



# The risks in risk-free assets

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Introducing a risk-control framework for cash portfolios

By Ron Akke, Dan Golosovker

## 1. Welcome

The fundamental question regarding any investment is how the return compares to the risk. Investing in cash<sup>1</sup> is no exception, although cash is special in that it's often considered riskless. Yet examples throughout history indicate that cash is not entirely risk-free<sup>2</sup>, as we recently saw during the bank runs where the Treasury had to step in to guarantee uninsured regional bank deposits<sup>3</sup>.

In addition to functioning as the investment of choice for capital preservation, cash is an investor's primary source of liquidity. In other words, cash can easily and quickly be converted into goods, services or other investments. Having cash in one's portfolio provides immediate access to funds, allowing an investor to meet short-term obligations. Because cash is not completely risk-free, it's important for managers to ensure as best they can that adequate liquidity is available during periods of high-risk, to continue to meet obligations and potentially have reserves for investment opportunities.

In this brief, we introduce a risk management framework for cash to help investors meet liquidity needs during periods of market stress. The methodology leverages our History-Based Multi-Lens (HBML) approach to cash markets to quantify maximum drawdowns for setting appropriate allocation limits to duration and credit spread<sup>4</sup> risk.

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<sup>1</sup> We define cash as any hard currency, bank deposit or short-term fixed income security with less than a year to maturity. This includes, among other securities, Treasurys maturing within a year, commercial paper, short-term agency debt and repos.

<sup>2</sup> We define risk as the possibility of losing money on your investment. In cash markets, this can occur in the short term, such as needing to sell Treasury bills at a discount during a liquidation event, or over time, such as counterparties defaulting on their short-term debt obligations to you.

<sup>3</sup> Additional examples include both Lehman Brothers' commercial paper default and money market funds 'breaking the buck' during the global financial crisis, as well as daily price fluctuations in Treasury bills (particularly pronounced during times of unexpected Fed tightening).

<sup>4</sup> While we discuss credit spread risk in this paper, the framework applies to other risks and spreads.



## 2. NTK

Here are the key takeaways you need to know (NTK) from this brief.

- **Cash is risky:** Cash is often viewed as a riskless asset by investors. And yet, even a 'safe' 1-month Treasury bill cash portfolio has experienced drawdowns during extreme surprise Fed tightening. Short-duration credit has experienced even larger drawdowns during periods of high market uncertainty such as the 2008 financial crisis.
- **Diversification boosts returns:** While all markets experience drawdowns — which have a low probability of occurring — investors can create portfolios that are better protected from drawdowns by holding a diversified mix of assets that includes both U.S. Treasuries and short-duration credit. This, in turn, increases compounded returns over time. This is as true for a cash portfolio as it is for risky assets.

In light of these findings, please see the ARB-itrage section at the end of this brief for our synthesis of what goals and approaches seem prudent for all investors to consider.

## 3. Significance

Measuring and managing the risk of losses in a cash portfolio is critical to effectively funding an investor's future liabilities. Failure to effectively manage this risk may result in:

- **Forced liquidations:** Investors may find their cash worth less than they expected during times of market stress when all asset prices have fallen. If investors lose too much money in their cash portfolios, they will be forced to liquidate riskier assets at potentially depressed prices.
- **Under-diversification:** Investors benefit from holding assets with different risk exposures, which reduces overall risk and drawdowns. Without acknowledging that cash securities are risky, investors may not maximize their risk-return trade-offs.
- **Counterparty risk:** Investors face the risk that the other party in an investment (including deposits) may not fulfill its part of the deal and may default. This counterparty risk is one of the few risks that doesn't provide a premium and should be diversified or hedged. Uninsured bank deposits are a form of counterparty risk.



In what follows, we provide a new framework to help investors quantify and analyze the amount of risk in their cash portfolios.

## 4. Context

In this brief, we're very explicit about the terminology that we use to describe risk, so before going forward, we should orient ourselves to define the meanings behind the vocabulary that we're using.

A **drawdown** refers to the peak-to-trough decline in the value of an investment or trading account during a specific period. It measures the extent of the decrease in value from the highest point (peak) to the lowest point (trough) before recovery occurs. Drawdowns can be expressed as a percentage, which provides an insightful metric into the riskiness of an investment or trading strategy. In our analysis, we look at rolling one-month drawdowns<sup>5</sup> because many investors roll cash on a one- to three-month basis. The analysis is minimally sensitive to this parameter<sup>6</sup> over this short time frame.

**Duration risk** is the possibility of loss in value of a security or a portfolio due to changes in interest rates. Duration<sup>7</sup> is used to assess the total market risk of a portfolio, because it provides a simple way to measure the interest rate risk contributions of each security within that portfolio. Duration is the weighted average-term-to-maturity of cash flows from a bond, which is just the term-to-maturity for a zero coupon bond as is the case for most cash instruments.

**Credit risk** is the possibility of loss in value of a security or a portfolio that would result from a security's issuer default. **Spreads** are a tool for assessing credit risk, and these spreads scale with the probability of default.<sup>8</sup> Deterioration in the perception of creditworthiness of a borrower leads to increased spreads and decreases in prices, ultimately resulting in investment losses. When a **default** occurs, the issuer fails to fulfill some part of a security's contractual obligations, and this often causes the investor to lose some or even all of their investment.

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<sup>5</sup> We define a one-month drawdown as the largest drawdown peak to trough over the preceding 30 days.

<sup>6</sup> An investor's maximum drawdown would be similar whether they measured the drawdown based on a one-month, two-month or three-month rolling window.

<sup>7</sup> Duration is the measurable change in value of a security or portfolio due to changes in interest rates. It's often employed as a scalar, such that the expected change in price of a portfolio or security is the change in rates multiplied by the negative of the duration of the security or portfolio.

<sup>8</sup> Spreads are measured as the difference in rates between two securities. In this analysis, we define spreads as the difference between a security and a maturity-matched Treasury bill.



Increases in credit risk scale with both the spreads and duration of a security. Credit risk scales with duration because the possibility of default can by definition only increase with time to maturity. Therefore, the concept of duration times spread (DTS)<sup>9</sup> can be used to estimate credit risk.

## 5. Approach

Investors hold cash both to earn the ‘risk-free rate’ and as a source of funding for the rest of their portfolio. This funding requirement is why cash needs to be generally liquidatable at any time, and therefore the key risk faced by investors is that they’ll need to liquidate their cash holdings at the worst possible time. With the short holding period of most cash securities, it’s reasonable to assume that the worst possible loss would occur over a relatively short time period, and therefore we measure risk using historical one-month maximum drawdowns.

As with any other investment, a cash portfolio holds a collection of risks; we focus our analysis on duration and spread risk. We use Treasury bills to measure historical duration risk, because these instruments have typically had very low credit and liquidity risk, and changes in prices tend to be driven by changes in rates. We use the historical spreads on high-grade commercial paper over duration-matched Treasury bills to isolate credit risk. Our commercial paper dataset<sup>10</sup> is derived from a highly diversified basket of securities traded over time, and therefore is fairly representative of the credit risk of a diversified portfolio of commercial paper.

We use historical scenario analysis to estimate expected maximum duration and credit losses. For this research, we rely on our History-Based Multi-Lens methodology.

We draw upon Treasury bill returns<sup>11</sup> dating back to the 1960s. This covers several Federal Reserve tightening cycles including the highly volatile Volcker era of the late 1970s to the early 1980s. Our commercial paper dataset uses daily data back to the mid-2000s, and hence includes the Global Financial Crisis of 2008–2009, when otherwise highly rated financial institutions went bankrupt. New regulations introduced in the crisis’s aftermath led to substantial decreases in commercial

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<sup>9</sup> With DTS, or duration times spread, we estimate losses based on the current spread at each term point, and then multiply those by that security’s duration and a scalar based on historical maximum losses in a variety of spread environments.

<sup>10</sup> We specifically use 90-day AA financial commercial paper rates for most analysis as sourced from FRED.

<sup>11</sup> We convert yields into returns by starting with daily yields, converting those yields into prices using the 30/360 day-count convention. We then calculate daily price returns as well as daily yield accruals. We add price returns to yield accruals to arrive at total returns.



bank credit risk. We therefore believe our expected maximum credit losses to be highly conservative.

## 6. Findings

The largest drawdowns in Treasury bills have largely occurred due to a surprise monetary tightening by the Fed, which has typically happened near the beginning of tightening cycles. In Exhibit 1 below, we show maximum one-month drawdowns in 1-year Treasury bills<sup>12</sup> from 1962 through 2023, overlaid with Fed tightenings (in gray). The maximum drawdown of 1.9% occurred during the Volcker era of unexpectedly large Fed tightenings. No other drawdown approached this size until 2022, when the Fed quickly tightened to counteract inflation.

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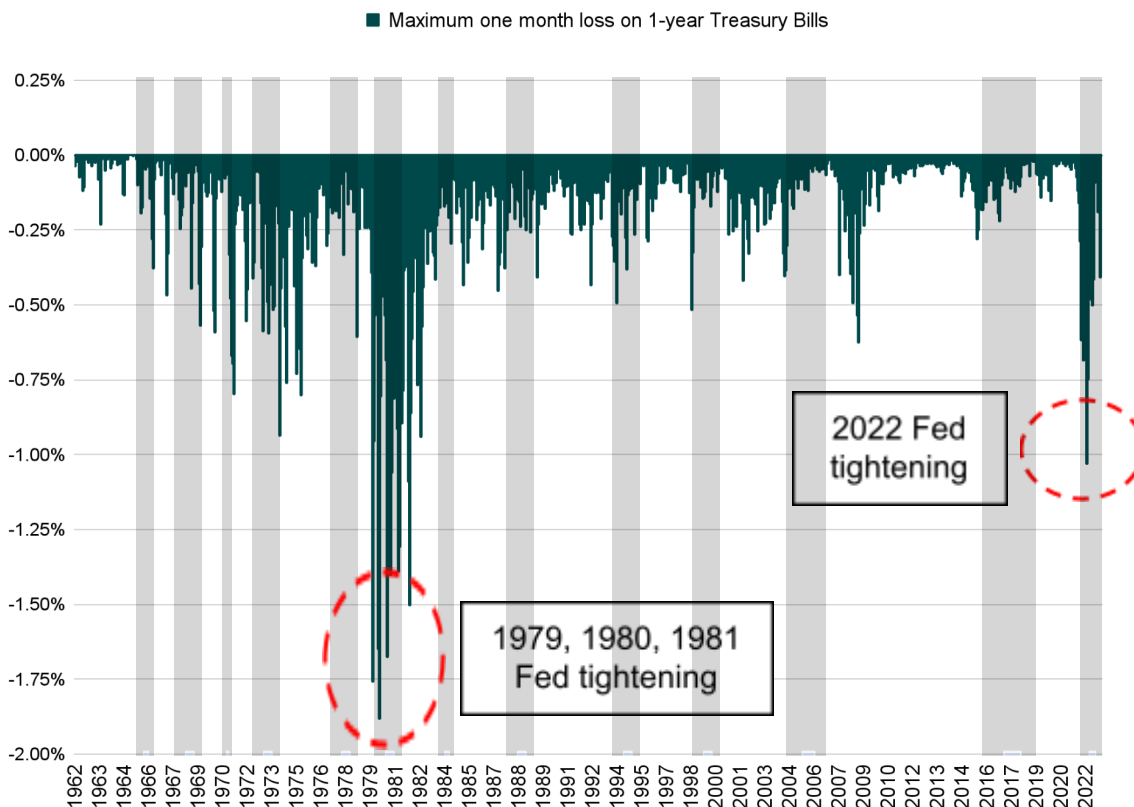
<sup>12</sup> We use 1-year Treasury bills because they have the longest history.



**Exhibit 1**

Large drawdowns tend to occur at the beginning of Fed tightening cycles

Maximum one-month loss on 1-year Treasury bills compared to Fed tightening cycles (gray), 1962–2023



Source: Addepar

**Maximum losses on Treasury bills tend to scale linearly<sup>13</sup> with duration, such that for each month of duration added, the maximum expected loss increases by 15 bps<sup>14</sup>.** Exhibit 2 shows this phenomenon; across the four largest Treasury bill drawdowns of the past half century, maximum drawdowns grow approximately linearly with duration.

<sup>13</sup> During periods of smaller drawdowns, higher rate environments may mitigate the size of losses particularly on the short end of the curve during relatively long drawdowns. This is because interest accrual helps to offset losses in low-volatility, shorter-duration instruments.

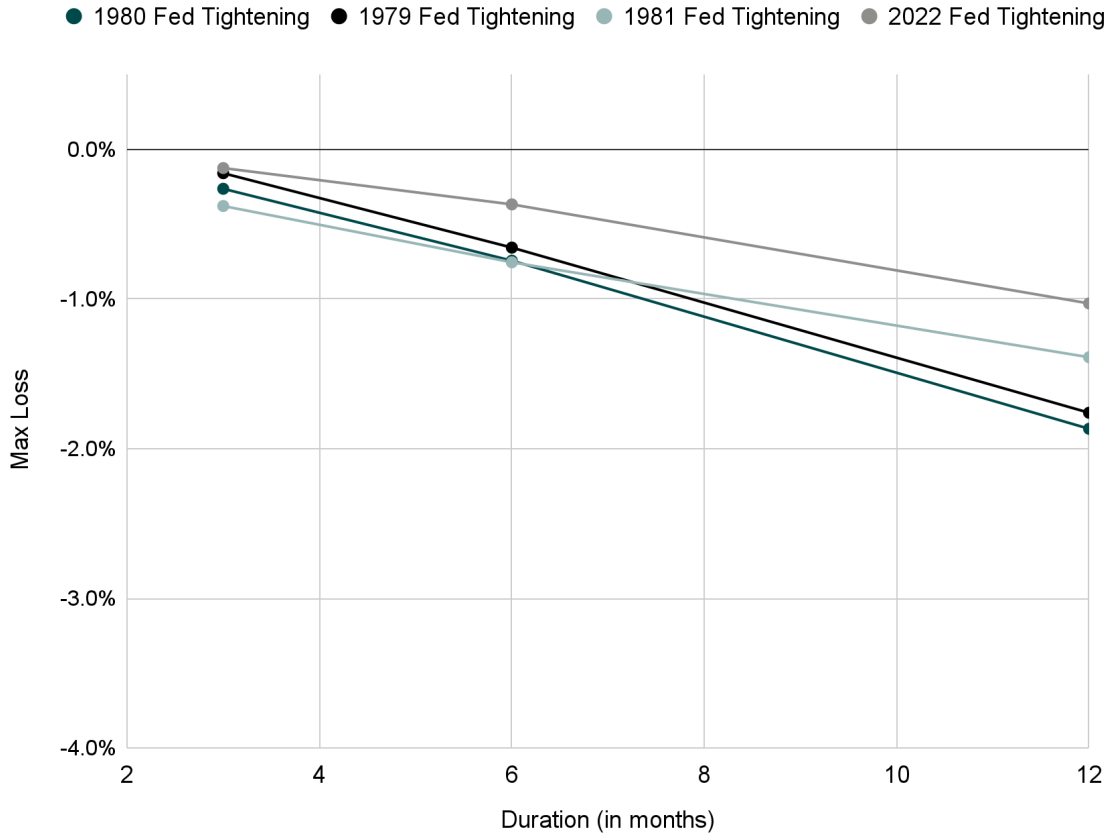
<sup>14</sup> This is a conservative estimate, particularly at the very short end of the curve where rates have mostly been flat in the one-month to three-month range, particularly for credit risky instruments.



**Exhibit 2**

Drawdowns due to changes in interest rates tend to scale linearly with duration

Maximum one-month drawdowns across the Treasury yield curve during maximal drawdown periods



Source: Addepar

Investors should be aware that their cash is not risk-free and should monitor the cash risk in their portfolios to ensure that they have liquidity when they need it most. To help you build some additional intuition, below we show a histogram of Treasury bill portfolios of private wealth investors and we overlay historical max-drawdowns for the quartiles in a Treasury-only portfolio.

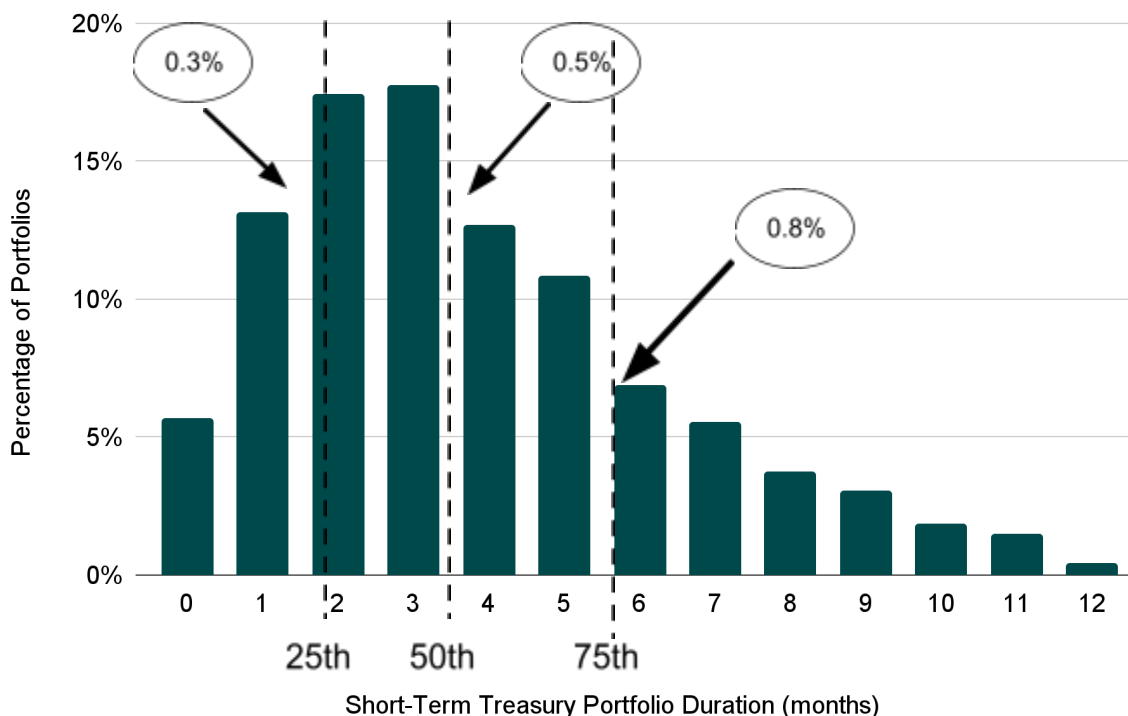




### Exhibit 3

The median short-term Treasury portfolio has an expected maximum drawdown of 0.5%

Histogram of short-term Treasury portfolio duration of investors with their percentiles and historical max drawdowns, May 2023



Source: Addepar

We next explore the inner workings of credit spreads. **Drawdowns due to spread widening tend to be highly concentrated during credit crunches**, such as during the Global Financial Crisis and the onset of the Covid-19 pandemic. Similarly to losses due to duration, credit losses scale approximately linearly with spreads and duration.<sup>15</sup>

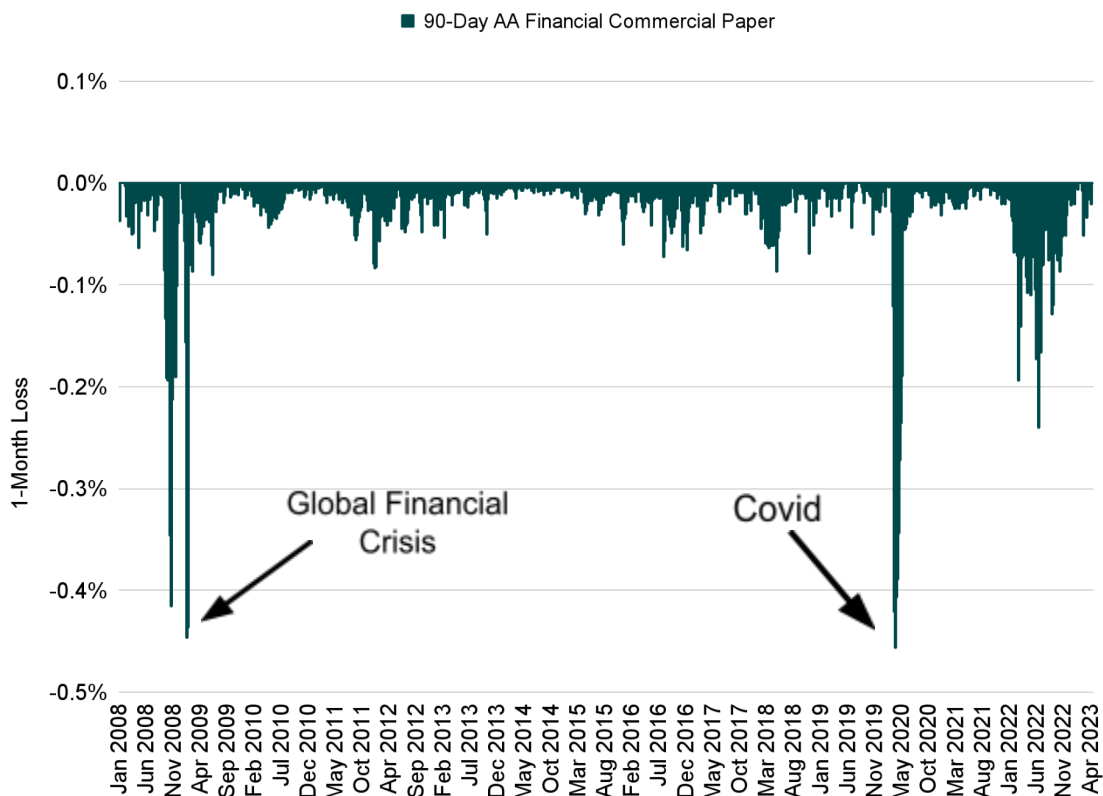
In Exhibit 4, we show maximum drawdowns in highly rated 90-day financial commercial paper due to spread widening since 2007. **Large drawdowns tend to be concentrated during times of significant market uncertainty** and, when also taking into account defaults, increased to their highest levels in 2008 when total drawdowns reached 3.2%.

<sup>15</sup> Our analysis shows that drawdowns tend to increase linearly with duration times spread, such that the longer the duration and higher the spread, the larger the drawdown will be. We've shown that duration and spread have a Pearson correlation of 0.65 to the size of drawdowns since 2008, with that correlation further increasing during periods of large market disruptions that cause a widening between low-grade commercial paper spreads relative to high-grade paper.



#### Exhibit 4

Credit drawdowns due to changes in rates tend to increase during periods of high market stress  
Maximum one-month losses on 90-day AA financial commercial paper, 2007–2023



Source: Addepar

While all markets experience drawdowns, a portfolio's drawdown risk is dependent on how much exposure it has to specific markets and how the correlation structure of exposures within the portfolio are controlled by diversification. **Within the context of cash, duration and credit risk are terrific complements because they're naturally diversifying**; when credit conditions deteriorate and spreads widen, investors generally seek the safe haven of U.S. Treasury bills. When Treasuries do poorly (i.e. surprise tightenings), credit generally does not materially sell off

To quantify the diversification benefit, we completed a historic simulation of cash portfolios that hold a mix of Treasury bills and high-quality commercial paper vs. a Treasury-only portfolio<sup>16</sup>. As shown in Exhibit 5 below, **the diversified portfolio that held commercial paper would have**

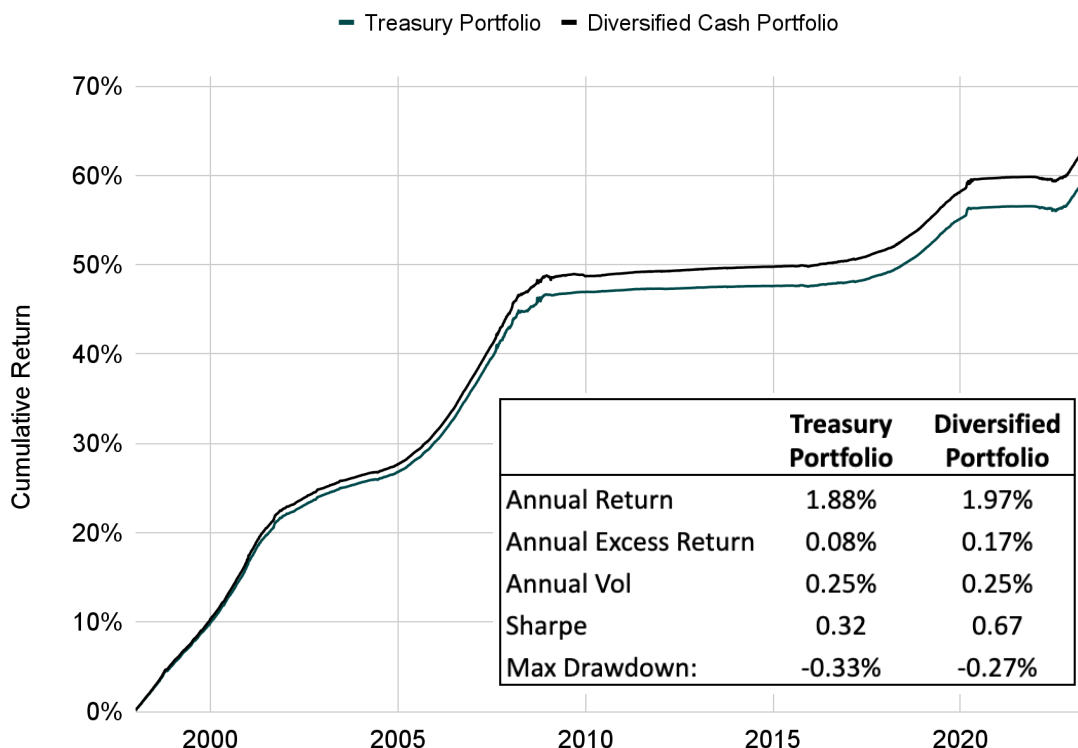
<sup>16</sup> We picked a mix that had similar volatility to a Treasury-only portfolio for comparison purposes. This mix consisted of 45.5% AA financial commercial paper, 21.2% 3-month Treasury bills and 33.3% 6-month Treasury bills.



**achieved 10 bps of return more per year at a similar volatility and smaller max drawdown than the Treasury-only portfolio.** Although the numbers are small because we’re talking about cash, that is, in fact, a doubling of the annual return above the 1-month Treasury bill at the same degree of volatility risk.

**Exhibit 5**

Diversified cash investors have earned higher risk-adjusted returns with lower drawdowns  
 Max one-month loss on a typical\* investor’s cash portfolio vs. a diversified portfolio over the previous 25 years



Source: Addepar

\* These simulated results build two portfolios. The all-Treasury portfolio is invested one-third in 6-month Treasury bills and two-thirds in 3-month Treasury bills and is rebalanced monthly. The diversified cash portfolio is invested in 90-day AA financial commercial paper and 3- and 6-month Treasury bills. We set the weightings to have the same volatility as the all-Treasury portfolio and also have a duration of four months at every monthly rebalance. The risk-free rate used to calculate annual excess returns is the 3-month Treasury bill from 1998 until the 4-week Treasury bill was introduced in 2001, and then we use the 4-week T-bill thereafter.

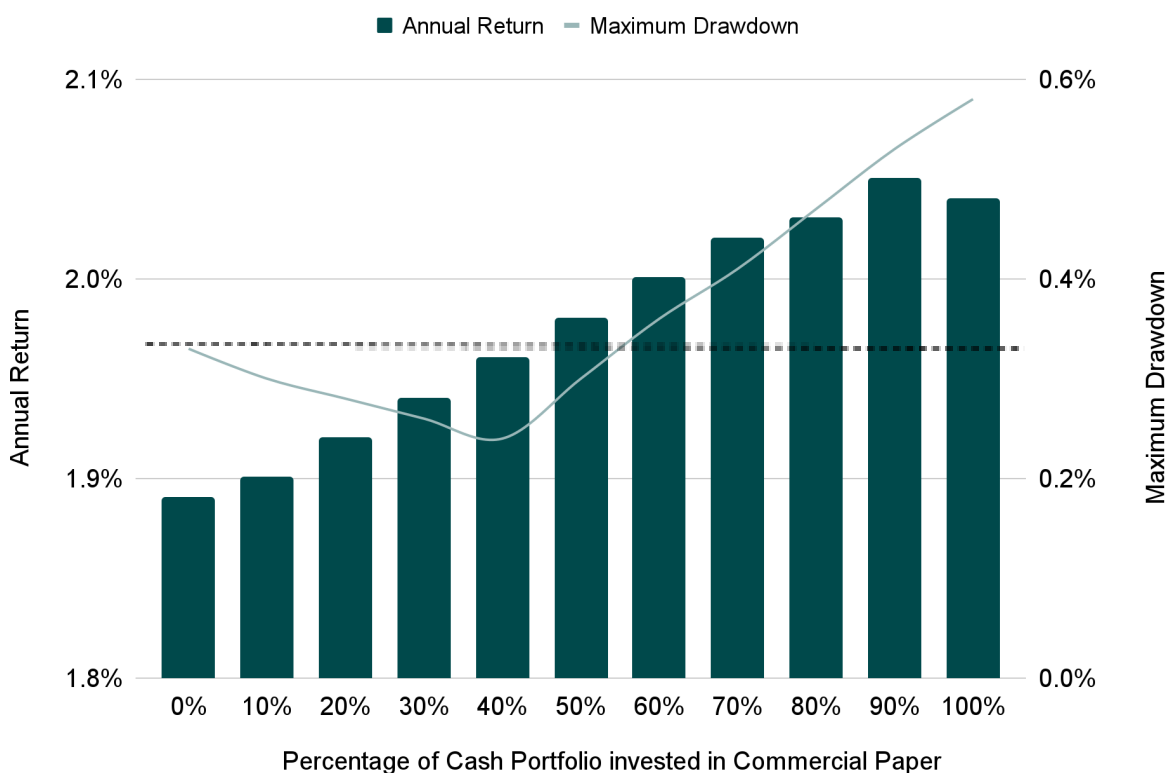
A well-constructed portfolio maximizes return while minimizing risk through diversification. For cash, **duration and credit risks are naturally diversifying.** Adding a little (say, up to 30%) of credit exposure into a cash portfolio has historically improved returns while reducing drawdown risk to a



comparable Treasury-only portfolio. While this analysis is shown within the context of cash portfolios, investors should also assess asset allocation decisions holistically across their entire portfolio.

**Exhibit 6**

Holding proportional amounts of Treasury bills and commercial paper maximizes return, given risk  
 Sharpe ratios and maximum drawdowns in cash portfolios by percentage invested in commercial paper



Source: Addepar

\* Simulated portfolios utilize total returns of 90-day AA financial commercial paper as well as 3-month, 6-month and 12-month Treasury bills. The duration of each diversified portfolio is four months, and the weightings chosen on Treasuries are those that maximize a portfolio's Sharpe ratio over the past 25 years.

## 7. The ARB-itrage

Cash is not risk-free and investors have experienced losses on even the 'safest' instruments. As investors consider risk in their cash portfolios, they should keep in mind these ideas:



- 'Safe' 1-month Treasury bills have experienced 15–20 bps drawdowns during extreme, surprise Fed rate tightenings.
- Short-duration credit, such as 1-month commercial paper, has experienced 50–80 bps drawdowns during periods of high market uncertainty such as the 2008 financial crisis.
- A good rule of thumb is that the duration risk of a 6-month Treasury bill is approximately twice as much as the risk of a 3-month bill. These results can also be extended to the portfolio level, such that the duration risk of a cash portfolio with four months duration is approximately twice that of a cash portfolio with two months duration.
- U.S. Treasuries are a good diversifier to credit because investors rush to them during periods of high market stress, and when Treasuries do poorly (i.e. surprise tightenings), credit has not materially sold off<sup>17</sup>. Holding roughly a 70/30 mix of Treasuries to credit<sup>18</sup> would have added 20 bps of return annually while reducing the max drawdown of a Treasury-only portfolio by 10–20 bps.

## 8. Coda

This research brief introduces a new framework for measuring risk in a cash portfolio. Although often assumed to be riskless, we've shown that cash suffers from drawdowns, which scale linearly with duration and spread. Because avoiding large drawdowns is a key to achieving high cumulative returns over time, it's imperative that investors understand these risks and make explicit decisions about the ones they're comfortable taking.

The primary goal of many cash managers is to have the ability to pay for short-term liabilities. To achieve this goal, managers must be able to make a reasonable assessment of future portfolio value in scenarios in which their cash portfolio loses value. We put a number to that lower bound by using one-month maximum drawdowns. We estimate that the maximum drawdown due to duration is approximately 15 bps per month of duration, and the maximum drawdown due to credit is up to 50 bps in 90-day AA financial commercial paper. Risk tends to scale linearly with duration times spread, and therefore higher credit spread instruments should be assumed to have larger maximal drawdowns. Here, we do not consider the mitigating effect of recoveries (i.e., how quickly and linearly values 'bounce back' in the wake of a maximum-drawdown event). Clearly, for two securities with equivalent maximum drawdowns, one is riskier than the other (all else being equal) if it recovers more slowly. Elsewhere, we've presented a framework for thinking about drawdown

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<sup>17</sup> October 2008 is a notable exception, when Treasury bill and commercial paper sell-offs were not caused by Fed tightening.

<sup>18</sup> At four months duration, which is the average duration of a direct Treasury bill portfolio over the long term.



and recovery risk in tandem; in future work, we intend to repeat the foregoing analysis within that paradigm.

Given that taking on risk is the basis for earning excess returns, we regularly explore companion pieces on cash expected return, duration, credit and illiquidity. We also regularly publish cash investment trends we see across high-net-worth investors.



## References

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<https://addepar.com/assets/research-papers/addepar-primer-simulation-and-stress-testing.pdf>

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