INSTITUTIONAL ADVISORY & SOLUTIONS

PGIM

THE DIFFERENTIAL

New Developments in Portfolio Construction

June 2022 | Issue 5

PGIM's Institutional Advisory and Solutions Group provides objective, data-informed analysis to help Chief Investment Officers and Investment Committees manage their portfolios.

To learn more about PGIM IAS, contact IAS@pgim.com or visit pgim.com/IAS.

IN THIS ISSUE

Dear Investor,

Upon the lifting of travel restrictions, the IAS team wasted no time hitting the road. In March, Harsh Parikh presented "Inflation with Real Assets at the **ALTSLA 2022 Alternative Investment Conference** in Los Angeles; Michelle Teng gave a guest lecture on "Asset Allocation with Illiquid Assets" at the **Dartmouth Tuck School of Business** in April; and Michelle Teng and Aili Chen presented "Cenland (III) – The CIO and the Transition to DC" to the **PGIM IRG Ascent Program** in April, and "Super Funds and Master Trusts" to the **Global Committee of the DCIIA** in Washington, D.C. in June. We summarize highlights of some of these presentations in a separate section below.

We have also scheduled our **1st Annual IAS EMEA Research Conference** at the London School of Economics in London on June 20. This half-day conference is designed to promote highly interactive roundtable conversations with asset allocators and their research teams as IAS researchers will present and discuss their current research.

1st Annual IAS EMEA Research Conference Agenda	
Noah Weisberger, PhD	Stock-Bond Correlation: Prospects for Regime Change and Portfolio Implications
Michelle Teng, PhD, CFA	Portfolio Construction with Illiquid Private Assets: Measuring Liquidity Risk & Portfolio Applications
Junying Shen, CFA	Unlisted Infrastructure Investments and Their Portfolio Role
Harsh Parikh, PhD	Constructing Natural Capital Investment Portfolios
Lorne Johnson, PhD	Portfolio Implications of a Higher U.S. Inflation Regime

Immediately following the IAS Conference at the LSE is the **PGIM Lecture Series in Honor of Charles Goodhart**. Professor Lawrence Summers of Harvard University will give the inaugural lecture titled *Secular Stagnation or Secular Stagflation?*

Finally, we have many new and exciting papers forthcoming after our Conference. Two research papers deserve a quick sneak peek which we provide below:

- *Unlisted Infrastructure Investments and Their Portfolio Role*
- *Measuring the Portfolio Value of Adding a Liquidity Line*

IAS's goal is to deliver pragmatic and implementable research to help CIOs and their Investment Committees make better-informed portfolio management decisions. The return to in-person meetings has been a welcome relief. While our research program remained productive and robust throughout the pandemic – thanks to the excellent effort on the part of each IAS team member – now that we are back to meeting face to face with our clients, the level and quality of our interactions have bloomed.

We hope you can join us at the IAS EMEA Research Conference and the PGIM Goodhart Lecture featuring Lawrence Summers. If not, do not despair! We plan a companion North America Research Conference towards the end of this year.

Warm regards,

Bruce D. Phelps, PhD, CFA

FORTHCOMING RESEARCH

PGIM IAS currently has four main research streams: Real Assets, Strategic Portfolio Construction, Manager Allocation & Selection, and Asset Allocation with Illiquid Private Assets. The common thread throughout is our focus on addressing new and emerging issues that CIOs and asset allocators are facing and that could affect long-term portfolio risk and performance. As always, we attempt to offer pragmatic, data-driven, actionable answers to critical questions.

ILLIQUID PRIVATE ASSETS

Unlisted Infrastructure Investments and Their Portfolio Role

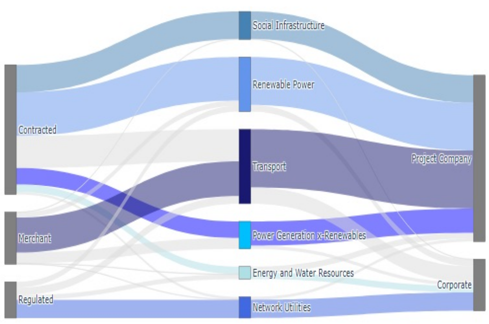
By Junying Shen, CFA, Summer 2022

Asset allocators have an increasing interest in adding infrastructure investments, both via infrastructure funds and direct investments, because of their potential diversification and income attributes. National governments are also encouraging plans to invest in infrastructure both to finance the energy transition and for the national welfare.

Using infrastructure data from a variety of sources, Shen's research investigates whether illiquid private infrastructure investments, both funds and direct investments, have lived up to their diversification and income potential. Importantly, Shen analyzes methods to help CIOs determine how best to bring infrastructure into portfolio asset allocation and liquidity risk analysis.

Interconnections of Business Risk, Corporate Structure, and Industrial Activities

(EDHECinfra Broadmarket Unlisted Infrastructure Equity $310b market cap, equally-weighted, Unhedged USD)



Source: EDHECinfra, PGIM IAS. As of 09/30/2021. For illustrative purposes only.

Shen first identifies the drivers of returns for infrastructure assets as a function of their business risk, corporate structure and sector. For example, a transport asset could have different performance depending on its business risk and corporate structure.

A more challenging step for portfolio construction and liquidity risk analysis is the estimation of infrastructure cash flows for different investment vehicles by age and by sector. Shen develops a novel method to estimate an infrastructure asset's net income over time as a function of its age and sector. Having estimated cash flows, Shen then uses IAS' OASIS framework to examine the portfolio performance-liquidity risk tradeoff for various allocations to infrastructure as well as other illiquid private assets.

Interconnections of Business Risk, Corporate Structure, and Industrial Activities

		(A) 30% Private Equity	(B) 20% PE + 10% Direct Infra Asset Investments	(C) 20% PE + 10% Infra Funds
Horizon Performance	Avg. Horizon "Return"	3.4%	4.2%	3.1%
Liquidity Measure	Probability of Hitting Early Alert Line (3.5%)	21.9%	5.2%	16.4%
	Average of quarterly infra income (%NAV)		2.0%	1.4%
	Stdev. of quarterly infra income (%NAV)		0.9%	1.6%
	Average of quarterly PE income (%NAV)	1.9%	1.9%	1.9%
	Stdev. of quarterly PE income (%NAV)	2.3%	2.3%	2.3%
12m Liquid ("Assured Cash") Drawdown	Avg. Freq. of Violation over 10y (-10% thresh.)	24.1%	20.4%	24.0%
	Avg. Maximum Drawdown %	-22.8%	-20.9%	-22.6%
	Expected Worst 5% Max-Drawdown	-52.7%	-43.7%	-51.0%

Source: PGIM IAS, EDHECinfra, Burgiss. Provided for illustrative purposes only.

STRATEGIC PORTFOLIO CONSTRUCTION

Measuring the Portfolio Value of Adding a Liquidity Line

By Aili Chen, CFA, and Michelle Teng, PhD, CFA, Summer 2022

While needed for portfolio liquidity, holding cash may come with high opportunity costs. Some CIOs contemplate reallocating a portion of portfolio cash into investment assets to help improve expected portfolio returns. However, having cash on hand during poor market environments is helpful as CIOs typically are loath to raise cash by selling investment assets because they may be temporarily undervalued. Is there a better way to balance this tradeoff?

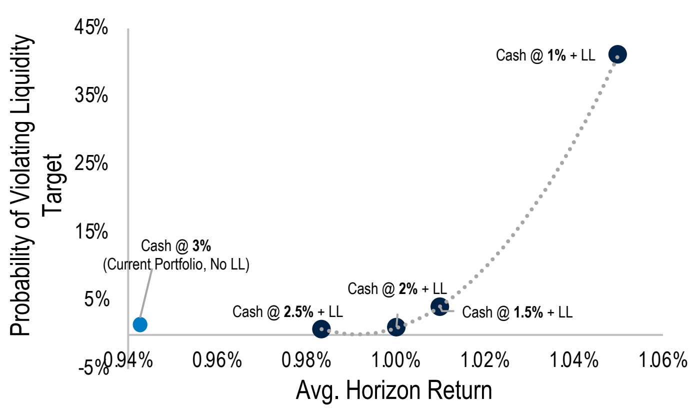
A collateralized portfolio liquidity line allows the CIO to borrow cash, at a spread to the short-term interest rate, to meet medium-term liquidity needs (say, for a few months at a time). Such a liquidity line not only allows the CIO to economize on cash holdings during normal market environments but allows the CIOs to sell investments in a more orderly and paced manner to replenish portfolio cash.

In ***"Measuring the Portfolio Value of Adding a Liquidity Line,"*** Chen and Teng use the IAS OASIS framework to quantify the portfolio performance and liquidity consequences of using a liquidity line.

Specifically,

1. How can a partial reallocation out of cash and into return-generating assets help improve expected portfolio returns?
2. What are the liquidity consequences of doing so?
3. To what extent can the contemplated liquidity line mitigate any liquidity consequences while maintaining expected portfolio performance benefits?

The graphic below illustrates the hypothetical performance-liquidity trade-off for various cash levels, with and without a liquidity line. A CIO can use this type of analysis to determine whether a liquidity line, and how large of a liquidity line, might be useful.



Source: PGIM IAS. Provided for illustrative purposes only.

WHAT WE'VE BEEN UP TO

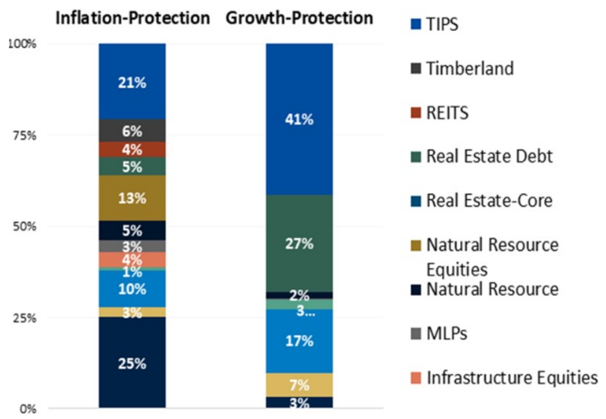
ALTSLA 2022 Alternative Investment Conference

Los Angeles, California
March 24, 2022
Harsh Parikh

In late March, IAS' Harsh Parikh headlined the Inflation and Real Assets breakfast session at the ALTSLA 2022 Alternative Investment Conference in Los Angeles (hosted by CFA Society Los Angeles, CAIA and California Alternative Investments Association).

Parikh discussed the diversity of real assets' macroeconomic sensitivities, and what that diversity means for real asset investing and portfolio construction. He highlighted how a CIO can tailor their allocation across real assets to match their macroeconomic outlook and to meet their specific investment objectives. Given the current backdrop, much of the subsequent presentation focused on how best to construct a real asset portfolio optimized for a specific economic environment such as low growth, high inflation, or stagflation (*i.e.*, low growth and high inflation).

The annual ALTSLA Conference brings together asset owners and asset managers to discuss topics critical for those who manage, advise, oversee or allocate to alternative assets. In addition to Parikh's session on real assets and macroeconomic risks, conference sessions covered the gamut of alternative assets classes, including private credit, private equity, venture capital, cryptocurrencies, and real estate, focusing on opportunities, risk, and challenges in the post-COVID era.



Source: PGIM IAS, Refinitiv Eikon, Burgiss and FRED. Provided for illustrative purposes only.

Tuck School of Business Invited Lecture: Quantitative Private Equity

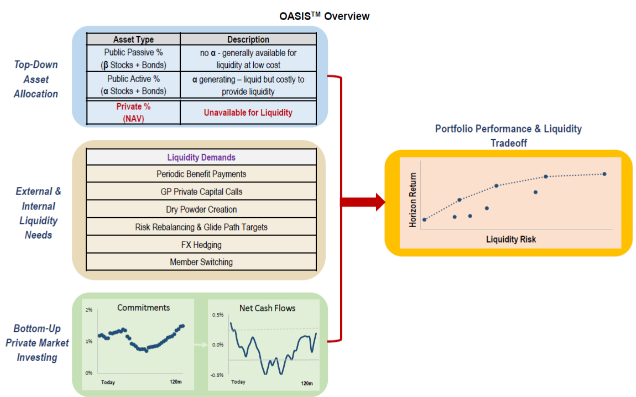
Hanover, New Hampshire
April 26, 2022
Michelle Teng

Dartmouth University (Tuck School of Business) Professor Morten Sørensen recently invited IAS' Michelle Teng (Tuck, '15) to deliver a guest lecture to his Quantitative Private Equity class. The class, newly introduced into the curriculum, focuses on private equity from a broad quantitative perspective, rather than focusing on individual deals.

During the 90-minute session, Teng outlined IAS' approach to modeling asset allocation with illiquid private assets. In the ensuing and highly interactive conversation, the students were particularly interested in hearing how practitioners approach portfolio construction challenges. Teng shared many specific real-life examples of how different types of investors have dealt with the liquidity issues that arise from allocating to both public and private assets.

Professor Sørensen's interaction with IAS began when he met Teng at the 2021 Private Equity Research Symposium in Chapel Hill, North Carolina. Since then, Professor Sorensen and the IAS team have been engaged in an ongoing conversation based on their shared research interest in better understanding the portfolio construction implications of private asset allocations

Managing Portfolios: Top-Down & Bottom-Up



Source: PGIM IAS. Provided for illustrative purposes only.

PGIM IRG Ascent Program: Asset Owner Workshop

Newark, New Jersey
April 28, 2022
Michelle Teng and Aili Chen

In late April, Michelle Teng and Aili Chen led a case study session at the PGIM IRG Ascent Asset Owner Workshop, presenting "Cenland (III) – The CIO and the Transition to DC." This case is the third in a series of original IAS business school style case studies and focuses on the portfolio management challenges facing the CIO of the fictional Cenland Corporation as it shifts to a DC pension scheme.

In their session, Teng and Chen asked participants to put themselves in the shoes of the CIO to work through critical issues facing DC plans such as the role of illiquid private assets and how to respond to possible unexpected liquidity demands caused by participant actions (*e.g.,* member switching) or policy changes (*e.g.,* an early release scheme).

IRG's Ascent Program is an annual workshop for young professionals who are identified as "rising stars" at their respective organizations. Client participants, representing a mix of public and corporate DB plans, DC plans and investment consultants, actively engaged in the case discussion and related their own experiences to the issues at hand, helping to bring the study to life.

Inflation vs. Stagflation: How Do Real Asset Portfolios Differ?

With an increased client focus on the investing implication of higher inflation and many incoming questions on this score, Harsh Parikh recently published an IAS **[Real Assets Article]** on this topic ("[Inflation vs. Stagflation: How Do Real Asset Portfolios Differ?]").

Suppose a CIO has a view that inflation is coming. This CIO may wish to construct a real assets portfolio with a high inflation beta using betas estimated only from high inflation environments, regardless of the growth environment. In contrast, another CIO may share the view that inflation is coming but also has the view of slower economic growth (*i.e.,* stagflation). In this case the CIO may wish to construct a real assets portfolio, with a high inflation beta and a low growth beta, using betas estimated specifically from stagflation environments.

How do the two portfolios compare? The inflation portfolio has a higher allocation to farmland, gold, infrastructure, timberland, and TIPS and a lower allocation to infrastructure equities, MLPs, real estate, and REITs.

WHAT WE'RE READING


The $800 Billion Paycheck Protection Program: Where Did the Money Go and Why Did It Go There?

David Autor, David Cho, Leland D. Crane, Mita Goldar, Byron Lutz, Joshua Montes, William B. Peterman, David Ratner, Daniel Villar, and Ahu Yildirmaz

The $800 Billion Paycheck Protection Program: Where Did the Money Go and Why Did It Go There?

By David Autor et al
Journal of Economic Perspectives, Vol 36, No. 2, Spring 2022

Early in the 2020 pandemic, the US responded with direct-lending programs to support the economy. The Paycheck Protection Program (PPP) provided loans (up to $10M) to businesses with fewer than 500 employees. (Larger firms had other programs.) The $800B PPP program began March 27 and ended December 27, 2020. PPP's goal was to keep workers in their jobs, helping to facilitate the eventual economic recovery.

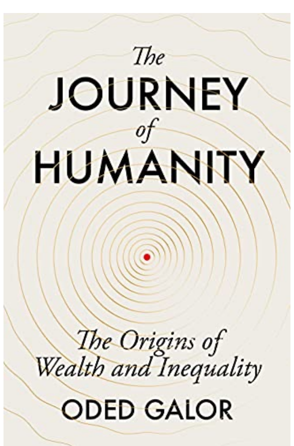
PPP loans were forgivable if the firm (1) spent at least 60% of the loan on payroll; (2) spent the full amount on expenses including payroll, rent, and mortgage payments; (3) maintained employment and (4) maintained wages at no less than 75% of the pre-crisis level. In addition, while the loan covered business expenses, firms could deduct these expenses for tax purposes even though the (forgivable) loan was not recognized as revenue! 94% of loans applied for, and received, forgiveness.

So, who got PPP money? The majority (66% - 77%) was kept by the businesses, their creditors and shareholders who are typically higher-income households who may have saved, not spent, the money. While workers received a minority share, they had help from other government programs (e.g., $800B stimulus checks and $680B of expanded unemployment assistance). How well did PPP support employment? The authors estimate that 1.98m job-years were saved at a cost of $258K per job-year.

A key objective of the PPP was to provide quick relief – which it did. However, the program did not target firms that needed assistance. Some firms did well during the pandemic but still received PPP, which made the cost per job-year saved so high. Ideally, the PPP should have been better targeted, but unlike other countries, the US does not have administrative systems to monitor worker hours to top-up paychecks.

CIO Takeaway: The U.S. faced an emergency and quickly disbursed assistance, albeit not in a targeted fashion. While the high cost per job-year saved is dispiriting, it may encourage businesses and policy makers to support development of government systems better able to provide quick, targeted assistance.

--Bruce P.



The Journey of Humanity: The Origins of Wealth and Inequality

by Oded Galor
Dutton, 2022

In *The Journey of Humanity*, Oded Galor, a tenured professor of economics at Brown University, argues that the trajectory of economic growth over the entirety of human history is an ongoing and continuous process driven by fundamental forces.

In the first half of his book, Galor explores the "Mystery of Growth," proposing a unified framework to explain why living standards stagnated for millennia before advancing rapidly in the last 200 years. For most of history the "Malthusian population trap" constrained living standards; technological advances (*e.g.,* fire, writing, metallurgy, etc.) were met with population growth, restraining the growth of per capital living standards. Society did not escape this trap until the Industrial Revolution when new technologies increased benefits to education, incentivized lower birth rates and further investment in education, which, in turn, spurred additional technological gains. This "demographic transition" and its flywheel effect on productivity unleashed explosive per capita growth.

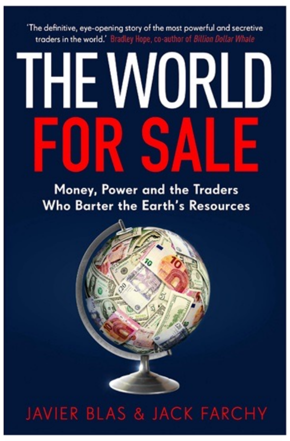
The second half of the book probes the "Mystery of Inequality" – the wide geographic disparities in living standards. Long-ago initial conditions (*e.g.,* continental orientation, genetic diversity, and the domestication of local fauna) caused variations in the cultural and institutional ability to benefit from new technologies, causing today's vast differences in economic development.

Supported by creative and well-crafted empirical studies, Galor concludes that the path of economic growth is a function of deeply engrained forces, making regional differences persistent. Referred to as "Unified Growth Theory," this innovative approach to growth and inequality stands in contrast to the notion that living standards will converge over time, a cherished economic orthodoxy and a key prediction of the workhorse "neo-classical growth model."

CIO Takeaways: CIOs are often encouraged to pursue global diversification strategies and to invest in "growth" markets, predicated, in part, on the assumption that economies converge, as laggards catch up to leaders to the benefit of their capital markets. In contrast, according to Galor's Unified Growth Theory, growth differentials are persistent, implicitly suggesting that investors ought to reexamine the extent to which their global allocation strategies and EM allocation choices assume a convergent world.

--Noah W.

WHAT WE'RE READING CONTINUED



The World for Sale: Money, Power and the Traders Who Barter the Earth's Resources

By Javier Blas and Jack Farchy
Oxford University Press, 2021

The World for Sale provides a provocative inside look at the evolution of commodity trading since the end of WWII. This well-researched volume by two veteran Bloomberg reporters traces how a handful of, usually privately-held, firms adapted to the changing business, geopolitical, regulatory and informational environment to dominate a crucial sector of the world's economy.

As commodity-rich countries gained independence they asserted control over their resources. This diminished the influence of Western business cartels (*e.g.,* the "Seven Sisters" oil companies), but made the countries increasingly exposed to embargos and sanctions arising from geopolitics. Small private traders stepped in to provide countries in difficulty with needed cash in return for commodities which could then be sold as "clean" or delivered clandestinely. These traders also capitalized on the opaqueness of early commodity markets by buying "cheap" oil in one region and selling where it was "expensive."

Having started as small operators, these traders adapted well to new business challenges. First was the development of commodity derivative markets which not only allowed global price discovery but gave anyone the opportunity to be a commodity speculator. The trading firms exploited their market knowledge to make even greater profits trading "paper" commodities as well as physical ones.

As markets matured and information itself became a commodity, the traders became large, vertically-integrated producers. But purchasing commodity sources required large sums and institutional capital. Some traders became public companies while others relied on structured financing. However, this exposed the traders to government regulation in their home countries. Trading companies that once viewed sanctions and embargoes as opportunities for profit, now became extensions of Western law enforcement as their trading activities were scrutinized by governments and outside investors.

CIO Takeaway: Today's CIO must navigate a world of sanctions, embargoes and de-globalization. How will markets reconcile commodity supply and demand imbalances? Knowing the evolution of the relationship between governments and trading companies will help CIOs better understand market dynamics and potential policy responses.

--Bruce P.

MEET IAS

Aili Chen, CFA

Senior Associate
PGIM IAS

Aili Chen is a senior associate in the IAS group, focusing on questions of asset allocation and portfolio construction. Before joining PGIM in October 2021, Aili was vice president and quantitative investment strategist within Morgan Stanley's Global Investment Office. Aili earned her bachelor's degrees in English and international relations from China Foreign Affairs University and her master's degree in economics from Cornell University.

You earned a BA in English and international relations and then an MA in economics. Given your liberal arts background, why did you decide on a career in quantitative investment research?

To me, quantitative investment research requires elements of both art and science, and I have always been drawn to the intersection of these two broad disciplines. To be able to investigate questions of quantitative portfolio construction, as we do in IAS, it is necessary to be able to bring both sets of skills to the table. The mathematical formalism of quantitative finance is obviously indispensable. But so are softer skills like being able to formulate a research question, being able to clearly communicate research findings, and knowing how to interpret relevant historical patterns and the like. Of course, learning does not end with college or graduate school, and, prior to joining IAS, my experience working at Morgan Stanley on the development of systematic, data-driven investment models was a transformative period of intellectual growth for me.

You started your career in wealth management. How do the needs of high-net-worth individuals differ from the needs of institutional clients and how has your research changed?

In my experience, many high net-worth clients are focused on absolute returns, have short-term tactical concerns and have allocation issues that can typically be addressed in a more generalized framework. In contrast, the work we do at IAS, focused more on the needs of institutional investors, usually tackles longer-term, strategic issues relating to portfolio construction and asset allocation, particularly with respect to illiquid private assets. Interestingly, the needs of institutional clients – particularly liquidity needs – are rarely one size fits all, and often require tailored solutions. In fact, in my short time at IAS, I have already had the privilege to work on several client projects where we have customized our OASIS model to the client's specific situation.

What research projects are you currently working on, and what other topics are on your agenda?

Last month I published my first IAS paper, which is joint work with my colleague Michelle Teng, entitled "Super Funds & Master Trusts in a World of Member Switching, Early Release Schemes (ERS) and Climate Catastrophes." In the paper, we measure the unintended costs of government policies that allow pension members to take lump-sum distributions from their retirement accounts (owing to one-off adverse circumstances like COVID). These policies change the plan's liquidity risk profile and can lead to worse investment performance as the plan needs to reduce allocation to illiquid assets to meet possible participant demands.

Looking ahead to future research, as with all good projects, when one paper ends another one naturally begins! One of the issues we speculate about in my first paper is that an adverse weather event that negatively impacts plan participants could be met with an ERS. Such a response would likely have clear portfolio costs. And the next step in this research agenda is to try and quantify the costs of unexpected weather and climate calamities for institutional portfolios.

More recently, also as an outgrowth of a client project, I am researching the value of a portfolio line of credit. CIOs know that moving out of cash to assets with higher expected returns will likely improve portfolio expected performance. A liquidity line can be at the ready when cash is needed, but it has a cost. My research tries to measure what CIOs need to know: What is the magnitude of the tradeoff between portfolio return and liquidity risk for various levels of cash reduction and the sizing and cost of the liquidity line?

Tell us a bit more about yourself. What do you do in your free time?

I grew up in Sichuan, China – a neighboring province of Tibet, often known for its giant pandas and extremely spicy food. I came to the US for school and eventually settled in New Jersey with my husband and our 2-year old son. Before the pandemic, I intensely practiced hot yoga, which, as the parent of a toddler, I have (much!) less time to pursue. I now spend far more time reading, playing and dancing with my son, and talking to him in a jumble of Mandarin, English and toddler babble.