. In addition to PGIM's capabilities, Warburg Pincus' alternative capabilities also support Prismic.

PPA's active portfolio management approach operates at three levels of focus:

1. Asset allocation recommended by PPA centers on solutions-driven portfolio analytics, with a focus on relative value views across asset classes, additions of new investible opportunities, risk and liquidity management, ALM and an aggregated view of performance across managers.

2. Asset class analysis determined by the underlying managers delivers sector-level expertise in origination and underwriting by borrower and geography, with focus on downgrades and watch lists along with credit rating richness/cheapness.

3. Integration of macro-level insights shared by PPA and subadvisors including economic conditions and their potential effect on a particular asset class, credit spread relative value, identification of emerging risks, and loan origination trends and market conditions.

The capabilities offered by PPA, along with other PGIM and Warburg Pincus capabilities, create an integrated solution for Prismic's asset-liability management and asset management needs in support of Prismic's long-term growth strategy. Additionally, it enables the platform to provide exposure to a predominantly investment grade portfolio, diversified with alternatives exposure from PGIM and Warburg Pincus, all in a dividend-yielding structure for its investors.

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PGIM PRIVATE CAPITAL

OPPORTUNITIES EMERGING FROM THE M&A SLOWDOWN

It was a slow year for mergers and acquisitions in 2023. By some estimates, global M&A deal volume was down by roughly 14% from the year before—just one domino to fall as financial markets and the broader economy felt the effects of higher interest rates.[1] But economic uncertainty only underscores the benefits of making allocations toward direct lending and mezzanine debt. Investors will find the current environment to be an attractive entry point, and more opportunities will likely reveal themselves as M&A and refinancing activity begin to thaw.

Direct lending and mezzanine present a strong investment case across economic cycles, offering greater flexibility, less volatility than public credit markets, and direct dialogue with companies that provides the opportunity to help management teams navigate a variety of business environments. In the current cycle, these characteristics are particularly attractive. From a borrower's perspective, direct lending and mezzanine are more compelling alternatives during a period in which senior debt capacity has dried up and higher rates have closed the price gap with other lending options. Businesses are looking for patience and flexibility in the current environment, creating a competitive edge for

firms that develop strong relationships with owners. When dislocation and uncertainty dominate, private credit is a compelling option for both borrowers and asset allocators.

Looking beyond the headlines on the lack of large LBO deals, investors can find opportunities in direct lending and mezzanine solutions that are built to weather a cooler M&A market through a reduced reliance on sponsored deals and a focus on the middle market, where M&A activity has been more resilient. Geographic diversification is also an important consideration, given the varied dynamics between dealmaking activity across different regions. Having a selective approach, close relationships with borrowers, and a regional network with local expertise can help direct-lending and mezzanine providers craft resilient debt solutions.

"We've developed our strategy to combat this market environment because of how diversified we are in terms of the types of deals that come through the funnel," said Anthony Ma, Vice President in PGIM Private Capital's Direct Lending Group.

The M&A slowdown in 2023 presents a strong entry point for investors with dry powder. Debt markets face

1 Boston Consulting Group, M&A Is Looking Up After Bottoming Out (August 2023) https://www.bcg.com/publications/2023/m-and-a-outlook-looking-up-after-bottoming-out

a recalibration as interest rates settle into a higher-for-longer pattern and the economic backdrop becomes more challenging. There will be pressure on the sponsored side to exit, which will likely spur more activity in 2024 than the year before.

> *We've developed our strategy to combat this market environment because of how diversified we are in terms of the types of deals that come through the funnel.*
>
> Anthony Ma, Vice President
> PGIM Private Capital's Direct Lending Group

The direct lending market has already begun to show signs of adjusting to the new rate outlook with EV multiples coming down. Meanwhile, given how quickly interest rates climbed, lenders are seeing more stress among the companies in their portfolios and are therefore becoming more disciplined about their credit underwriting. A resurgence in deal flows is likely to coincide with stronger underwriting discipline on the mezzanine side as well, laying the foundation for a market that more closely resembles the post-GFC years when leverage and valuations were down—a strong environment for lenders to put money to work.

"These are challenging markets for borrowers to navigate their businesses, but the broader uncertainty tends to create strong opportunities for mezzanine investors and our LPs," said Eric Seward, Managing Director and Co-Managing Partner at PGIM Capital Partners.

Big maturity walls in 2024 and 2025 suggest that corporate debt markets will be more active in the coming years. This creates a potential spillover effect for private credit, which has captured a larger share of the market for sponsored deals. Meanwhile, large banks have retreated from lending markets since the GFC, with private credit filling the void. Regional banks are under pressure as well due to valuation markdowns on existing assets.

Roughly one-quarter of leveraged loans are up for refinancing this year, and rates have risen dramatically since the last time many borrowers tapped credit markets. Mezzanine lenders that work with good companies in bad balance sheet situations can offer a more patient refinancing option for businesses that are facing challenges solely due to a higher cost of interest. More of these situations will reveal themselves should macro headwinds intensify.

With maturity walls approaching and interest rates up, companies are changing the way they look at their capital structures going forward. Direct lending and mezzanine are well positioned to capitalize on demand for flexible debt solutions in this environment. As the M&A market thaws, additional opportunities will arise for asset allocators looking to deploy capital across private credit markets. Investors will benefit from working with asset managers that can offer diversification beyond sponsored deal flows and uncover deals that would otherwise remain off the radar.

"We've been investing in this asset class across many different economic and geopolitical cycles, and pursuing consistent returns for investors," Seward said. "Most investors are seeking diversification of risk-return and unique sourcing. I think those attributes are competitive advantages for us."

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PGIM REAL ESTATE

CAPITALIZING ON AN EXPECTED PICKUP IN RENTAL GROWTH

That forecasters have revised down the risks of recession – particularly for the United States – and that talk of a so-called soft landing is being heard more often is very much a surprise. For real estate, this speaks to an investment outlook that is better than expected with opportunities to capitalize on an expected pickup in rental growth.

Nonetheless, risks do remain as the outlook is weaker than expected. Jobs growth forecasts remain weak while interest rates are set to remain higher than the past few years. Faced with such uncertainty, investors would be forgiven if they remained focused on sectors that, to date, have offered resilient income streams – income that holds up better than the economic backdrop. For most that means continuing to invest heavily into both logistics and multifamily sectors – those sectors that continue to demonstrate a resilience in values that resonates with previous downturns (Exhibit 1).

The problem for investors, however, is that when a real estate recovery kicks in, these sectors at large do not outperform to the upside. Their resilience is more about lower cyclical volatility, both on the downside and upside of a real estate cycle.

This is where geography matters.

Cities' Reliance on Job Growth Signals Resiliency

That the macroeconomic backdrop to a world of rising interest rates has demonstrated economic resilience is not a surprise when looking at the role jobs growth plays in driving economic activity over time. Economies are typically less cyclical when the economic growth story is driven more by jobs than by productivity.

For example, in Exhibit 2 we look at a selection of U.S. cities and analyze how city economies have performed relative to the broader U.S. economy during downturns and in recovery.

In particular, by subtracting each city's GDP growth from the national average in years of national negative growth and the immediate year after, we build up an average score that tells us which U.S. cities perform better (are more resilient) or worse (are less resilient) than the national economy.

What we find is cities in which most economic growth is due to job growth (as opposed to productivity growth) perform relatively better – are more resilient to the national economic cycle – than cities more dependent on productivity growth. In other words, we find that the more a city's economy depends on jobs, the more resilient it is. We see this connection between jobs growth forecasts and resiliency playing out around the world.

Exhibit 1: Sector Focus Is Not a New Story
Peak-to-Trough Prime Real Estate Nominal Capital Values, Main Sectors, During Previous Downturns

Legend: Early 1990s · Asia Crisis · Dot-com · GFC
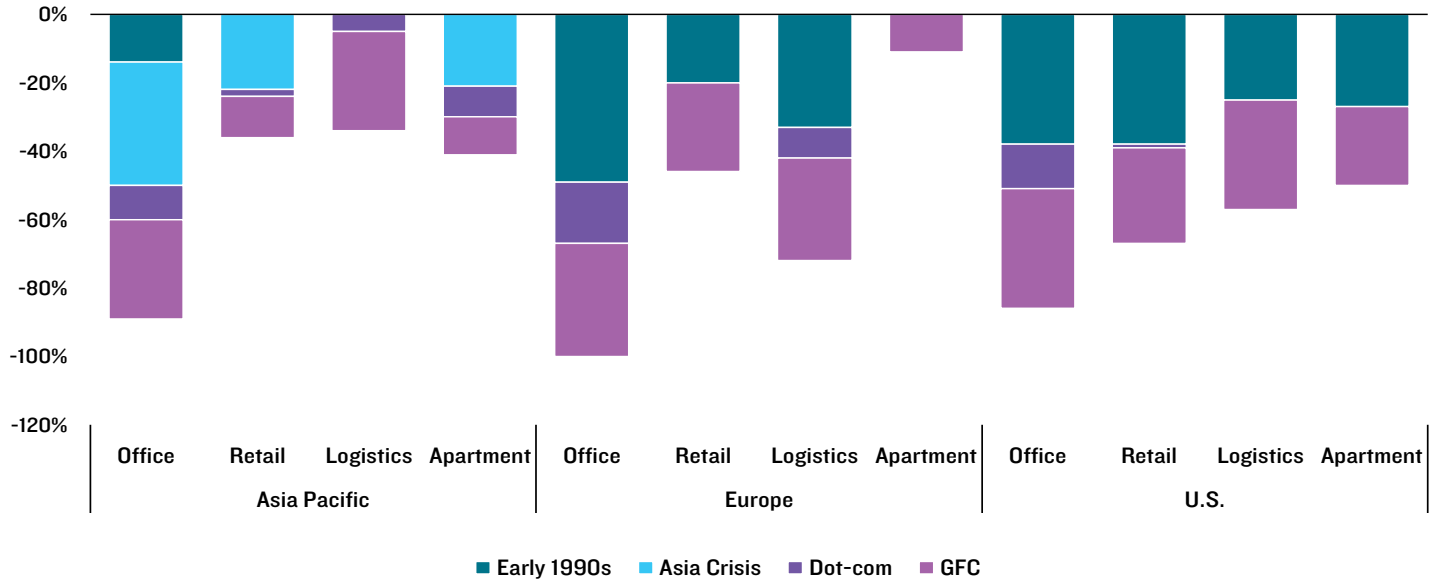
Sources: CoStar, PMA, Cushman & Wakefield, JLL, CBRE, PGIM Real Estate. As of December 2023.

Exhibit 2: The Economic Resilience* and Employment Share of Real GDP Growth
(Various U.S. Cities, 1991-1992, 2001-2003, 2009-2011, 2020-2021, (%))

Relatively resilient cities

$R^2 = 0.65$

*Note: Calculated as the average of city real GDP growth relative to national GDP growth when national GDP growth was negative and the first year of positive growth. Negative values mean weaker than the U.S. national.
Sources: Oxford Economics, PGIM Real Estate. As of December 2023.

The Intersection of Cities and Sectors in Uncovering Opportunities

What this means for investors is that while the sector play continues to make sense – protecting investors on the downside – it also works by investing in cities that are not only dependent on jobs growth but also have a stronger jobs growth outlook – promising upside growth.

So far so good. For major cities around the world, this resilience story leads to compelling investment opportunities in markets such as San Francisco and Dallas in the United States, Amsterdam, Stockholm and London in Europe, Sydney and Melbourne in Australia and possibly Tokyo in Japan, where strong jobs growth forecasts sit alongside very much job-driven city economies.

Jobs growth alone, however, is not the entire story. Investors still need to account for supply. While there are pockets of relatively high development, such as logistics in greater Tokyo and greater Seoul or multifamily across the U.S. sunbelt, don't forget about supply pressures in the office market given the shift to remote work; supply pipelines remain below averages set over the last cycle. That bodes well for rental growth, even if jobs growth comes in weaker than expected.

WHY THE PE SECONDARY MARKET REMAINS ATTRACTIVE

Private equity is inherently an illiquid asset class, with money locked in closed-end structures for extended periods, from the time of investment until eventual sale of the portfolio holdings. To address this liquidity challenge, investors often employ diversification as a strategy. By consistently committing to a portfolio of funds over time, they can anticipate a continuous flow of distributions that can be used to cover capital calls. This approach helps mitigate the impact of underperforming funds, as stronger-performing ones can offset shortfalls. Furthermore, the timing and magnitude of capital calls and distributions tend to balance out, minimizing idiosyncratic risks—similar to how diversification works in the public stock market.

However, the analogy with the public market also extends to the systematic aspects of the portfolio that resist diversification efforts. When the tide goes out, ships sink in unison. Despite limited available data, there are indications that this phenomenon is currently playing out in the private equity landscape.

For instance, Burgiss, a reputable collector of limited partner (LP) data, has suggested that 2023 might witness the most significant cash-flow deficits in the industry's history. Similarly, when examining our own funds of funds ("FoFs") holdings, which represent diversified portfolios of private

Exhibit 1: Distributions for Fund of Funds (% of Fund Size)
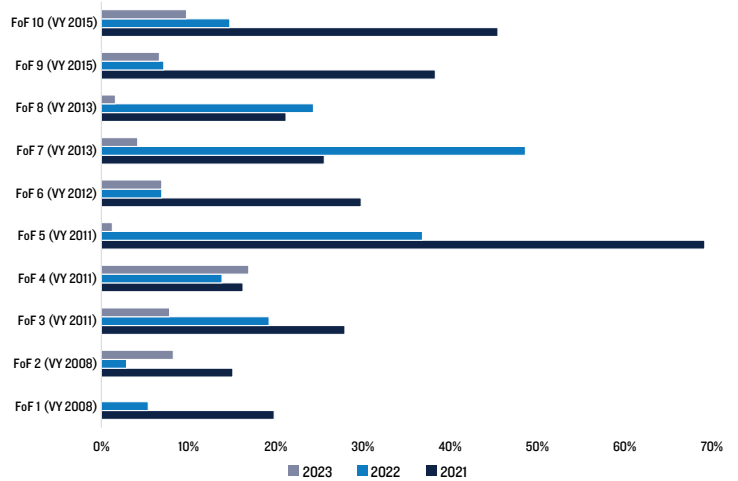
Note: Distributions in relation to fund size for FoFs in mcp's portfolio for the years 2021 to 2023. Distributions in 2023 scaled by 7% as data was obtained on December 6, 2023. Source: mcp 2023.

equity funds, it is evident that distributions have significantly dwindled in 2023 compared to previous years.

As can be seen from the chart, the median distributions relative to commitments across the 10 FoFs in our sample have shrunk from 27% in 2021 to 14% in 2022, and were a

Exhibit 2: Liquidity Concerns Have Become the Main Driver of Secondary Market Engagement
Share of investors that consider liquidity needs the main driver

+16pp

10% (2021)

26% (2023)
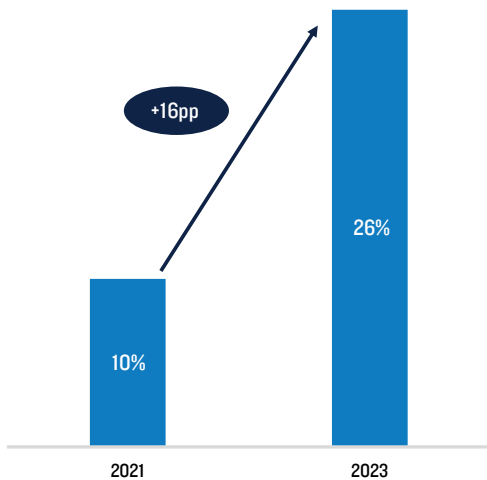
> We see strong tailwinds in the secondary market driven by liquidity needs from institutional investors and expect secondary fund managers to take advantage of attractive deal flow in the near-term.

> We are actively looking into selling investments with managers where we will not re-up in order to generate sufficient liquidity for new investments.

> CVs offer a great exit route for GPs as there is always liquidity issues in downtrends and CVs can generate win-win opportunities.

Notes: Results from mcp's annual investor survey, which gathers the views of institutional investors, such as banks, asset managers, pension funds, insurance companies, and sovereign wealth funds (classified throughout the report as "institutional investors"), as well as reputable family offices and foundations / endowments ("family offices and foundations").
Source: mcp 2023 Annual Investor Survey: Private Equity in the spotlight – how leading investors navigate the slowdown. mcp 2023.

mere 7% in 2023. This substantial decline has caught many investors off guard. As a result, investors find themselves in the position of needing to respond to these changing circumstances. Since they cannot compel their fund managers to sell the underlying investments, their only alternative is to initiate the sale of their fund holdings themselves.

In mcp's annual investor survey, more than a quarter of investors expressed that they are considering selling some of their private equity positions for liquidity reasons, marking a 160% increase compared to 2021.

This quest for liquidity has reignited interest in the LP segment of the secondaries market. Over the past decade, LP transactions steadily declined in favor of general partner ("GP")-led transactions, where the underlying fund managers initiated liquidity options in various forms. However, this trend began to reverse from 2021 onward. In 2020 and 2021, GP-led transactions dominated the market, but by 2022 and 2023, LP-led transactions regained prominence, as evidenced in the following chart.

Exhibit 3: Driven by Macroeconomic Factors, the Secondary Market Continues to be Attractive
LP-led/GP-led Split ($USD Billion)

% of total volume	24%	24%	32%	30%	58%	52%	48%	42%
	2016	2017	2018	2019	2020	2021	2022	1H23
GP-leds	9	14	24	26	35	68	52	18
LP-leds	28	44	50	62	25	64	56	25

■ LP-leds   ■ GP-leds
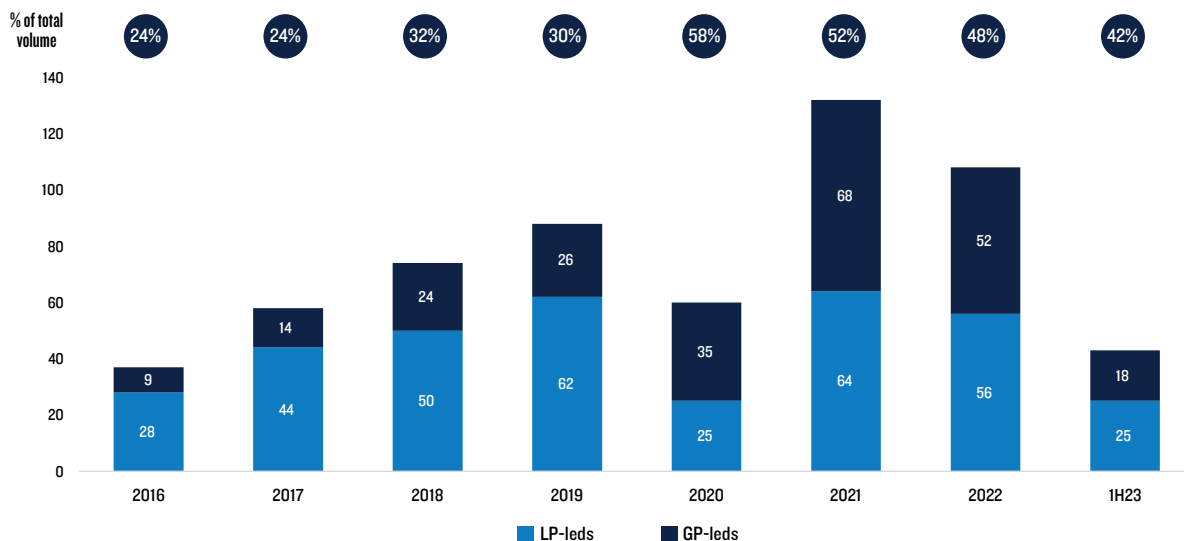
Sources: Jefferies 2023 Global Secondary Market Review (July 2023).

JENNISON ASSOCIATES

ARTIFICIAL INTELLIGENCE: THE GREAT WAVE

We believe recent advances in artificial intelligence (AI) herald a technological transformation, one that will be as significant and long lasting as the advent of the internet and mobile computing. Within the next several years, we expect to see generative AI use cases and applications spread from technology providers and developers to a wide range of industries. Companies can use these tools to harness data in increasingly sophisticated ways, which could help increase competitive positioning, improve time to market, and streamline customer service. For well-positioned, well-managed, and adaptable companies, in our view, the scope and depth of the opportunity is extraordinary.

It is understandable that some investors dismiss this as technology hype — especially since generative AI does not actually think as much as it uses data, statistics, and algorithms to make a prediction. In our view, however, the AI revolution is real and is just beginning. Demand for the infrastructure components necessary to support generative AI models has already soared, and we expect the full impact of generative AI will be like a wave sweeping through the economy. To capitalize on this opportunity, investors need a deep understanding of the AI ecosystem, where it is today, and the full implications of its future development.

WHAT IS GENERATIVE AI?

Generative Artificial Intelligence (generative AI) is a subset of AI technology. Generative AI can create new and unique content, including text, images, video, music, and computer code. This content is often indistinguishable from those created by humans. By contrast, traditional or predictive AI systems are predominantly deterministic and rule based. They are excellent at following explicit guidelines to perform tasks, but traditional AI lacks the capacity for creative or "novel" output.

Generative AI achieved a major breakthrough in November 2022, when OpenAI publicly released a large language model (LLM)—ChatGPT-3.5, which offered the power of generative AI to everyday users.

TODAY'S AI INVESTMENT OPPORTUNITIES

Semiconductors, Semi Cap Equipment, and EDA Software
We believe one of the most tangible ways to invest in generative AI today is through the semiconductors and infrastructure needed to support AI model training and running scaled AI-enabled applications. Graphic processing

The AI Wave Is Sweeping Through The Economy
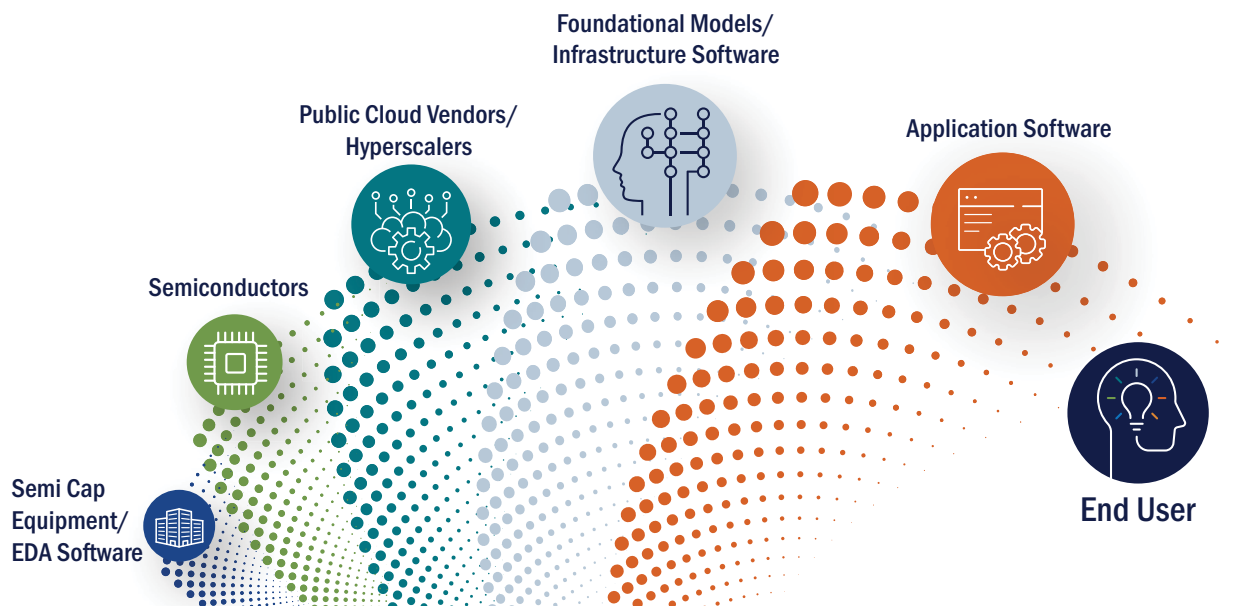
The information is provided for illustrative and educational purposes only and should not be considered investment advice. Source: Jennison. Explore the infographic at https://jennison.com/catch-great-ai-wave.

units (GPUs) are the core technology, combining cutting-edge semiconductors and customized software to process multiple computations simultaneously.

The growing usage of semiconductors has driven demand for the semi cap equipment companies that create the sophisticated hardware needed to manufacture chips.

Electronic design automation (EDA) companies write the software that makes the chips more efficient and more effective for customized tasks. The importance of this software has grown as chips become smaller, more complicated, and require great power efficiency.

Public Cloud Vendors/Hyperscalers
Hyperscale cloud vendors provide cloud computing infrastructure. They appear to be well positioned to meet growing demand for generative AI from medium-sized and smaller companies, who cannot afford to build, train, and operate their own models. They also work with large enterprises who value the unlimited scalability and flexibility offered by the public cloud.

Foundational Models and Infrastructure Software
Foundational models (or base models) are large machine learning models that are trained on extensive data sets with parameter counts that are frequently in the tens of billions. They are "foundational" because they can be adapted to a wide variety of tasks/functions such as educating, image creation, and coding. Foundational models can also be multimodal — they can interpret and generate multiple

types of data. For example, a multimodal model could record a conference call, transcribe the audio into text, graph each participant's time speaking, list the topics of discussion, and calculate their duration on the call.

Infrastructure software includes the tools and data management systems that software developers use to build their own generative AI applications. These companies provide the "technological plumbing" that enables enterprises to run applications and services, allowing them to tap into generative AI functions and get insights on their data.

Application Software
Application software is used by an end user to perform a specific set of tasks and/or to solve a particular problem.

Business applications for generative AI are in use — and many more are being developed — throughout the economy. Software companies are enjoying higher productivity as software engineers use generative AI to draft code. Customer service departments are handling inbound calls, emails, and voice inquiries through a model that draws on the firm's internal guidelines and knowledge. Product designers could simply describe what they want to create, and generative AI applications could generate options for the designer to consider and further refine.

Large banks or insurance companies are using generative AI to improve risk underwriting through the analysis of large sets of data and consumption patterns, focusing on consumer risk and fraud. Entertainment companies can use generative

AI to compose music, write first drafts of scripts, and create moving images with dialogue. In medicine, it can scan test results, diagnose disease, and recommend treatments. Generative AI can also detect inefficiencies, accelerate drug discovery (and generate new molecules), and improve clinical-trial planning and execution.

For individual consumers, we believe a transformative moment will occur when generative AI applications can interact with user tools — such as browser, calendar, email, office and entertainment apps. Apps can assist the user to complete personal or business-related tasks: to draft a memo, or organize a spreadsheet, or lay out a presentation. Ultimately, this will make the end user more productive, which in turn raises demand for generative AI and the infrastructure that makes it possible — completing a virtuous circle and starting the wave all over again.

A HISTORIC TRANSFORMATION — A HISTORIC OPPORTUNITY

Long-term structural change in the economy does not happen every day — our goal is to be there when it does. We are watching the AI transformation closely. It is difficult, at this stage, to identify the companies that will develop the next generation of generative AI applications for end users. We are more confident that, while there will be many failures, the companies that successfully use generative AI will have extraordinary advantages. We have been applying our approach to growth investing for more than five decades, and we believe that our commitment to fundamentals, our deep resources, and our experience investing through multiple cycles of economic transformation leave us well positioned to select the next generation of innovators.

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PGIM FIXED INCOME

UNCOVERING VALUE IN HIGH-QUALITY SECURITIZED CREDIT

Coming off a year of spread compression and positive excess returns, the outlook for securitized products remains nuanced amid several cross currents. However, the spreads and yields on high-quality securitized products remain attractive relative to comparable fixed-income instruments, setting up a promising year ahead for long-term investors who can sift through the sector's dispersion to identify its ample alpha-generating opportunities.

There has been no shortage of headlines around the challenges in the commercial real estate market. Offices have come under the most scrutiny, with headwinds from the rapid rise in interest rates and the work-from-home era converging. Valuations across the CRE spectrum have declined, financing has become scarce, and transaction volumes have fallen. But despite the likelihood of losses in the CRE market, recent trends have created fertile ground for investment opportunities. Lower valuations have made high-quality CMBS attractive, particularly for those with a long-term perspective.

Higher interest rates have a cascading impact on the CRE market. As rates rise, property owners with floating-rate debt must meet higher financing costs, and some borrowers

will find that their properties won't generate enough cash flow to cover financing costs. Purchase prices for new capital investments must therefore be adjusted lower for owners to achieve target returns. Fixed-rate borrowers may be better positioned, but lower valuations and weakening fundamentals still pose refinancing challenges.

An uncertain outlook may help make the case for an allocation toward high-quality CMBS, particularly in senior tranches that hold the potential for relatively attractive risk-adjusted returns with robust structural credit protection. It is also important to note that the office sector, which has no doubt faced intense pressure given the shift to remote work, is just one piece of the CRE pie. Office loans account for approximately 16% of total CRE mortgage debt outstanding.[1]

The strain in the office sector has pressured more defensive corners of the CMBS capital structure, thus raising the value proposition for fixed-income investors.

There is value emerging within conduit AAA securities, where spreads have been wider than those of the IG Corporate Index for the first time since the Global Financial Crisis. These high-quality, diversified conduit securities are

1. Mortgage Bankers Association, as of Q2 2023. https://www.mba.org/news-and-research/newsroom/blog-post/2023-q2-databook

poised to benefit from credit stress in the underlying pool of CRE loans. Even in a default scenario, investors can capture upside in price, given that these bonds have been trading at discounts to par due to elevated rates.

While conduit loans are generally weaker than those from balance sheet lenders, these securities are structurally insulated from credit and extension risk because of their significant credit enhancement and payment priority within the deal waterfall.

Investors with the capabilities to perform rigorous bottom-up underwriting can also find opportunities further down the capital structure. Significant repricing has created value within certain single asset, single borrower (SASB) securities, which allow investors to target specific sectors and assets. Investors can capture this value through selective exposure to mezzanine and subordinate tranches of trophy assets that have been priced to worst-case scenarios.

The current environment presents an array of challenges for the CRE market. The effects of higher rates and tighter credit conditions are set to play out slowly given the nature of multi-year leases across the office, retail and industrial sectors. In the industrial and multifamily sectors, loans originated at peak valuations will likely struggle to refinance, and mezzanine tranches could be at risk of principal losses in the event of further price erosion. Price volatility, distressed workouts and market negativity may very well continue to afflict the CRE market as borrowers approach looming maturity walls.

Although this backdrop has cast a shadow over commercial real estate, bargains are emerging across the CMBS capital structure — even in the office sector, where pockets of value are developing within select properties and markets that are expected to survive the current cycle. Meanwhile, fundamentals in the industrial and multi-family sectors are generally sound, banks will be incentivized to extend and amend distressed loans, and onshoring policies and industrial spending may help offset a potential lull in new construction.

Headwinds in the CLO market will likely remain amid weaker credit fundamentals, even as low supply and strong demand from new issuance provide technical support for underlying loans. Investors can also expect an increase in CCCs, as a higher-for-longer rate environment weighs on floating-rate loan borrowers. Although CLO mezzanine tranches have widened, they have yet to account for potential loan losses. A better entry point remains further down the road. In the meantime, AAA and AA CLOs in the US and Europe stand out as attractive investments.

Conduit AAA vs IG Corporates Basis
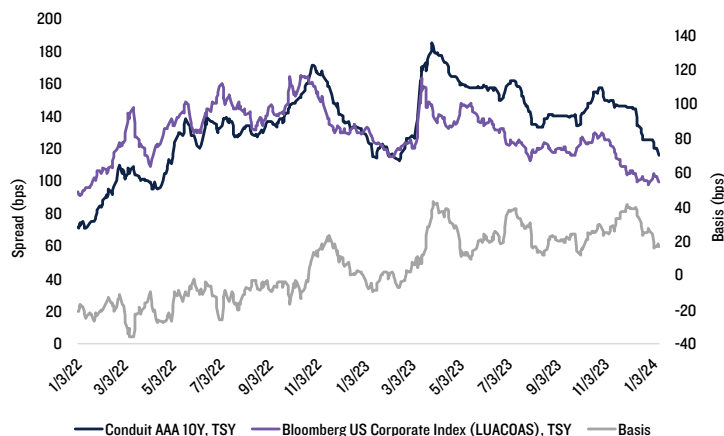
Source: PGIM Fixed Income, JPM Indices, Bloomberg Index as of January 10, 2024.

Having a tactical approach will also prove useful when navigating the market for asset-backed securities, where two very different stories have played out. Credit performance within sub-prime auto and marketplace lending securitizations has deteriorated, which reflects rising costs for rent, food and gas that have taken a toll on consumers at the lower end of the income spectrum. Meanwhile, mortgage credit and prime auto performance has remained robust, buoyed by rising home prices and resilient equity markets that have benefited higher earners. Tougher banking regulations may give rise to new ABS opportunities in the form of asset sales or regulatory capital transactions related to significant risk transfer.

In real estate, strong housing fundamentals underpin investments in mortgage credit. Home prices have stabilized after initially feeling pressure from rising mortgage rates. While higher prices and rates will likely hurt affordability and dampen demand, the residential housing market remains tight amid below-average supply. Home prices are thus poised to stay range bound. Against a backdrop of moderate changes in home prices and strong underwriting practices over the past decade, investors will find a positive outlook for mortgage credit instruments.

With a holistic view of the securitized credit market, patient investors with a long-term perspective will be able to seize opportunities as they reveal themselves.

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PGIM QUANTITATIVE SOLUTIONS

WHY QUANT FOR THE FUTURE

Since the first quantitative equity funds launched more than 30 years ago, the demise of systematic investing has been predicted many times over. Most recently, quants faced the "Quant Winter" that started in 2018 and lasted nearly three years. Many thought that this extended period of underperformance by systematic strategies was the nail in the coffin for quant investing. But quantitative equity strategies are not only alive and well, they are also in a remarkable position to address today's evolving investor concerns.

While the investment opportunities that arise from quants' ability to efficiently process data are important, the precision with which quants apply that data to construct portfolios and manage risk is what sets them apart. Expertise in portfolio construction allows quants to build diversified portfolios that aim to deliver on alpha promises while avoiding uncompensated risk. This precision may serve clients in several capacities, from adding consistent alpha in the most inefficient illiquid markets, to serving as a predictable core position that provides solid beta exposure with the ability to add value in most market environments. While upside may be more modest than that of concentrated active managers, the consistent application of the investment strategy enables quants to avoid style drift, and their flexible approach to

portfolio construction makes it easier to customize for modern institutional investor needs, including being adapted for tax efficiency.

DISCIPLINE, DATA, DIVERSIFICATION

As the concept of investment bias began to take hold in the 1970s and 1980s, many investors started to explore how to prevent biases such as overconfidence, loss aversion, and confirmation bias from disrupting sensible investment decisions. In response, quantitative investors built simple models that took advantage of these biases and applied their models dispassionately through bubbles and dips. As the first quant equity funds launched, simple measures of valuation, quality, momentum, and earnings trends delivered consistent alpha. The concept of "risk-adjusted returns" wasn't yet appreciated, and investors were drawn to concentrated, high-conviction portfolios where portfolio managers could tell compelling stories about each stock held in their portfolio. In contrast, listening to a quant drone on about capturing market inefficiencies was enough to put investors to sleep.

Today, those simple models have evolved to incorporate vast amounts of newly available data, paired with new analytical

Quant vs Fundamental, Median Rolling 3 Year Excess Returns in Emerging Markets Small Caps
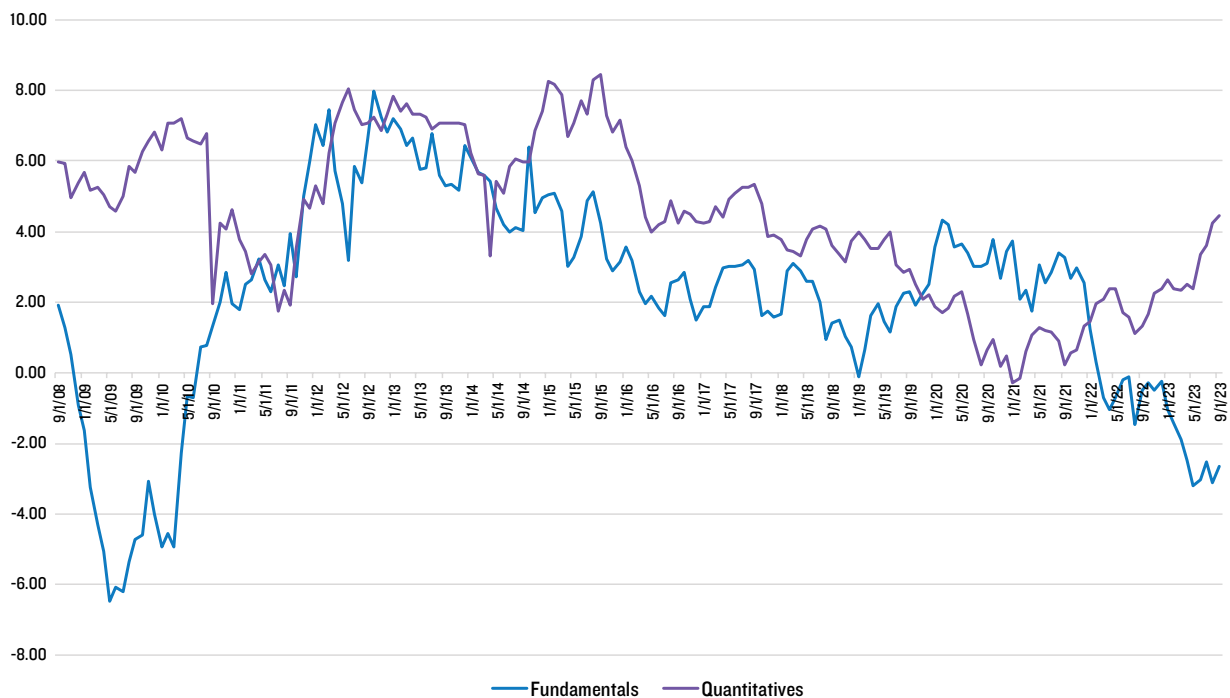
Source: eVestment

techniques such as natural language processing (NLP) and machine learning. In this more data-intensive, technology-driven world, quants can more effectively deliver on their traditional strategies while also expanding into more custom solutions that cater to nuanced client preferences. Outlined below are three ways in which quants can deliver outcomes for investors.

Cracking the Code of Inefficient Markets

The most inefficient markets in the world have great alpha potential and often face greater investment challenges. For example, illiquidity is both a risk and a cost investors face when investing in areas like emerging markets, small or micro caps. When dealing with liquidity challenges, a quant's ability to measure alpha potential and model trading costs to produce "net alpha" expectations is crucial. A portfolio with many small positions is both easier and cheaper to trade than a more concentrated strategy with larger blocks of buys and sells in the market. Thus, a systematic small cap emerging markets strategy typically has a higher capacity limit than its more concentrated counterparts.

But inefficient markets also include a vast amount of data: tens of thousands of companies, multiplied by their underlying data points – often messy, inconsistent, or missing. This presents the challenge of both verifying the reliability and relevance of the data and determining whether the company or opportunity shows investment potential.

Importantly, neither excessive nor dirty data poses a challenge for quants because they have a long history of leveraging tools to process data in these opaque markets. As a result, quants can bring valuable insights to these less efficient markets, allowing them to build diversified portfolios with more focused risk/return tradeoffs. As shown in the chart above, quant has delivered more consistent alpha than fundamental in the 9/2008-9/2023 time period

Style drift, both intentional and unintentional, is often an issue faced by investors who may chase trends or leave portfolio drift unchecked. Divergence from the portfolio guidelines may not only impact a client's risk-return profile, but it can also lead to unpleasant surprises when the market inevitably shifts. A systematic process consistently keeps the portfolio true to its style. Traditional strategies may also take bigger positions at the country/sector level. These bets may lead to alpha, but certainly lead to higher risk. On the other hand, quant strategies typically maintain tighter portfolio limits and, therefore, derive their alpha from stock selection as opposed to country or sector bets.

The ability to add value without taking large country/sector bets is an advantage in a world where geopolitical and macro risks are ever-present. With a comprehensive perspective across an inefficient market, a quant can capitalize on alpha opportunities in a cost-effective manner that also limits concentration risk.

Average Active Sector Position
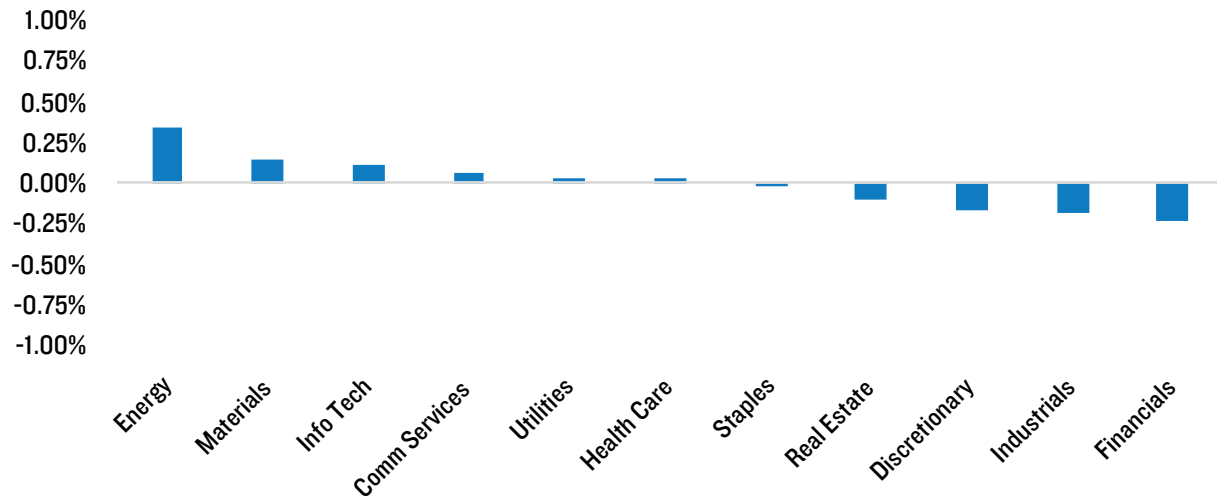
Source: PGIM Quant, Factset, MSCI

Average Active Country Position
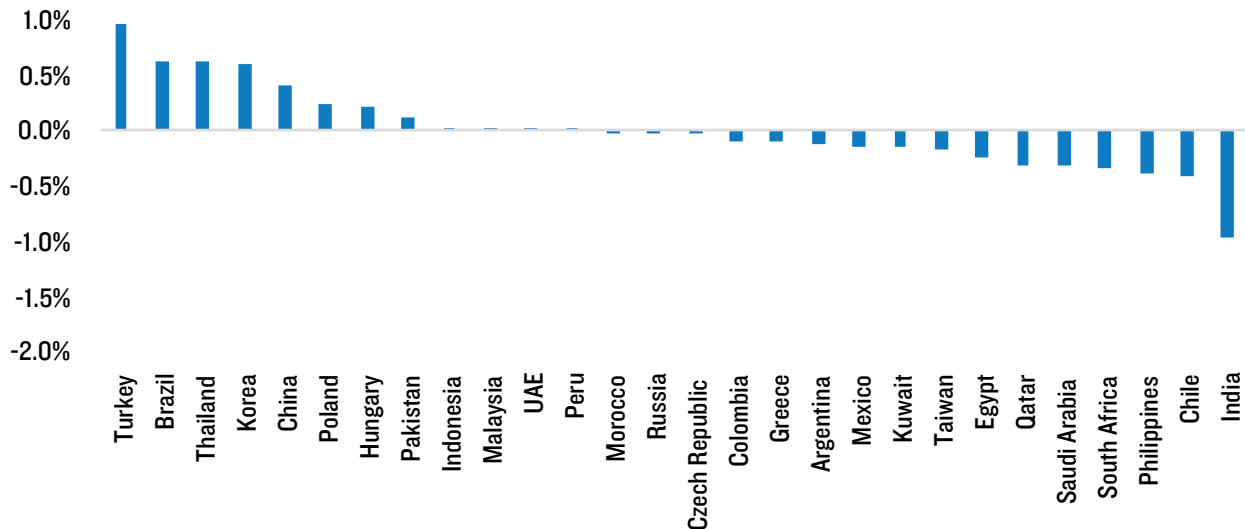
Source: PGIM Quant, Factset, MSCI

Providing the Reliability Needed for Core Portfolios

While transaction costs are less of a headwind in developed markets, there are also fundamental benefits to a systematic, repeatable investment process that may lead to consistent outcomes in more efficient markets. Investors are under tremendous pressure to both meet their fiduciary duties and deliver strong returns in line with their investment policy statement. Investors need to balance their desire for alpha with downside risk, while keeping their costs low. Because quant strategies focus on delivering attractive risk-adjusted alpha at a lower fee – a sweet spot in public equity markets – they can provide a solution to this challenge. By allocating higher risk and fee budgets to areas that are more likely to be rewarded such as private equity or private credit, investors can focus

their public equity segments to highly efficient quant strategies which can provide a diversified, customizable, lower-fee, style-pure solution. The chart below shows that additional risk beyond 2-3% tracking error – where quants typically fall in emerging markets – has not paid off over the last 10 years.

By allocating higher risk and fee budgets to areas that are more likely to be rewarded, such as private equity or private credit, investors can focus their public equity segments to highly efficient quant strategies which can provide a diversified, customizable, lower-fee, style-pure solution.

Creating Custom Exposures that Meet Risk/Return Goals

Investor needs have become more nuanced, and their need for active solutions that are nimble, customized and diversified

Quants Are in the Sweet Spot: More Risk Doesn't Necessarily Get You More Return
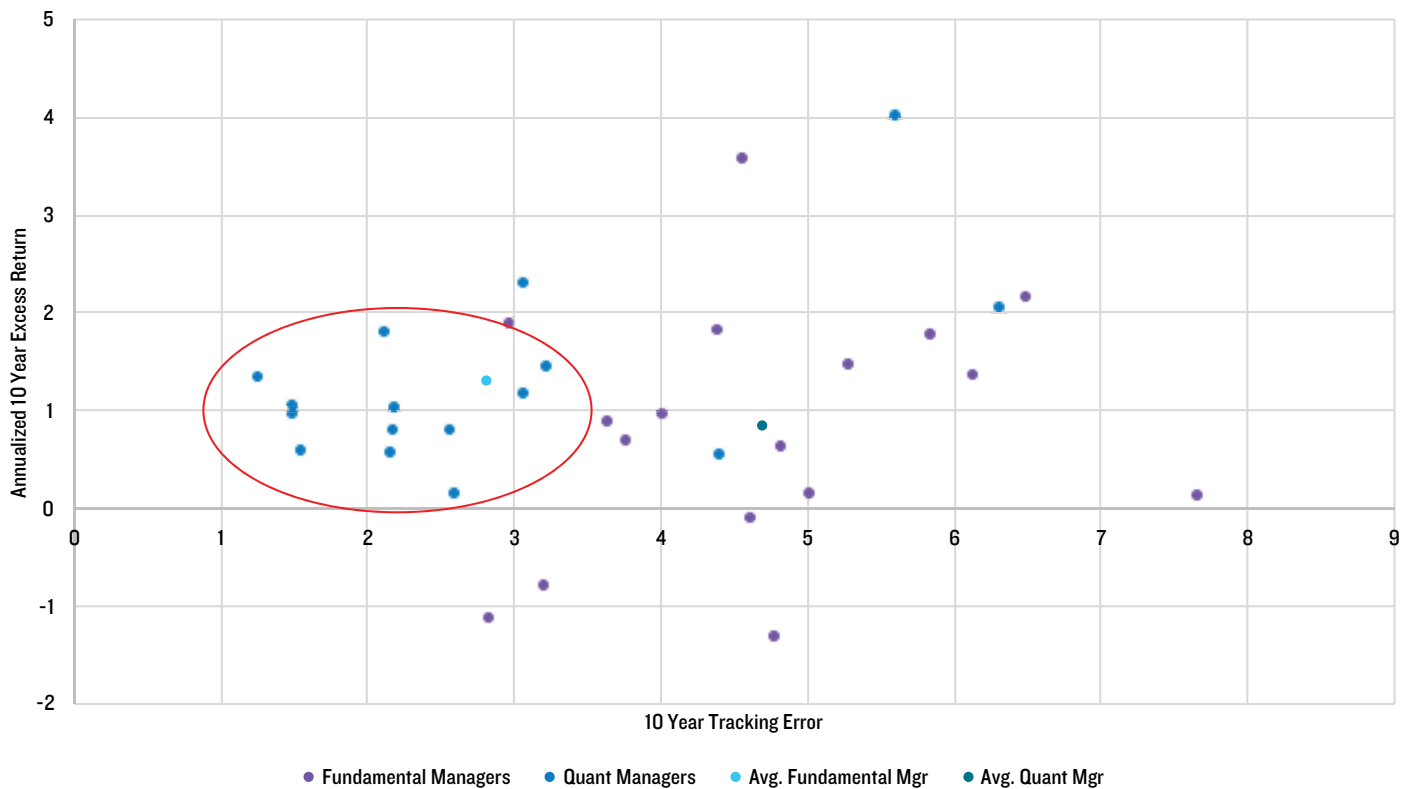
Source: eVestment

has grown. University endowments are facing calls from their student government associations to divest from fossil fuels. Family offices need to balance portfolio diversification with tax impact in order to manage capital gains. Institutions of all types are trying to navigate the existing and potential impact of one global macro event after another.

Take China for example. There are varying options on how to approach an investment in the world's second largest economy. Do investors continue to invest in standard emerging markets to gain exposure to China? Do they invest in a China-only strategy? Do they eliminate an allocation to China altogether? A systematic manager can build completion portfolios around an existing China strategy, allow for custom country weights, or eliminate China exposure all together without losing alpha potential in their emerging markets allocation.

Once again, a quant's advantage in data analysis comes into play here. With such a broad view of the universe, quants are able to partner with investors to build custom portfolios that solve for a wide array of issues without sacrificing alpha or blowing up tracking error targets.

KEEP CALM AND CARRY ON

Periods of underperformance are often used by critics to forecast a style's impending demise, but the reality is that all active strategies struggle at some point in a market cycle. Investors should look forward; the investment landscape has become exponentially richer with information, and quantitative tools have evolved to efficiently interpret and capitalize on these new data points. This environment is ripe for quantitative strategies to not only continue to deliver favorable long-term investment results, but also to provide more targeted solutions to solve investor problems.

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A YEAR OF MACRO SURPRISES AND WHAT MAY BE NEXT

PGIM | WADHWANI

Following 2022's "blow-out" year for many trend- and macro-based strategies, 2023 was a very different story – with generally poor performance, not just relative to 2022 but also relative to the longer-term historical track-record. Economists' forecasts in late 2022 were for a dismal 2023. Bloomberg's consensus predictions for US real GDP growth were just 0.3% with 3.6% inflation. Little surprise, then, consensus expectation put the likelihood of a 2023 recession at 65%, the highest recorded response since Bloomberg started its surveys in 2008, barring the few episodes when the economy had actually been in recession.

For a better feel for how rare such gloomy forecasts are, consider the Federal Reserve Bank of Philadelphia's "Anxious Index" which shows there have been very few occasions over the past 55 years when economists were as worried about a recession as they were in late 2022. And very few when they were wrong. Historically, when the Anxious Index is above 45, the economy generally enters recession. But not this time:

the consensus forecast today is for real GDP growth of 2.4% for 2023 – or eight times higher than what was expected a year ago.

WHY DID ECONOMISTS PREDICT A RECESSION AND WHY WERE THEY WRONG?

One of the most commonly used recession prediction models is based on the yield curve slope.[1] Specifically, when the slope of the difference between 10-year US Treasury yields and the 3-month Treasury Bill turns negative – either with short-term interest rates high, long-term rates low, or some combination of the two – recessions tend to follow. When the model has gauged that the probability of a recession occurring over the next 12 months is above ~25%, a recession has typically followed. 2023 is the only occasion when the predicted likelihood wasn't just close to the critical "tipping point," but miles past it. Clearly, this model got it badly wrong.

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1 One of the earliest studies to notice the regularity used data from the end of WWII to the 1960s — i.e., before that used by the NY Fed's research, summarised below — is the book The Cyclical Behavior of the Term Structure of Interest Rates, by Kessel, R., NBER, January 1965.

Figure 1: The Anxious Index in the United States*

One-quarter-ahead probability of a decline in real GDP
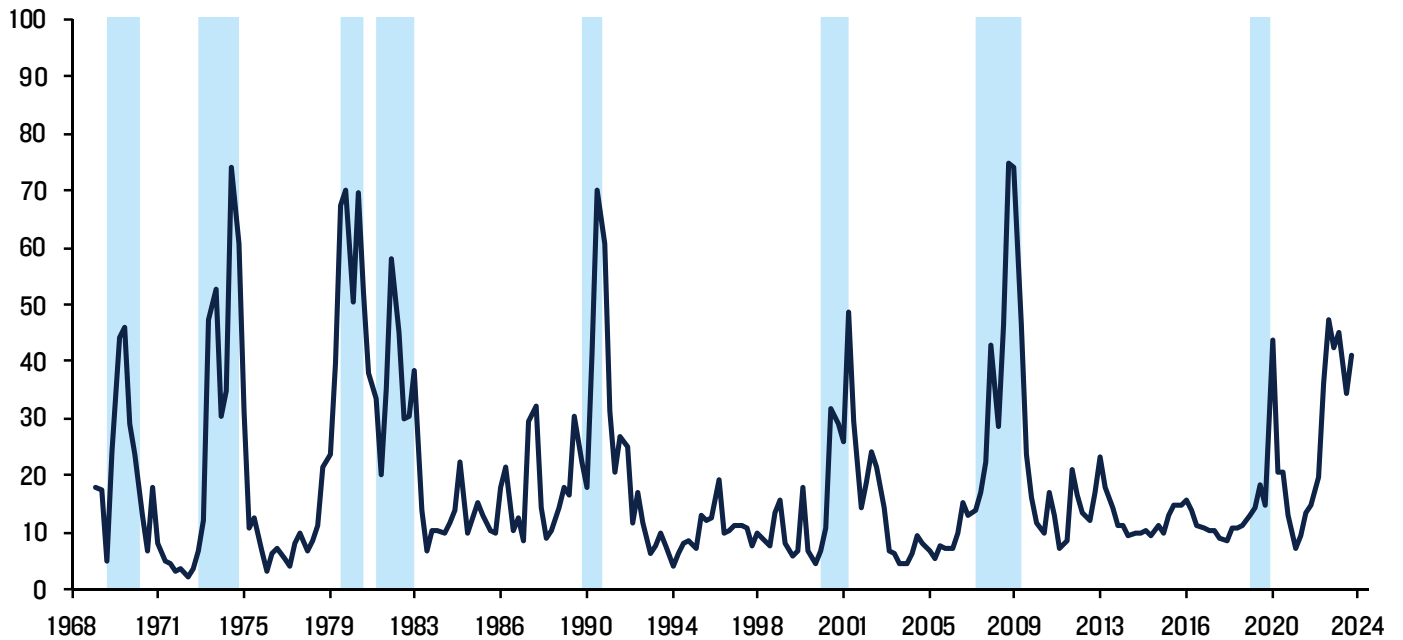
Source: Federal Reserve Bank of Philadelphia, as of 13th November 2023.

* The Anxious Index is based on the Survey of Professional Forecasters, carried out by the Federal Reserve Bank of Philadelphia, showing respondents' expectations of a decline in real GDP occurring over the next quarter. The chart covers the period 1969:Q1 to 2023:Q4. NBER recessions are shown as blue bars.

Figure 2: The Probability of a Recession in the United States as Predicted by the Treasury Spread*

Probability of a recession over the next 12 months
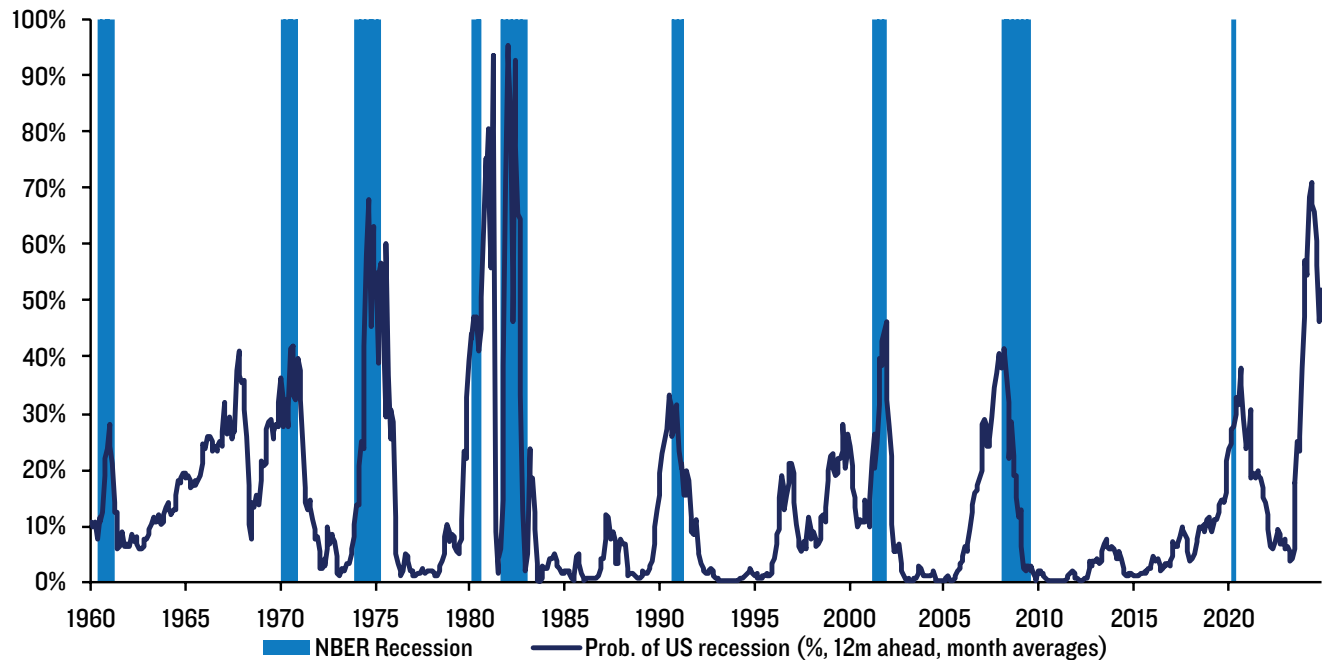
Source: New York Federal Reserve, as of 30th November 2023.

* The blue bars show actual recessions, based on the NBER's analysis. Model parameters have been estimated using data from January 1959 to December 2009 by the New York Fed's researchers. Recession probabilities have been predicted using data through to November 2023. For more details, see https://www.newyorkfed.org/research/capital_markets/ycfaq#/

Figure 3: Real Personal Disposable Income and Real Personal Consumption in the United States

Trillions of 2012 dollars, annualized
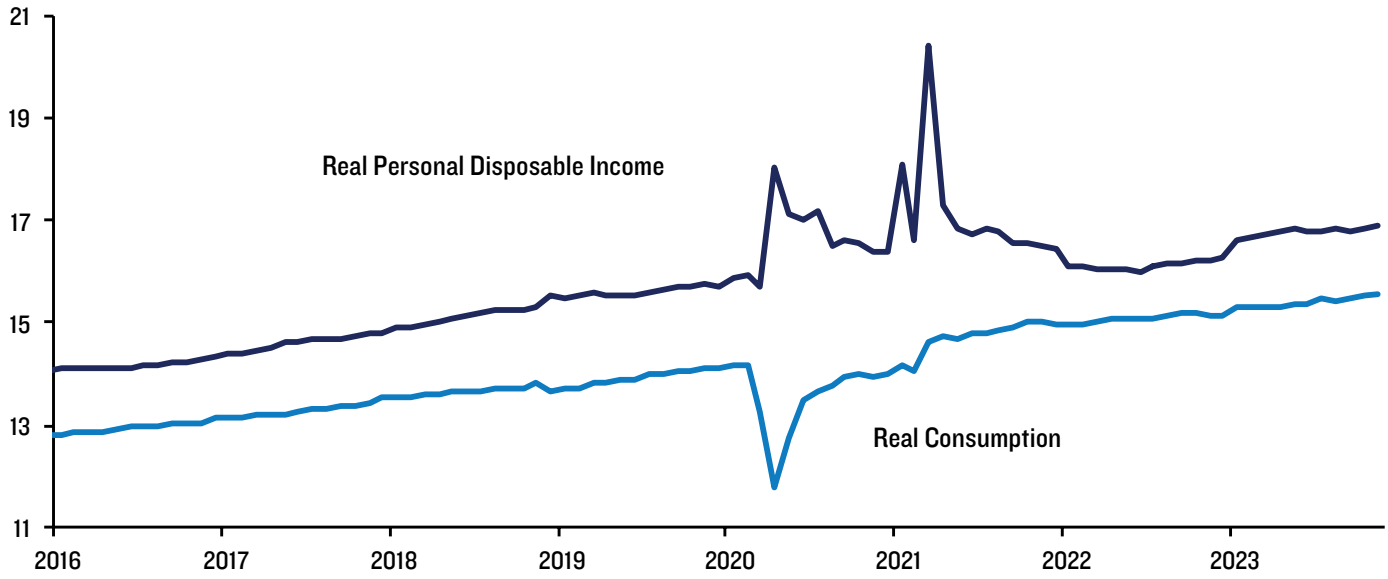
Source: Bureau of Economic Analysis. The data covers the period January 2016 to November 2023.

With personal consumption accounting for around two-thirds of total GDP, the consumer is key to the US economy. Generous subsidies that boosted incomes, combined with a sharp drop in consumption during pandemic-related closures, led households to build up substantial "excess savings," which helped consumer spending to hold up more than usual in the face of declines in Real Personal Disposable Income (RPDI) – the consequence of wage increases that failed to keep up with inflation and slowing jobs growth. While 2022 saw an outright drop in the level of real after-tax income, income growth got "back in the saddle" in 2023 and started recovering – although the income level today is still shy of what one would have expected had the pre-pandemic trend persisted (Figure 3).

More surprisingly, consumption growth continued rising at its pre-pandemic trend growth rate, with the volume of consumer spending growth for 2023 now poised to register a healthy 2.2% rate, whereas last year's predictions put it at a miserly expansion of just 0.9%.

Why such consumer strength? Early estimates of "excess savings" turned out to be far too low: preliminary estimates of Gross Domestic Income were revised higher, and given

that savings is a residual of income, so too was the savings rate.[2] Easier-than-expected fiscal policy, which drove the "Disposable" bit of RPDI to do better than expected, also bolstered consumer spending. In late 2022, for example, the IMF gauged that 2023 would see the "structural" budget deficit widen by 1.3% of GDP. A year on, this estimate was revised by a full percentage point to 2.3%.[3] Given the normal fiscal multipliers, this factor is likely responsible for more than half of the economists' underestimation of 2023 GDP growth.

WHAT TO DO WHEN THE MODEL BREAKS DOWN?

When long-standing economic models break down, where can economists and asset managers turn?

Use different inputs: Implement alternate models that incorporate other definitions of yield curve slope using different maturities. For example, the Fed has used a "near-term-forward-spread" version of the yield-curve-slope model,[4] rather than the more commonly used 10s-2s and 10s-3mth models.[5] However, it also flipped into negative territory towards the end of 2022 and has been there ever since. So, it too has undergone what appears to be a systemic failure.

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2 One such example – when economists were forced to admit that "there is more excess savings currently left over for consumers" – was when the BEA revised up its estimates for second-quarter GDI. For further details, see "US: 2Q real GDP unrevised at 2.1% saar + annual revisions", by Silver, D., J.P. Morgan Economic Research note, 28th September 2023, from which the quote is taken.
3 The two figures quoted here come from the October 2022 and October 2023 editions of the IMF's World Economic Outlook publication.
4 To see the near-term-forward-spread, see https://www.neartermforwardspread.com/
5 For details, see "(Don't Fear) The Yield Curve, Reprise, by Engstrom, E., and Sharpe, S., FEDS Notes, 25th March 2022, and the references therein.

Consider non-linearities: A recession-prediction model naturally assumes that a higher expected recession probability would be bad news for equity markets. In practice, it's important to recognize that this relationship is more complex. A recent piece by PGIM Institutional Advisory & Solutions[6] showed that it's both the predicted level and the predicted change in recession probability that matter, and the two interact to produce a much more complex relationship.

Incorporate different models: Consider an alternate model – such as using labor market data – to predict recession. For example, the Sahm rule,[7] which compares the current average unemployment rate with the lowest three-month average from the past year, rather than using the latest data in isolation. The rule shows that almost every time unemployment has risen past a certain threshold, a recession has occurred.

So, when one model breaks down, it's critical to diversify the set of models used – whether switching to another model altogether or comparing several alongside the original.

WHAT'S ON THE HORIZON?

While the forecast for 2023 was dismal, the view going into 2024 is cautiously optimistic. The Fed's most recent Summary of Economic Projections (SEP) took a slightly more positive view of the 2024 outlook than its previous SEP forecasts, projecting moderate economic growth rather than a recession. However, with the forecast also predicting unemployment to rise above 4% this year – the sort of increase that has historically gone hand-in-hand with recession – concerns of an economic downturn persist.

An array of models confirms this conflicting view. Yield curve slope models remain inverted. The question remains, however, whether 2023 was an anomaly and the model will get it right this time around. On the other hand, some labor market-based models, like the Sahm rule, are more optimistic, suggesting the labor market is finally in balance and thus, will protect against a recession. As investors we will watch each economic indicator with a discerning eye, but only time will tell which forecast will prevail.

While we're still disappointed from the drawdowns in 2023, it's worth noting that today's economic climate – with expectations for moderate growth and further disinflation – should be a supportive one for riskier assets, despite the uneven forecasts for 2024. Liquid alternatives have, in our view, generally been a sound strategic investment in any market, and given the current conditions, we remain confident that macro strategies will resume performing as they are designed to do and will continue to offer investors a diversifying stream of significant risk-adjusted returns.

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6 See "What to Expect when Expecting a Recession", by Weisberger, N., and Xu, X., PGIM Institutional Advisory & Solutions research note, June 2023.

7 Brookings, https://www.brookings.edu/wp-content/uploads/2019/05/ES_THP_Sahm_web_20190506.pdf

PGIM DC Solutions

GENERATING INCOME FOR RETIREES

Defined contribution investment options are not designed to be "retirement ready." Efficient retirement portfolios look different than efficient accumulation portfolios, given the more focused objective of generating an income stream, and unfortunately the key building blocks for efficient retirement portfolios are often missing from DC plans. The portfolio efficiency costs of these gaps can be staggering, exceeding roughly 100 basis points on an alpha-equivalent basis.

By incorporating more extended asset classes, there is the potential to generate five or more years of additional income for retirees. Therefore, it is essential that DC plan sponsors review their core menus and investment offerings to ensure they are designed to truly optimize outcomes for plan participants, especially those nearing and in retirement.

The role of the core menu has evolved considerably over time. For example, the mass adoption of default investments, in particular target-date funds, over the last few decades has resulted in fewer participants selecting core menu funds, especially those who would generally be considered less sophisticated. While early research suggested larger core

menus could negatively affect plan participation, these concerns are significantly less relevant in the age of default investments and automatic enrollment. That said, certain asset classes are still better offered through pre-packaged portfolios, whether that's target-date funds or multi-asset solutions available on the core menu.

When thinking about overall plan sponsor interest and general availability of asset classes, we can place them into three general groups, which are included in Exhibit 1.

Extending the breadth of the asset classes available to participants, and retirees in particular, can result in notable potential diversification benefits. The effect is seen in the exhibit below, which includes correlations of the Basic asset classes to the three different potential coverage levels (Basic, Enhanced, and Extended) when US stock market returns are positive and negative. The analysis uses quarterly returns from Q1 2000 to Q4 2022, with asset class definitions included in the Appendix using data obtained from Morningstar Direct.

Exhibit 1: Asset Classes by Coverage Level

BASIC	ENHANCED	EXTENDED
US Large Cap	Emerging Markets Equity	Private Real Estate Equity
US Small Cap	REITs	Private Real Estate Debt
Non-US Equity	Commodities	Long Duration Bonds
Core Fixed Income	High Yield Bond	Infrastructure Equity
Cash	TIPS	Defensive Equity

Exhibit 2: Asset Class Correlations Across US Historical Market Return Environments: 2000-2022

	POSITIVE MARKET ENVIRONMENTS — ASSET CLASSES					NEGATIVE MARKET ENVIRONMENTS — ASSET CLASSES				
	LC	SC	Intl	Bond	Cash	LC	SC	Intl	Bond	Cash
BASIC										
US Large Cap (LC)	1.00	0.82	0.73	0.14	-0.20	1.00	0.88	0.82	-0.40	0.09
US Small Cap (SC)	0.82	1.00	0.67	0.00	-0.13	0.88	1.00	0.74	-0.38	0.18
Non-US Equity (Intl)	0.73	0.67	1.00	0.15	-0.10	0.82	0.74	1.00	-0.22	0.25
Core Fixed Income (Bond)	0.14	0.00	0.15	1.00	0.24	-0.40	-0.38	-0.22	1.00	0.30
Cash (Cash)	-0.20	-0.13	-0.10	0.24	1.00	0.09	0.18	0.25	0.30	1.00
ENHANCED										
Emerging Markets Equity	0.62	0.62	0.83	0.22	0.07	0.70	0.60	0.76	-0.25	0.03
REITs	0.54	0.51	0.44	0.44	-0.07	0.53	0.63	0.50	0.03	0.37
Commodities	0.25	0.24	0.32	0.05	0.00	0.60	0.50	0.73	-0.28	0.18
High Yield Bond	0.69	0.60	0.73	0.36	-0.22	0.67	0.61	0.48	-0.07	0.13
TIPS	0.15	0.03	0.14	0.78	0.12	-0.05	-0.08	0.06	0.72	0.25
EXTENDED										
Private RE Equity	-0.40	-0.37	-0.40	-0.17	0.19	0.42	0.35	0.43	-0.15	0.21
Private RE Debt	0.14	-0.02	0.10	0.83	0.09	-0.04	0.02	0.04	0.56	0.24
Long Duration Bonds	0.15	-0.03	0.12	0.94	0.10	-0.36	-0.40	-0.26	0.90	0.06
Infrastructure	0.61	0.45	0.75	0.33	0.02	0.62	0.44	0.68	-0.28	-0.11
Defensive Equity	0.55	0.34	0.20	0.06	-0.07	0.18	0.17	0.07	0.32	0.10

Source: Morningstar Direct. See Appendix for asset class definitions.

As shown, the correlations among the risky asset classes included in the Basic group, which would include US large cap, US small cap, and non-US equity, had relatively high correlations regardless of the market return environment (positive or negative). In contrast, the correlations of the riskier asset classes in the Enhanced (e.g., emerging markets equity, REITs, and commodities) and Extended (e.g., long duration bonds, defensive equities, infrastructure, etc.) groups are notably lower and can vary across market environments.

Portfolio Optimizations

To demonstrate the potential benefits of increasing the opportunity set of asset classes when building portfolios, we ran a series of portfolio optimizations using PGIM Quantitative Solutions' Q4 2022 Capital Market Assumptions, including an "asset-only" optimization, which is a traditional mean variance optimization approach. The optimizations include a maximum 33.3% allocation to a single asset class, other than cash, to ensure the resulting

portfolios are reasonably diversified. The efficient frontiers for the three opportunity sets are included in the exhibit below.

As the opportunity set moves from Basic to include Enhanced and then Extended asset classes, the expected risk-adjusted returns for the portfolio improve. For example, focusing on the asset-only optimizations for portfolios with a standard deviation of 6%, the efficient Basic + Enhanced portfolio has a return that is 0.53% higher than the efficient Basic Only, while the efficient portfolio that also includes Extended asset classes has a return that is 1.12% higher than the Basic portfolio.

We also ran a series of "surplus" optimizations, where inflation is held short as a liability in the optimization routine. This reflects the goal, for example, for a retiree to generate income for life, adjusted by inflation. Inflation protection for a portfolio is less important when someone is working because human capital (i.e., wages) are a natural inflation hedge.

Increasing the opportunity set to include the Enhanced and Extended asset classes improves portfolio efficiency; however, the improvements are even greater for the surplus optimizations, which is more relevant to retirees, compared to the asset-only optimizations. For example, if we focus on the portfolios with a 6% surplus standard deviation, the efficient Basic + Enhanced portfolio and efficient Basic + Enhanced + Extended portfolio have higher expected returns of 0.54% and 1.28%, respectively.

The larger difference for the surplus optimization is a function of the unique benefits of including inflation-sensitive assets in a retirement portfolio.

Including the additional diversifier asset classes within the Enhanced and Extended groups can be especially valuable during periods of high inflation. We demonstrate this effect focusing on the expected returns for the efficient portfolios with a 6% surplus standard deviation, but break out the returns by the annual inflation rate.

Introducing the Enhanced and Extended asset classes results in higher forecasted average portfolio returns when inflation is higher. This is when the value of the inflation protection is technically the highest because these are the periods a retiree is going to be most challenged at accomplishing his or her goals. In other words, increasing the opportunity set of asset classes has the potential to not only increase portfolio efficiency, but also increases the likelihood of a retiree accomplishing his or her income goals.

We demonstrate this effect in the exhibit below, which includes the results of Monte Carlo projection, using these same three portfolios, with an assumed 5% initial withdrawal rate, where we estimate the number of years the portfolio can sustain the income goal given varying target probabilities of success.

As demonstrated, increasing the asset class coverage can result in a notable improvement in years of retirement income. For example, if a retiree is targeting an 80% success rate, which our recent research suggests is an appropriate target, moving from Basic to Basic + Enhanced can result in three years of additional retirement income (27 years to 30 years), and moving from Basic to Basic + Enhanced + Extended can result in nine years of additional retirement income (27 years to 36 years). This is a significant improvement that has the potential to significantly improve outcomes for retirees.

Exhibit 3: Asset Only Efficient Frontier Using Capital Market Assumptions
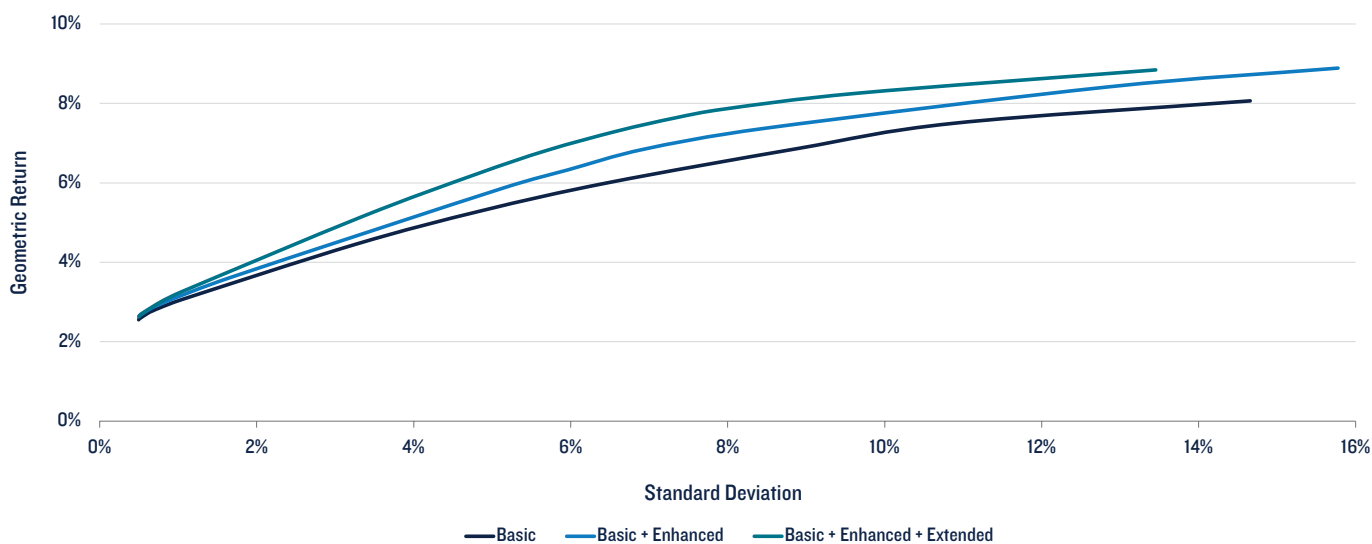
For illustrative purposes only. Past performance is not a guarantee or reliable indicator of future results.

Exhibit 4: Years of Retirement Income by Success Rate and Asset Class Coverage
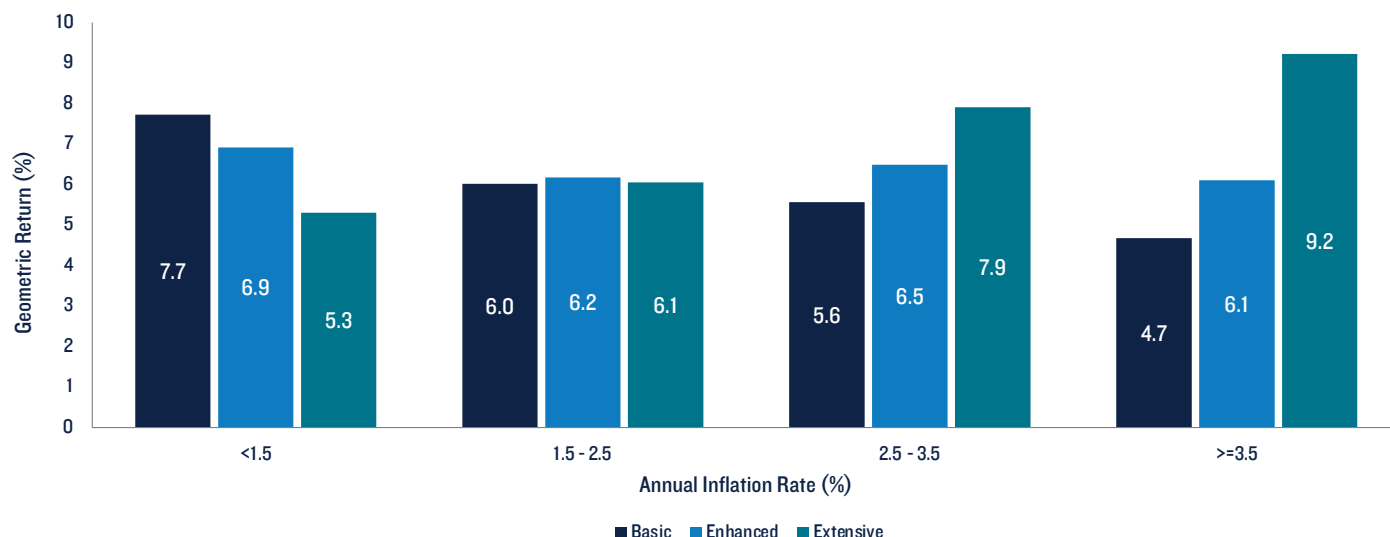
For illustrative purposes only. Past performance is not a guarantee or reliable indicator of future results.

Appendix

ASSET CLASS	INDEX PROXY NAME
US Large Cap	Russell 1000 TR USD
US Small Cap	Russell 2000 TR USD
Non-US Equity	MSCI EAFE GR USD
Core Fixed Income	Bloomberg US Agg Bond TR USD
Cash	ICE BofA US 3M Trsy Bill TR USD
Emerging Markets Equity	MSCI EM GR USD
REITs	FTSE Nareit All Equity REITs TR USD
Commodities	Bloomberg Commodity TR USD
High Yield Bond	Bloomberg US Corporate High Yield TR USD
TIPS	Bloomberg Gbl Infl Linked US TIPS TR USD
Private Real Estate Equity	NCREIF Property
Private Real Estate Debt	Giliberto-Levy Real Estate Total Return Index
Long Duration Bonds	Bloomberg US Govt/Credit Long TR USD
Infrastructure	MSCI ACWI Infrastructure NR USD
Defensive Equity	PGIM Quant Market Participation Strategy

DISCLOSURES