United States Government Accountability Office

Report to the Ranking Member
Committee on Ways and Means
House of Representatives

November 2024

401(k) PLANS

Industry Data Show Low Participant Use of Crypto Assets Although DOL's Data Limitations Persist

GAO-25-106161

GAO Highlights

Highlights of GAO-25-106161, a report to the Ranking Member, Committee on Ways and Means, House of Representatives

November 2024

401(k) PLANS

Industry Data Show Low Participant Use of Crypto Assets Although DOL's Data Limitations Persist

Why GAO Did This Study

Retirement savings in 401(k) plans totaling more than $6.7 trillion in 2022 are a key component of the U.S. retirement system. Since 2022, some investment firms have offered options for participants to invest in crypto assets, raising questions among regulators and some in industry. GAO was asked to review crypto asset investment options in 401(k) plans.

This report examines (1) the presence of crypto asset investment options in 401(k) plans, (2) the potential effects of crypto assets on participant savings, (3) how fiduciaries meet ERISA responsibilities when offering crypto assets in 401(k) plans, and (4) the extent of federal oversight of crypto asset investment options in 401(k) plans.

GAO reviewed data from firms that serve 401(k) plans, forms filed by 401(k) plans, and relevant federal statutes, regulations, and guidance. GAO conducted 28 interviews with government officials, researchers, and associations of plan fiduciaries, participants, service providers, and crypto asset companies. GAO also performed a simulation analysis to estimate potential retirement savings.

What GAO Recommends

In prior work, GAO recommended DOL improve the form for fiduciary reporting on 401(k) plans (GAO-14-441). DOL improved some aspects of the form but has yet to determine what additional actions it will take. GAO also reported that Congress should consider legislation to fill federal regulatory gaps over crypto assets (GAO-23-105346). Legislation has been introduced but no bill has become law as of October 2024.

View GAO-25-106161. For more information, contact Tranchau (Kris) T. Nguyen at (202) 512-7215 or nguyentt@gao.gov, or Michael E. Clements at (202) 512-8678 or clementsm@gao.gov.

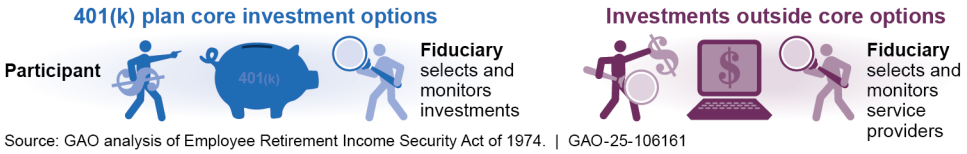
What GAO Found

Available industry data and stakeholder interviews suggest crypto assets are a small part of the 401(k) market. Crypto assets are generally private-sector digital instruments that depend primarily on encryption and distributed ledger or similar technology to conduct transactions without a central authority, such as a bank. Limited Department of Labor (DOL) data prevent systematic measurement of crypto assets in 401(k) plans. Based on available information, crypto assets are a small part of the 401(k) market. GAO identified 69 crypto asset investment options available to 401(k) participants. Participants may have multiple ways to access these options. Some may have access through their 401(k) plans' core investment options. Participants may also have access to crypto assets outside these core options, through arrangements like self-directed brokerage windows.

GAO's analysis of investment returns indicates crypto assets have uniquely high volatility—a measure of their riskiness to participants—and their returns can come with considerable risk. GAO's simulation found a high allocation (20 percent) to bitcoin, the crypto asset with the longest price history, can lead to higher volatility than smaller allocations (1 and 5 percent). Further, GAO's interviews with researchers and firms that develop crypto asset investment options indicate there is no standard approach for projecting the potential future returns of crypto assets.

DOL guidance states that 401(k) fiduciary responsibility does not change when crypto assets are offered as investment options. ERISA requires fiduciaries to be prudent in selecting and monitoring their 401(k) plans' core investment options, including any crypto asset investment options. DOL officials told GAO they generally had not required fiduciaries to select and monitor all options offered outside this core—for example, through self-directed brokerage windows—in accordance with ERISA's fiduciary standards. Thus, participants who invest outside their plan's core may have to take primary responsibility for selecting and monitoring crypto asset investment options (see figure).

401(k) Participants May Assume Greater Responsibility When Investing outside Core Investment Options



Source: GAO analysis of Employee Retirement Income Security Act of 1974. | GAO-25-106161

Lack of comprehensive data, along with regulatory uncertainty GAO has previously identified, limits federal oversight of participant investment in crypto assets in 401(k) plans. DOL does not have comprehensive data to identify 401(k) plans that give participants access to crypto assets. For example, the forms 401(k) plan fiduciaries file to meet federal reporting requirements do not identify crypto asset investment options in plans with fewer than 100 participants. Plans with 100 or more participants aggregate self-directed brokerage window investments, hindering DOL's ability to isolate investments in crypto assets. Additionally, federal regulatory gaps GAO identified in June 2023 remain unaddressed. As a result, certain crypto assets continue to trade in markets that do not have investor protections or comprehensive oversight.

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Abbreviations

ATS	Alternative Trading Systems
CFTC	Commodity Futures Trading Commission
DC	Defined Contribution
DOL	Department of Labor
EBSA	Employee Benefits Security Administration
ERISA	Employee Retirement Income Security Act of 1974
ETP	exchange-traded product
FINRA	Financial Industry Regulatory Authority
Form 5500	Annual Return/Report of Employee Benefit Plan
Form 5500-SF	Short Form Annual Return/Report of Small Employee Benefit Plan
IRR	internal rate of return
IRS	Internal Revenue Service
OTC	over-the-counter
S&P 500	Standard and Poor's 500
SEC	Securities and Exchange Commission
TDF	target date fund

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
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November 19, 2024

The Honorable Richard E. Neal
Ranking Member
Committee on Ways and Means
House of Representatives

Dear Mr. Neal:

Employer-sponsored retirement plans, such as 401(k) plans overseen by the Department of Labor's (DOL) Employee Benefits Security Administration (EBSA), are a key source of retirement savings for older Americans.[1] DOL reported that in 2022 nearly 686,000 401(k) plans held over $6.7 trillion in total assets for more than 102 million participants.[2]

Since 2022, some firms that provide services to retirement plans have been offering options to invest in crypto assets through 401(k) plans.[3] However, EBSA and some in industry have raised concerns about risks when investing in crypto assets. In March 2022, EBSA cautioned, among other things, that crypto assets' extreme price volatility could have a potentially devastating impact on 401(k) participants, particularly those approaching retirement and those who allocate a substantial portion of

[1]Named after section 401(k) of the Internal Revenue Code, 401(k) plans are the predominant type of defined contribution (DC) plan available to U.S. workers. DOL data indicate that in 2022, 401(k) plans accounted for approximately 91 percent of all DC plans, and 401(k) participants and assets accounted for approximately 84 percent of all DC participants and assets, respectively. U.S. Department of Labor, Employee Benefits Security Administration, *Private Pension Plan Bulletin: Abstract of 2022 Form 5500 Annual Reports*, *Data Extracted on 7/8/2024*, Version 1.0 (Sept. 2024).

[2]U.S. Department of Labor, Employee Benefits Security Administration, *Private Pension Plan Bulletin: Abstract of 2022 Form 5500 Annual Reports*, *Data Extracted on 7/8/2024*, Version 1.0 (Sept. 2024).

[3]For the purposes of this report, crypto assets are generally private-sector digital instruments that primarily depend on encryption and distributed ledger or similar technology, as defined by the Financial Stability Board. Ledgers—records of purchases, sales, and transfers—are considered distributed because multiple participants in a computer network share and synchronize copies of the ledger. See Financial Stability Board, *Assessment of Risks to Financial Stability from Crypto-Assets* (Basel, Switzerland: Feb. 16, 2022). Blockchains are one form of distributed ledger technology that organize transactions into blocks that are linked, or chained, together using cryptography. For more on blockchain technology, see GAO, *Blockchain: Emerging Technology Offers Benefits for Some Applications but Faces Challenges*, GAO-22-104625 (Washington, D.C.: Mar. 23, 2022).

their portfolio to crypto assets.[4] EBSA cautioned fiduciaries of 401(k) plans to exercise extreme care before they consider adding crypto asset investment options.[5] Further, one of the largest providers of recordkeeping services to 401(k) plans does not offer crypto asset investment options, citing crypto assets' speculative nature and research indicating that even a small allocation to crypto assets can substantially raise the risk profile of participants' investment portfolios.[6] We previously reported that crypto assets and related products present significant risks and challenges—including volatility, cybersecurity, and theft risk—that may limit their potential benefits to consumers and investors.[7]

You requested that we study the prevalence, administration, and oversight of crypto asset investment options in 401(k) plans. This report examines (1) the presence of crypto asset investment options in 401(k) plans, (2) the potential effects of crypto asset investment options on 401(k) participant savings, (3) how fiduciaries meet their responsibilities under the Employee Retirement Income Security Act of 1974 (ERISA) when offering crypto asset investment options to 401(k) participants, and (4) the extent to which crypto asset investment options in 401(k) plans are overseen by federal regulators.

To answer all four of our objectives, we conducted 28 interviews with a range of stakeholders, including officials from DOL, the Securities and Exchange Commission (SEC), the Commodity Futures Trading

[4]U.S. Department of Labor, Employee Benefits Security Administration, *401(k) Plan Investments in "Cryptocurrencies,"* Compliance Assistance Release No. 2022-01 (Washington, D.C.: Mar. 10, 2022).

[5]Under the Employee Retirement Income Security Act of 1974 (ERISA), fiduciaries include anyone who has discretionary control or authority over the management or administration of an ERISA-covered plan, such as a 401(k) plan, including any authority or control over the plan's assets. See 29 U.S.C. § 1002(21). Plan sponsors—typically the employer offering the plan—are generally the principal fiduciaries, referred to in ERISA as named fiduciaries. Plan sponsors may hire companies to provide the services necessary to operate their 401(k) plans. These service providers may also be fiduciaries depending on the functions they perform for the plan.

[6]Record keepers are service providers that maintain systems, referred to as recordkeeping platforms, to account for contributions to and distributions from 401(k) plans, among other services. See Vanguard, *No bitcoin ETFs at Vanguard? Here's Why* (Jan. 24, 2024). We define the size of the record keeper as total assets held in the 401(k) plans this record keeper serves. See PLANSPONSOR®, *2023 Recordkeeping Survey* (Rockville, MD: June 30, 2023).

[7]GAO, *Blockchain in Finance: Legislative and Regulatory Actions Are Needed to Ensure Comprehensive Oversight of Crypto Assets*, GAO-23-105346 (Washington, D.C.: June 22, 2023).

Commission (CFTC), academic and industry researchers, associations that represent 401(k) plan sponsors, participants, and industry, and individual service providers to 401(k) plans—including record keepers, investment consultants, asset managers, and attorneys. We selected interviewees to obtain a variety of perspectives on the 401(k) market. Appendix I provides more information on our objectives, scope, and methodology.

To address our first objective, we reviewed public, private, and proprietary sources of data on 401(k) plan investment, primary among them DOL's Form 5500 Series.[8] To assess the reliability of DOL's Form 5500 Series data we reviewed related documentation, obtained written responses from DOL officials about the data, and analyzed selected filings for plan year 2022.[9] We concluded these data were sufficiently reliable to report on the size of the 401(k) market, through counts of 401(k) participants, plans, and assets, but insufficiently reliable to meet our other reporting objectives.[10] We surveyed members of an industry association and obtained responses from 13 record keepers who together served a majority of 401(k) plans, participants, and assets.[11] Additionally, we

[8]The Form 5500, Annual Return/Report of Employee Benefit Plan (Form 5500), the Form 5500-SF, Short Form Annual Return/Report of Small Employee Benefit Plan (Form 5500-SF), and applicable schedules and attachments comprise the Form 5500 Series. Plan administrators are generally required to file these annual reports that collect information on particular plan aspects and fulfill specific filing requirements, including information on plan investment, service provider fee information, annual participant contributions, and the number of participants. Jointly developed by DOL, the Department of Treasury's Internal Revenue Service (IRS), and the Pension Benefit Guaranty Corporation, the Form 5500 Series is an important compliance, research, and disclosure tool for DOL and a source of information for Congress and other federal agencies in assessing employee benefit, tax, and economic trends and policies.

[9]A plan year is generally the calendar year, or an alternative 12-month period, that a 401(k) or other retirement plan uses for plan administration. We reviewed data for plan year 2022 because it was the most recent full plan year for which summary data on 401(k) plans, participants, and assets were available.

[10]Specifically, we identified limitations with reporting of investments that prevented us from systematically measuring the presence of an asset type or specific investment option. App. II provides additional detail on limitations in Form 5500 Series data.

[11]The Society of Professional Asset Managers and Recordkeepers Institute distributed our survey to its record keeper members.

obtained data from two providers of self-directed brokerage windows to 401(k) plans.[12]

To address our second objective, we performed a historical analysis and a forward-looking simulation. For our historical analysis, we obtained monthly price data from Yahoo! Finance and Investing.com for the five crypto assets identified as available for direct investment in 401(k) plans at the time of analysis: ada, bitcoin, DOT, ether, and SOL.[13] For each crypto asset, we calculated and reported performance statistics including return, volatility, and risk-adjusted return.

Next, to provide an illustrative example of the potential effects of adding various allocations of bitcoin to a standard 401(k) portfolio consisting of a target date fund (TDF), we conducted a forward-looking simulation.[14] The simulation required a variety of assumptions, including but not limited to starting account balances, annual contributions, and future bitcoin risk and return. We performed a historical analysis of bitcoin and interviewed industry and academic researchers and firms that developed crypto asset investment options to inform our simulation assumptions.[15] We included several sensitivity tests for our model assumptions including one for the TDFs used, one for the distribution of bitcoin and TDF returns, and one for rebalancing. Appendix III provides more information on our simulation analysis.

To address our third objective, we reviewed relevant federal laws and regulations. We also reviewed EBSA guidance to fiduciaries and a report to the Secretary of Labor on self-directed brokerage windows by the

[12]Self-directed brokerage windows, referred to by a variety of names, including brokerage accounts and brokerage windows, are arrangements under which 401(k) participants may select investments beyond those designated by plan fiduciaries. In addition to these data sources, we met with a representative of an analytics firm that researches retirement markets to preview proprietary data on crypto assets in 401(k) plans.

[13]A stablecoin, USD Coin, was also available for investment in 401(k) plans. Our quantitative analysis does not focus on USD Coin because USD Coin is designed with the intent to maintain a stable value, following the U.S. dollar. Therefore, USD Coin does not exhibit the same traits as the other crypto assets available for investment in 401(k) plans.

[14]We use bitcoin for the simulation because it has the longest price history. Bitcoin also has a large market share relative to other crypto assets and we identified it as a crypto asset offered in 401(k) plans. A target date fund is a diversified mutual fund that shifts towards a more conservative mix of investments as it approaches a particular target date in the future.

[15]We also conducted a literature search of industry publications and conference papers over the past 5 years to identify methods used to estimate the future return of bitcoin.

Advisory Council on Employee Welfare and Pension Benefit Plans, also known as the ERISA Advisory Council.[16]

To address our fourth objective, we reviewed EBSA, SEC, and CFTC guidance, EBSA enforcement priorities pertaining to crypto assets, relevant federal laws and regulations, enforcement actions, and previous GAO reports on federal enforcement efforts.[17]

We conducted this performance audit from August 2022 to November 2024 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

ERISA and 401(k) Plans

ERISA establishes minimum standards and requirements for most voluntarily established private employer-sponsored retirement plans, including DC plans, which allow workers to save for retirement by diverting a portion of their wages, and sometimes employer contributions, into investment accounts on which taxes are deferred.[18]

ERISA sets standards of conduct, or fiduciary responsibilities, for those who perform certain functions with respect to 401(k) plans and their assets to, among other things, act solely in the interest of plan

[16]Created by ERISA and composed of 15 members representing employees, employers, the public, and industry, the duties of the council are to advise the Secretary of Labor of his or her functions under ERISA. 29 U.S.C. § 1142. See also Advisory Council on Employee Welfare and Pension Benefit Plans, *Report to the Honorable Martin Walsh, United States Secretary of Labor: Understanding Brokerage Windows in Self-Directed Retirement Plans* (Dec. 2021).

[17]See GAO-23-105346; GAO, *Private Pensions: Targeted Revisions Could Improve Usefulness of Form 5500 Information*, GAO-14-441 (Washington, D.C.: June 5, 2014); and GAO, *Employee Benefits Security Administration: Systematic Process Needed to Better Manage Priorities and Increased Responsibilities*, GAO-24-105667 (Washington, D.C.: Oct. 24, 2023).

[18]Eligible contributions from employees and employers to traditional 401(k) plans are generally excluded from taxable income, while withdrawals from those plans are generally included in taxable income at the time of withdrawal. Alternately, participants with Roth 401(k)s contribute after-tax income, but qualified withdrawals are generally tax-free.

participants and beneficiaries. Among their responsibilities, fiduciaries must act prudently in selecting and monitoring plan investment options.[19] Fiduciaries must also act prudently in selecting and monitoring service providers to the plan, including those that offer self-directed brokerage windows or similar plan arrangements enabling participants to select investments other than those in a plan's core investment lineup.[20] Self-directed brokerage windows offer individual securities, mutual funds,

[19]In this report, we refer to investment options selected and monitored by plan fiduciaries as a 401(k) plan's core investment lineup. In some plans—commonly referred to as participant-directed individual account plans—participants direct the investment of their individual investment accounts among a plan's investments options. Fiduciaries of these plans can limit their liabilities if their core investment lineup meets certain conditions. Conditions include providing at least three different designated investment alternatives that give participants a reasonable chance of diversifying their assets, and giving participants control to select among them. Fiduciaries of plans that meet the requirements are not responsible for losses that result from participants' suboptimal allocation among the plan's designated investment alternatives. See generally, 29 C.F.R. § 2550.404c-1(d)(2); see also 29 C.F.R. § 2550.404c-1(d)(2)(iv), *Hughes v. Northwestern University*, 595 U.S. 170 (2022). EBSA officials told us that despite limiting their liability, fiduciaries remain responsible for ensuring that the investment options included on the core investment lineup are prudent in the first place. Officials told us that, for example, plan fiduciaries cannot defend an imprudently constructed lineup by suggesting that the participants could have prudently allocated their retirement assets, if only they had avoided the imprudent options that the fiduciaries included in the lineup.

[20]EBSA issued guidance in 2012 stating that although investment options offered through self-directed brokerage windows or similar plan arrangements, apart from a plan's core investment lineup, are not selected and monitored by fiduciaries, plan fiduciaries still have duties of prudence and loyalty to participants. These duties pertain to the selection and monitoring of the provider offering the self-directed brokerage window or other arrangements, and the nature and quality of the services offered under these arrangements. See U.S. Department of Labor, Employee Benefits Security Administration, *Fee Disclosure Guidance*, Field Assistance Bulletin No. 2012-02R (Washington, D.C.: July 30, 2012). Plan fiduciaries also are responsible for evaluating the compensation that will be received by the provider. In connection with offering a self-directed brokerage window, for example, this could include charges to make trades within the window, or for ongoing administration of a participant's brokerage account.

exchange-traded products (ETP), grantor trusts, and other investment options.[21]

Employers that sponsor 401(k) plans for their employees typically serve as their plans' named fiduciaries. Plan sponsors can also designate one or more people, or an office within the company, as named fiduciaries to a plan. For example, a plan sponsor could designate a company's board of directors as a plan's named fiduciaries.

Plan sponsors may also hire third-party service providers to help with their 401(k) plans. Some of these service providers may act in a fiduciary capacity when they make investment decisions, give advice on which investment options to offer participants, or assist with plan operations.[22] Service providers include:

- **Asset managers** that offer investment options. These options may be designed specifically for use in 401(k) plans' core investment lineups, or for investors generally and offered to participants through self-directed brokerage windows.

[21]Securities are defined by the federal securities laws to include financial instruments such as stock and bonds, as well as investment contracts, among others. Mutual funds are companies established by asset managers that pool money from investors and invest it in stocks, bonds, and other securities. Investors purchase and redeem shares of mutual funds either directly from the funds themselves or through intermediaries, such as providers of self-directed brokerage windows. While there is no single definition of ETPs, ETPs generally pool assets to provide investors with exposure to a wide range of asset classes, including securities. ETPs also generally issue shares that are listed on exchanges. ETPs include exchange-traded funds, which are regulated under the Investment Company Act of 1940 and primarily invest in securities, and exchange-traded vehicles that invest primarily in nonsecurities instruments, in which case they are not regulated under the Investment Company Act of 1940. Grantor Trusts are entities established and governed under State law. They create a fiduciary relationship between asset managers, who serve as grantors, and investors, who serve as beneficiaries. Grantors generally own the assets initially contributed to the trust, while beneficiaries are entitled to receive benefits from the trust, such as investment returns. Grantor Trust shares can trade in over-the-counter (OTC) markets, which are generally networks of brokers and dealers that facilitate trading in investments that may not be listed on an exchange.

[22]Under ERISA, plan fiduciaries are individuals or entities who (1) exercise discretionary authority or discretionary control with respect to management of a plan or who exercise any authority or control with respect to management or disposition of its assets; (2) provide investment advice for a fee or other compensation, direct or indirect, with respect to any moneys or other property of the plan or who have any authority or responsibility to do so; or (3) have any discretionary authority or discretionary responsibility for the administration of a plan. 29 U.S.C. § 1002(21).

- **Record keepers** that manage data on participant accounts and transactions through their administrative recordkeeping platform.
- **Investment consultants** that recommend or select investment options for plans.[23]
- **Custodians** that hold plan assets on behalf of participants, but in contrast to fiduciaries, generally do not exercise discretionary authority over these assets.
- **Attorneys** that advise plan fiduciaries on compliance with applicable laws, such as those under ERISA and the Internal Revenue Code, as well as with investigations and audits conducted by EBSA and IRS, respectively. They may also review contracts with service providers, assist with plan design, represent fiduciaries in connection with EBSA audits or investigations, and resolve administrative questions, such as the disposition of assets fiduciaries conclude should not be held in the plan.

Participants in 401(k) plans are often responsible for choosing how to invest contributions to their plan accounts.[24] This includes periodically rebalancing their accounts to maintain an allocation that aligns with their retirement goals and risk tolerance. For example, participants commonly invest in TDFs, which allocate assets over time based on participants' targeted retirement dates.[25]

DOL data indicate that the market for 401(k) plans is highly concentrated, with most participants and assets concentrated in a relatively small number of larger plans. According to DOL data for 2022, 11 percent of 401(k) plans had 100 or more participants yet accounted for 88 percent of both 401(k) assets and participants, respectively. Alongside these large plans exist a greater number of smaller plans, each with fewer

[23]We did not examine participant-level investment advice in this report. Other federal laws and regulations apply to the provision of advice made directly to participants.

[24]Further, we have reported that participants bear investment risk for their account and must determine how best to use their savings to last throughout retirement. See GAO, *401(K) Plans: DOL Could Take Steps to Improve Retirement Income Options for Plan Participants*, GAO-16-433 (Washington, D.C.: Aug. 9, 2016).

[25]We have reported that TDFs are widely offered by 401(k) plans and increasingly used by participants. As a result, TDFs have become the most popular investment option used by participants. GAO, *401(k) Plans: Department of Labor Should Update Reporting Requirements and Guidance on Target Date Funds*, GAO-24-105364 (Washington, D.C.: Mar. 28, 2024).

participants. In 2022, 89 percent of 401(k) plans had fewer than 100 participants.[26]

EBSA Oversight of 401(k) Plans

EBSA is responsible for, among other things, administering and enforcing the fiduciary and reporting and disclosure provisions of Title I of ERISA. EBSA's national and regional office staff work together to ensure plan participants receive the health and retirement benefits to which they are entitled. The national office develops enforcement guidance regional office staff use to conduct investigations, identifies national priorities, and issues guidance to fiduciaries. Regional offices may develop their own regional projects and areas of expertise based, in part, on issues or practices prevalent in that region and the results of previous investigations.

EBSA uses the Form 5500 Series for plans to fulfill statutory duties under ERISA, as well as a primary tool to monitor and enforce plan fiduciaries' and service providers' ERISA responsibilities.[27] With limited exceptions, employee benefit plans subject to ERISA, including 401(k) plans, must report detailed information about the plan annually by filing Form 5500 or Form 5500-SF, as applicable.[28] The most recent versions of the forms contain multiple schedules and attachments that collect information on, among other things, plans' investments and service provider fees.[29]

[26]U.S. Department of Labor, Employee Benefits Security Administration, *Private Pension Plan Bulletin: Abstract of 2022 Form 5500 Annual Reports, Data Extracted on 7/8/2024*, Version 1.0 (Sept. 2024).

[27]DOL, IRS, and the Pension Benefit Guaranty Corporation jointly developed the Form 5500 Series to satisfy annual reporting requirements for 401(k) plans under ERISA and the Internal Revenue Code. DOL describes the Form 5500 as part of ERISA's reporting and disclosure framework, which is intended to assure that employee benefit plans are operated and managed in accordance with certain prescribed standards. This framework is further intended to give participants, beneficiaries, and regulators access to sufficient information to protect the rights and benefits of participants and beneficiaries. As such, Form 5500 filings serve as a research tool for DOL and other Federal agencies, Congress, and the private sector to assess employee benefit, tax, and other economic trends and policies.

[28]Plans with 100 or more participants generally file Form 5500. Plans with fewer than 100 participants generally file Form 5500-SF.

[29]For example, plans with 100 or more participants that meet certain requirements file Schedule H, Financial Information. The schedule requires these larger plans to report, among other things, participant savings, or plan assets, by asset type. Plans with fewer than 100 participants do not file this schedule, although some file Schedule I, Financial Information—Small Plan.

In March 2022, EBSA released guidance to plan fiduciaries that outlined the risks and challenges that investments in crypto assets pose to 401(k) accounts, such as volatility, valuation concerns, and crypto assets' evolving regulatory environment.[30] The guidance also noted that EBSA expected to conduct an investigative program aimed at plans that offer participants crypto asset investment options.

Crypto Asset Investment Options

Crypto assets are generally private-sector digital instruments that depend primarily on encryption and distributed ledger or similar technology to conduct and record transfers of value without a central authority, such as a bank.[31] Crypto assets take a variety of forms and in some cases are referred to by the functions they are designed or intended to serve, such as:

- **Cryptocurrency:** generally, a digital representation of value protected through cryptographic mechanisms (instead of a central repository or authority), and typically not government-issued legal tender. Bitcoin, which emerged in 2009, is the first and most widely circulated cryptocurrency.[32]
- **Stablecoin:** a type of crypto asset designed with the intent to maintain a stable value, typically with reference to a fiat currency (government-issued legal tender such as the U.S. dollar) or other reference asset or assets.

Investors have multiple options for gaining exposure to crypto assets through investment, which may include:

- **Direct investment in crypto assets.** This refers to the purchase of crypto assets in spot (cash) markets, where financial instruments such

[30]Compliance Assistance Release No. 2022-01.

[31]While definitions of crypto assets may vary, we use this definition for purposes of this report. A crypto asset may or may not meet the definition of a security under the federal securities laws. The SEC Chair has expressed the view that the vast majority of crypto assets are offered and sold as securities, thus their offers and sales should be registered unless subject to an exemption from registration. See, for example, SEC Chair Gary Gensler, *Kennedy and Crypto* (Washington, D.C.: Sept. 8, 2022). Also see SEC Chair Gary Gensler, *Statement on the Approval of Spot Bitcoin Exchange-Traded Products* (Washington, D.C.: Jan. 10, 2024). We do not opine on whether a particular crypto asset is or is not a security, and we use the term generally to include nonsecurities and securities.

[32]Bitcoin is commonly referred to in the crypto asset industry as a cryptocurrency. For purposes of this report, we refer to bitcoin as a type of cryptocurrency, as cryptocurrency is defined herein.

as commodities and securities are traded for immediate exchange of another crypto asset, cash, or other financial instrument. Crypto asset trading platforms facilitate transactions in crypto assets, for example allowing users to trade one crypto asset for another, or for fiat currency. These platforms may combine the services offered by separate intermediaries in traditional financial markets, such as brokers that place orders on behalf of investors, exchanges that bring together buyers and sellers, and clearing agencies that assist in the clearing and settlement of transactions, or act as custodians that safekeep assets.

- **Indirect investment in crypto asset funds, grantor trusts, and ETPs.**[33] In contrast to the direct purchase of crypto assets, this refers to the purchase of units or shares of investment options that, in turn, invest in crypto assets. Alternately, these investment options may invest in crypto asset derivatives to track the price of one or more crypto assets.[34]

Oversight of Crypto Assets

CFTC and SEC have the authority to oversee certain transactions involving crypto assets, crypto asset markets, and crypto asset intermediaries.[35] However, as we have previously reported, there are

[33]Generally, an ETP is an investment vehicle that is listed on a U.S. exchange and seeks to provide exposure to the performance of a benchmark, an index, or an actively managed strategy. Shares of ETPs trade on national securities exchanges and other secondary markets that are regulated by SEC under the Securities Exchange Act of 1934. An ETP can include securities and nonsecurity commodities, among other asset types.

[34]Derivatives are financial instruments that derive their value from other financial instruments or indicators such as crypto assets. One example of a crypto asset derivative is a futures contract on bitcoin. A futures contract is an agreement to purchase or sell an asset at a future date. Such transactions occur in derivatives markets where, for example, investments in futures contracts result in an agreement to purchase or sell a commodity in the future.

[35]Federal prudential regulators (the Board of Governors of the Federal Reserve System, the Federal Deposit Insurance Corporation, the Office of the Comptroller of the Currency, and the National Credit Union Administration) and the Consumer Financial Protection Bureau oversee depository institutions' engagement with crypto assets. For example, some depository institutions may be capable of maintaining custody of crypto assets or holding assets for stablecoin issuers to maintain its stable value. Additionally, the Financial Crimes Enforcement Network and other federal law enforcement agencies play a role in attempting to prevent money laundering involving crypto assets and prosecuting crimes involving the use of crypto assets.

gaps in the federal oversight of certain crypto assets, including stablecoin arrangements.[36]

- **CFTC.** CFTC has regulatory and enforcement jurisdiction over markets for commodity (nonsecurity) derivatives.[37] CFTC also has enforcement jurisdiction over spot commodities, including nonsecurity crypto assets.[38] As such, CFTC oversees crypto asset investments that involve commodity derivatives. CFTC regulation of derivatives markets focuses on protecting price and market integrity. CFTC requires registration of and regulates:
  - Certain market participants who transact derivatives and intermediaries, including futures commission merchants that buy and sell them on behalf of clients.[39]
  - Derivatives exchanges that provide participants in the derivatives markets the ability to execute or trade derivatives with one another.
  - Derivatives clearing organizations that provide clearing services for agreements, contracts, and transactions, and act as a third party between market participants.

[36]GAO-23-105346.

[37]Under the Commodity Exchange Act, a commodity is defined by reference to a delineated list of goods and articles (such as wheat, cotton, and all other goods and articles with certain exceptions). This list of goods and articles, along with all accompanying services, rights, and interests in which contracts for future delivery are presently or in the future dealt with, are considered commodities. 7 U.S.C. § 1a(9), 17 C.F.R. § 1.3. Commodity derivatives are contracts or financial instruments that derive their value from an underlying measure, such as the price of an asset—where the underlying asset or other measure falls within the definition of commodity under the Commodity Exchange Act. 7 U.S.C. §§ 1-27f. CFTC regulatory authority generally includes authority over commodity options, futures markets, and swap markets.

[38]According to CFTC officials, as of September 30, 2024, CTFC has filed 138 enforcement actions related to nonsecurity crypto assets, including actions for fraud and manipulation, and actions against decentralized finance protocols and crypto asset trading platforms that illegally offered derivative, margined, or leveraged transactions without registering with CFTC.

[39]In general, a futures commission merchant solicits or accepts orders for commodities futures, commodity options, or swaps, among other things, and accepts any money, securities, or property to margin, guarantee, or secure any trades or contracts that result therefrom. See 7 U.S.C. § 1a(28). Futures commission merchants, among other intermediaries, generally must be members of the National Futures Association. See 17 C.F.R. § 170.15.

CFTC uses its enforcement authority to take action for apparent violations of the Commodity Exchange Act, which include, among others, fraud, market manipulation and disruption, and violations of registration and regulatory requirements.

CFTC does not directly regulate the markets for commodities underlying derivatives contracts (commodity spot markets) in the same manner that it regulates derivatives markets.[40] However, CFTC has anti-fraud and anti-manipulation enforcement authority over transactions in commodities in interstate commerce, including transactions in commodity spot markets. CFTC exercises that authority through enforcement actions.[41]

- **SEC.** SEC has jurisdiction over entities, persons, transactions, and other activities that involve securities, including crypto assets that are offered and sold as securities, under federal securities laws.[42] When assets, including crypto assets, meet the definition of securities under federal securities laws, their offer and sale must be registered with SEC before they can be offered and sold in interstate commerce, unless there is an applicable exemption. Additionally, federal securities laws require registration of intermediaries and market participants involved in crypto asset securities unless an exception or exemption applies. These intermediaries include, for example, broker-dealers, investment companies, certain investment advisers, clearing agencies, and national securities exchanges.

  To determine whether an activity is subject to federal securities laws and SEC jurisdiction, there must be a determination of whether the activity involves an asset that was offered and sold as a security. Federal securities laws define the term security to include an

[40]A cash commodity is the physical or actual commodity as distinguished from the derivatives contract and is sometimes called a spot commodity.

[41]The Commodity Exchange Act makes it unlawful for any person to use or employ in connection with any "contract of sale of any commodity in interstate commerce, or for future delivery on or subject to the rules of any registered entity, any manipulative or deceptive device or contrivance, in contravention of such rules and regulations as the [CFTC] shall promulgate" 7 U.S.C. § 9(1). CFTC regulations make it unlawful for any person, in connection with any contract of sale of any commodity in interstate commerce to intentionally or recklessly "[u]se or employ, or attempt to use or employ, any manipulative device, scheme, or artifice to defraud." 17 C.F.R. § 180.1.

[42]State securities regulators also play a role in overseeing the securities markets.

investment contract, among other instruments.[43] The U.S. Supreme Court's *Howey* test, along with subsequent case law, is used to determine if the offer and sale of an asset is the offer and sale of an investment contract.[44]

States may also play a role in oversight of crypto assets and custody, but laws vary significantly across states. For instance, some states that require licensure or registration as a money transmitter or money services business extend these requirements to entities conducting crypto asset transactions in certain circumstances. On the other hand, some states may require a virtual currency license or similar licensure that directly regulates delineated crypto asset–related activities. Furthermore, other states may not require any sort of licensure or registration for crypto asset market participants. In addition, entities providing custodial services for crypto assets, among other services, may apply to be chartered in a state that allows nonbanks to provide these services without federal deposit insurance.

Available Industry Data and Stakeholder Interviews Suggest Crypto Assets Are a Small Part of the 401(k) Market

Our review indicates that crypto asset investment options are a small part of the 401(k) market. However, we could not systematically measure their prevalence in 401(k) plans due to limitations we identified in the Form 5500 Series, some of which we previously recommended DOL address.[45] Appendix II provides details on these limitations.

Despite limitations in Form 5500 Series data, industry data we were able to obtain indicate investment in crypto assets and their derivatives has been minimal, relative to the overall market for 401(k) plans. For example, our survey of 401(k) plan record keepers, while not generalizable, showed minimal participant investment in crypto assets and their derivatives (see table 1). Record keepers who responded to our survey

[43]In addition to investment contracts, the federal securities laws define the term security to include other instruments such as notes, stocks, bonds, and transferable shares. 15 U.S.C. §§ 77b(a)(1); 78c(a)(10).

[44]The *Howey* test defines an investment contract as an investment of money in a common enterprise with the expectation of profits to be derived from the managerial or entrepreneurial efforts of others. *SEC v. W.J. Howey Co.*, 328 U.S. 293, 298-99 (1946). SEC also has applied factors set out in *Reves v. Ernst & Young*, 494 U.S. 56 (1990) in enforcement actions to determine if a financial instrument is a note that is a security under the federal securities laws. See, for example, *SEC v. Genesis Global Cap.,* 2024 WL 1116877, at *9-14 (S.D.N.Y. Mar. 13, 2024).

[45]GAO, *Private Pensions: Targeted Revisions Could Improve Usefulness of Form 5500 Information*, GAO-14-441 (Washington, D.C.: June 5, 2014).

with data on use of crypto asset investment options by plans and participants reported that none of the plans they served offered crypto asset investment options on their core investment lineups. Nor did the plans they served offer participants direct investment in crypto assets through links, or windows, to crypto asset trading platforms. Record keepers reported minimal participant investment in crypto asset investment options purchased through self-directed brokerage windows. This investment amounted to substantially less than 1 percent of the 401(k) market, whether measured by plans, participants, or assets.[46]

Table 1: Selected Results from Survey of Record Keepers about 401(k) Crypto Asset Investment Options

	Core investment lineup[a]	Window to crypto asset trading platform[b]	Self-directed brokerage window[c]
Use of crypto asset investment options as measured in:			
Number of plans/percent of total 401(k) plans in 2022	0/0%	0/0%	375/0.055%
Number of participants/percent of total 401(k) participants in 2022	0/0%	0/0%	3,418/0.003%
Amount invested ($, millions)/percent of total 401(k) assets in 2022	$0/0%	$0/0%	$66.3/0.001%

Source: Survey of Society of Professional Asset Managers and Recordkeepers Institute members and DOL documents. | GAO-25-106161

Note: Record keepers manage data on participant accounts and transactions for 401(k) plans. GAO and the Society of Professional Asset Managers and Recordkeepers Institute fielded the survey between July 20 and September 13, 2023. The results of the survey cannot be generalized to the whole 401(k) market. This is in part because we did not receive responses from all 28 record keepers that could have responded. Further, we did not determine how representative the surveyed record keepers were of all record keepers serving 401(k) plans. Thirteen record keepers provided at least one response to the survey. In combination, the thirteen record keepers reported serving 55 percent of all 401(k) plans, 52 percent of all 401(k) participants, and 65 percent of all 401(k) assets, based on totals the Department of Labor's (DOL) Employee Benefits Security Administration (EBSA) reported for 2022. See U.S. Department of Labor, Employee Benefits Security Administration, *Private Pension Plan Bulletin, Abstract of 2022 Form 5500 Annual Reports, Data Extracted on 7/8/2024*, Version 1.0 (Sept. 2024).

[a]Twelve record keepers responded with data on core investment lineups. The record keepers' combined market share was commensurate with approximately 51 percent of plans, 29 percent of participants, and 27 percent of assets EBSA reported for the total 401(k) market in 2022.

[b]Twelve record keepers responded with data on links, or windows, to crypto asset trading platforms. The record keepers' combined market share was commensurate with approximately 54 percent of plans, 49 percent of participants, and 62 percent of assets EBSA reported for the total 401(k) market in 2022.

[c]Eight record keepers responded with data on self-directed brokerage windows. The record keepers' combined market share was commensurate with approximately 36 percent of plans, 20 percent of participants, and 16 percent of assets EBSA reported for the total 401(k) market in 2022.

[46]Total 401(k) plans, participants, and assets as reported by DOL from 401(k) plan filings in plan year 2022. See U.S. Department of Labor, Employee Benefits Security Administration, *Private Pension Plan Bulletin, Abstract of 2022 Form 5500 Annual Reports, Data Extracted on 7/8/2024*, Version 1.0 (Sept. 2024).

In addition to our nongeneralizable survey of record keepers, providers of self-directed brokerage windows to most 401(k) and other retirement plans with whom we spoke confirmed that investment in crypto asset investment options on their platforms was minimal. For example, in February 2024, representatives of one provider told us that combined investment in 53 crypto asset investment options we identified represented less than 0.1 percent of total assets in the plans in which these investments were made.[47] Representatives of another provider told us investment in these options totaled less than 1 percent of total retirement plan assets invested through their self-directed brokerage window.

Corroborating our review of industry data, a range of agency officials, industry representatives, and other stakeholders indicated that use of crypto asset investment options in 401(k) plans was minimal.

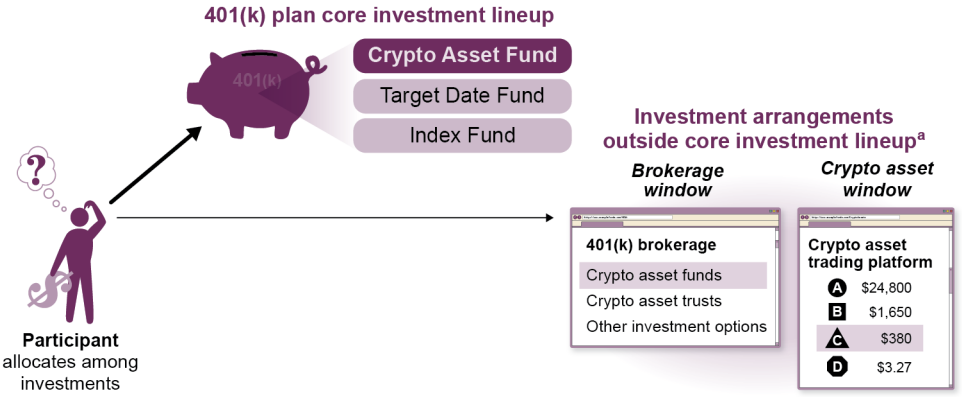
- **EBSA officials** told us that based on their investigations and interactions with industry and plan stakeholders, 401(k) plans had generally not adopted crypto asset investment options. Officials observed that overall plan exposure to these investments had been minimal.
- **Leaders of associations that represent 401(k) plans and their service providers**—including asset managers, record keepers, investment consultants, and attorneys, as well as plan sponsors and other fiduciaries—told us that the majority of their members were not currently providing or interested in providing crypto asset investment options.
- **Representatives of individual service providers** we spoke with—including investment consultants, attorneys, self-directed brokerage window providers, record keepers, and a representative of a firm that interacts with an array of providers to analyze retirement markets—told us they had seen little interest in crypto asset investment options for 401(k) plans.
- **Asset managers that offer crypto asset investment options to 401(k) plans and representatives of crypto asset associations** we spoke with cited interest in these investment options, generally among younger participants who worked with or were familiar with crypto assets and other emerging technologies. However, representatives of

[47]To identify crypto asset investment options, we reviewed asset managers' marketing materials and filings with SEC. We also reviewed a list of crypto asset investment options EBSA officials developed. Finally, we reviewed relevant industry and media reports.

both crypto asset associations and others we interviewed pointed to regulatory uncertainty as potentially affecting demand for crypto asset investment options in 401(k) plans. Relatedly, interviewees cited fiduciaries' concerns about participant lawsuits as potentially limiting use.

While our review showed low use in 401(k) plans, we identified 69 crypto asset investment options available to 401(k) plans. In marketing to 401(k) plans, service providers identified multiple ways for fiduciaries to offer various options to participants (see fig. 1). EBSA officials told us that despite how crypto asset investment options were marketed, fiduciaries were responsible for determining whether such options should have been included in their plan's core investment lineup or offered through an investment arrangement apart from the lineup.

Figure 1: Illustration of 401(k) Plans That Offer Crypto Asset Investment Options



Source: GAO analysis of industry documents and media reports. | GAO-25-106161

Note: Target Date Funds allocate assets over time based on participants' targeted retirement dates. Index funds are passive funds that seek to replicate the performance of a market index instead of outperform it. Self-directed brokerage windows, referred to by a variety of names, including brokerage accounts and brokerage windows, are arrangements under which 401(k) participants may select investments beyond those designated by plan fiduciaries. Crypto assets are generally private-sector digital instruments that depend primarily on encryption and distributed ledger or similar technology to conduct and record transfers of value without a central authority, such as a bank. Crypto asset trading platforms facilitate transactions and allow users to trade one crypto asset for another, or for fiat currency (government-issued legal tender such as the U.S. dollar). Trusts are entities that create a fiduciary relationship between grantors, who generally own the assets initially contributed to the trust, and investors, who are entitled to receive benefits from the trust, such as investment returns.

[a]Service providers described self-directed brokerage windows and crypto asset windows as offering investment arrangements apart from 401(k) plans' core investment lineups. However, officials from the Department of Labor's Employee Benefits Security Administration told GAO that fiduciaries are responsible for deciding whether features such as self-directed brokerage windows and crypto asset windows, or any of the crypto asset investment options they offer, should be included in plans' core investment lineups.

Available only on the core investment lineup. We identified one crypto asset investment option that is available solely for use in 401(k) plan core investment lineups.[48] This option is a unitized fund that primarily holds bitcoin along with other short-term investments for liquidity.[49] The provider establishes a separate account within each 401(k) plan that adopts this option. Participants invest in units of their plans' separate accounts. The provider of this option told us plan fiduciaries are responsible for setting limits on the proportion of contributions and savings participants can allocate to this option, up to 20 percent of their account balance.

One of the larger 401(k) service providers supports this crypto asset unitized fund by providing recordkeeping, trading, and custodial support through affiliates. The provider incorporates features common to other investment options in 401(k) plans. For example, although bitcoin trades continuously, participant orders to buy or sell units of this option are processed once daily, based on a closing price referred to as the net asset value. This is similar to the way other assets commonly offered in 401(k) plans, such as shares of mutual funds, are priced. To do this, each business day the net asset value is generally calculated based on the value of the bitcoin (using a publicly available bitcoin index as reference) and the short-term investments held in the account.[50]

Available through windows to crypto asset trading platforms. We identified another, substantially smaller, 401(k) service provider that offers

[48]In September 2024, the provider of this option told us it no longer actively offered this option to its clients. Because this option was designed for 401(k) plans' core investment lineups, data on its use will be partially reported in Form 5500 filings. Specifically, use will be reported in filings for 401(k) plans with 100 or more participants. However, we were unable to measure use of this option due to limitations detailed in Appendix II. We conducted a limited search of Form 5500s filed for 2022 by 401(k) plans of five companies that are involved with, or invest in, bitcoin but did not identify investments in this option. More broadly, EBSA officials told us they had not observed use of this option in Form 5500 filings as of December 2023.

[49]A unitized fund establishes units representing undivided interests in the assets held in the account. The provider of this option told us 401(k) plans use unitized funds as a method of accounting for employer stock in a plan. In this instance, the provider used the unitized fund to invest primarily in bitcoin, along with a comparably small amount of cash invested in money market funds. The money market funds provide liquidity needed to operate the unitized fund, for example to handle daily participant transactions. Plan fiduciaries choose the amount of cash for their separate account and the money market in which to invest.

[50]In the event of heavy outflows—for example, from participant orders to sell in response to steep drops in prices—the provider may have to suspend transactions, which would then be priced as of the day the provider could provide sufficient liquidity to process them.

a window to a crypto asset trading platform.[51] In contrast to the other options we identified, the crypto asset window gives participants access to spot markets for crypto assets in which participants invest directly in crypto assets, as opposed to in units or shares of funds or trusts. The crypto asset window offers direct investment in six crypto assets, including one stablecoin.[52]

The provider of this crypto asset window described it as an arrangement selected by plan fiduciaries that enables participants to invest outside a 401(k) plan's core investment lineup. According to the provider, this has the benefit of emphasizing that investments made through the crypto asset window are voluntary, which participants acknowledge when they take the extra step of signing up for the window.[53] The provider contrasted this with including crypto asset investment options in a 401(k) plan's core investment lineup, which the provider said could expose fiduciaries to the risk of liability in the event an investment option is determined to be imprudent. The provider also cited the imposition of limits on allocations and contributions made through the crypto asset window as a tool fiduciaries could use to reduce risks to participants. Fiduciaries that adopt this option are responsible for setting limits of up to 5 percent on allocations and contributions made through the window.[54]

As noted previously, EBSA officials told us fiduciaries were responsible for determining whether features such as crypto asset windows were most prudently adopted for their plans' core investment lineups or as investment arrangements apart from their core lineups. In its guidance to fiduciaries on crypto assets, EBSA said fiduciaries should be prepared to support how their decision to adopt such features, either as part of the

[51]For example, the total assets under management for this record keeper and investment consultant to 401(k) plans equated to less than 0.1 percent of the recordkeeping assets the larger provider manages for 401(k) plans.

[52]The provider's window offers access to ada, bitcoin, DOT, ether, SOL, and USD Coin. Participant investments in crypto assets are held by a custodian, rather than participants taking responsibility for maintaining access to them.

[53]The provider requires that participants review disclosures and pass a quiz on the risks of investing in crypto assets before accessing the crypto asset window.

[54]In contrast to the crypto asset unitized fund we identified for use on 401(k) plan core investment lineups, contributions to this option are not suspended if allocations to crypto assets exceed 5 percent of participants' balances. Instead, participants receive alerts and are given the option to rebalance their portfolio to what the provider described as a more prudent risk level.

lineup or apart from it, met fiduciary requirements under ERISA.[55] We discuss these requirements later in the report.

Available through self-directed brokerage windows. We identified 62 crypto asset investment options that provided indirect exposure to crypto assets and could be made available to participants through self-directed brokerage windows as of October 2024. In January 2024, SEC approved applications for spot bitcoin ETPs to trade on U.S. exchanges. SEC subsequently approved applications for spot ether ETPs, which began trading in July 2024.[56] Executives from two asset managers that offer crypto asset investment options told us these approvals would lead to lower fees for investment options that provide indirect exposure to crypto assets. As table 2 shows, ETPs that invest directly in bitcoin and ether through spot markets had lower median annual fees than other types of crypto asset investment options, including ETPs that invest in crypto asset derivatives, such as futures contracts.

Table 2: Crypto Asset Investment Options Available from Providers of 401(k) Self-Directed Brokerage Windows That GAO Identified

Investment type	Number of options	Invests in	Exchange(s)[a]	Annual fees lowest–highest, median[b]
Exchange-Traded products (ETP)	21	bitcoin or ether	Cboe BZX Exchange, Inc. The Nasdaq Stock Market NYSE Arca, Inc.	0.15–2.5 percent, 0.25 percent[c]
	20	Derivatives of bitcoin, ether, or both		0.65–1.85, 0.95
Mutual funds	3	Derivatives of bitcoin	N/A[d]	1.15–2.5, 1.26
Index funds	2	Multiple crypto assets[e]	OTC Markets Group	2.5, 2.5
Trusts	16	Multiple crypto assets[f]	OTC Markets Group	0.49–2.5, 2.5[g]

Source: Filings with the U.S. Securities and Exchange Commission (SEC), documents from the Department of Labor, media reports, and industry documents. | GAO-25-106161

Note: GAO previously analyzed Morningstar fee data for Target Date Funds (TDF), the most popular investment option used by 401(k) participants. As compared to the crypto asset investment options we identified, TDF mutual funds had annual net expense ratios ranging from 0.08 to 0.78 percent, with a 2022 average asset-weighted net expense ratio of 0.32 percent. Expense ratios are a measure of fees, showing an investment's total operating expenses as a percentage of its assets. GAO, *401(k)*

[55]Compliance Assistance Release 2022-01.

[56]The term spot refers to investment by these products directly in bitcoin or ether as opposed to bitcoin or ether derivatives, such as futures contracts. These spot products may have the term Exchange-Traded Fund in their names. However, asset managers for these options described them as not registered under the Investment Company Act of 1940. Similarly, asset managers for all but one of these options described them as not subject to regulation under the Commodity Exchange Act of 1936. One option invested in a mix of bitcoin and futures contracts on bitcoin. Managers of this option described it as subject to regulation under the Commodity Exchange Act of 1936.

Plans: Department of Labor Should Update Reporting Requirements and Guidance on Target Date Funds, GAO-24-105364 (Washington, D.C.: Mar. 28, 2024). Our prior work also shows that even seemingly small differences in fees, such as an annual 1 percent charge, can significantly reduce the amount of money saved for retirement. GAO, *Private Pensions: Changes Needed to Provide 401(k) Plan Participants and the Department of Labor Better Information on Fees*, GAO-07-21 (Washington, D.C.: Nov. 16, 2006).

[a]Cboe BZX Exchange, Inc., the Nasdaq Stock Market, and NYSE Arca, Inc. are national securities exchanges. Over-the-counter (OTC) markets operated by OTC Markets Group are networks of broker-dealers where securities that often do not meet the requirements to be listed on a national exchange can trade.

[b]Except as noted below with respect to temporary fee waivers, we report net fees when asset managers listed both gross and net fees for investment options. Net fees may be contingent on the asset manager applying fee waivers.

[c]In January 2024, SEC approved 10 ETPs that invest in bitcoin. One of these options was previously available through OTC Markets Group. The annual fee for this option decreased from 2 percent to 1.5 percent when its asset manager received approval to list shares of their crypto asset trust on an exchange as an ETP. The other nine options had lower annual fees, ranging from 0.19 to 0.39 percent. Asset managers for eight of the nine bitcoin ETPs further offered temporary waivers of any annual fees in marketing these options. SEC subsequently approved nine ether ETPs, which began trading in July 2024. As with the bitcoin ETPs, one of the ether ETPs had higher annual fees than the others. The asset manager similarly received approval to list shares of this previously available option that invested in ether as an ETP on NYSE Arca, Inc. The asset manager for this option retained its 2.5 percent annual fee. The other eight ether ETPs had comparatively lower annual fees, ranging from 0.15 to 0.25 percent.

[d]Shares of mutual funds do not trade on exchanges. Instead, investors purchase and redeem shares through the funds directly, or an intermediary such as a broker-dealer.

[e]In SEC filings, the asset manager of these two options described them as Limited Liability Companies incorporated in the Cayman Islands. The asset manager also stated that these two options were not registered investment companies under the Investment Company Act of 1940. Between them, the two index funds invested in 11 crypto assets.

[f]Fifteen of the trusts invest in a single crypto asset each. In SEC filings, asset managers described these options as grantor trusts, which are entities established and governed under state law. Grantor trusts create a fiduciary relationship between asset managers, who serve as grantors, and investors, who serve as beneficiaries. The other trust invested in multiple crypto assets to track the performance of an index. In SEC filings, the asset manager described this option as a statutory trust organized under Delaware law and anticipated that for federal tax purposes it would not be classified as a grantor trust, because it would not hold a fixed pool of assets. Between them, the trusts invested in 17 crypto assets.

[g]All but one of the crypto asset trusts had annual fees of 2.5 percent.

Asset managers we spoke with cited further advantages of ETPs that invested in crypto assets over the crypto asset investment options available prior to January 2024. Specifically, although the crypto asset trusts we identified as available through OTC markets invest directly in crypto assets, they have limited redemption features. This means that although investors are allowed to sell their shares on OTC markets, they cannot redeem shares with the asset manager in exchange for the underlying crypto asset. Asset managers told us this limitation could contribute to premiums or discounts between market price and net asset value—meaning the unit price of the investment option would diverge from the price of the underlying crypto asset. Further, they told us investment options that tracked the price of crypto assets by purchasing

futures contracts based on them might experience increased or decreased returns, caused by differences between the value of the crypto assets and their futures contracts, as well as the need to purchase new futures contracts as the old ones expire.[57]

Fiduciaries of 401(k) plans can and do limit the offerings available through self-directed brokerage windows but may face challenges limiting participant access to crypto asset investment options. For example, industry data from a 2021 report on self-directed brokerage windows indicate that between 15 and 20 percent of DC retirement plans restrict self-directed brokerage window offerings to mutual funds.[58] However, this broad limitation would not fully restrict access to the crypto asset investment options we identified, three of which were mutual funds. Further, representatives of a self-directed brokerage window provider for 401(k) plans told us they did not offer plans a categorical restriction on crypto asset investment options available on their platform. The representatives told us this is because they could not be sure what investments did or did not qualify under EBSA's guidance as crypto asset investment options. They said fiduciaries could, however, further restrict specific investment options from a self-directed brokerage window if the fiduciaries identified options that invested in crypto assets or their derivatives.

[57]Specifically, a crypto asset investment option's returns may be decreased when the price of new futures contracts for a crypto asset is higher than those of an investment option's expiring contracts—a situation referred to as contango. Conversely, a crypto asset investment option's returns may be increased if the price for new futures contracts is lower than that of the expiring contracts—a situation referred to as backwardation.

[58]See Advisory Council on Employee Welfare and Pension Benefit Plans, *Report to the Honorable Martin Walsh, United States Secretary of Labor: Understanding Brokerage Windows in Self-Directed Retirement Plans* (Dec. 2021).

Future Crypto Asset Investment Returns are Highly Uncertain and Could Have Significant Wide-Ranging Effects on 401(k) Participant Savings

Crypto Assets Available to 401(k) Participants Are an Emerging Group of Assets with No Standard for Long-Run Evaluation

What does standard deviation mean for investments?

Standard deviation is a measure of volatility. Volatility is the uncertainty or risk related to an investment's return. A higher standard deviation means higher riskiness because there could be large upward or downward swings in investment return. For example, an investment with a lower standard deviation, or risk, could have a positive return of 5 percent or a negative return of 5 percent in an average year. On the other hand, an investment with a higher standard deviation could have a positive return of 20 percent or a negative return of 20 percent in an average year. Among two investments with the same expected return, the investment with the lower standard deviation (risk) is generally preferred by investors.

Source: Industry documentation. | GAO-25-106161

A primary risk of crypto assets we reviewed is that they mainly derive their value from investor sentiment rather than through tangible company assets or cash flows. Officials from DOL pointed out that unlike traditional stocks, investors in crypto assets typically do not own blockchain technology and generally do not have an entitlement to income streams from investment in the same way that holders of stocks have rights to dividends from an operating company. Additionally, some industry stakeholders and researchers we interviewed told us that, unlike traditional commodities, crypto assets do not have a well defined use case or a fundamental driver of value beyond supply and demand.[59] For example, while individuals value gold as jewelry and as a store of value, gold is also used for its conductive and corrosion resistant properties in other industries. If market sentiment shifts to a new crypto asset, older crypto assets could become obsolete and lose their value.

[59]We previously reported blockchain related products and services have the potential to produce cost savings and faster transactions, among other benefits, GAO-23-105346.

Another risk of crypto assets available for direct investment in 401(k) plans is their uniquely high volatility.[60] Volatility is a measure of riskiness, and high volatility means there could be large upward or downward swings in investment returns.[61] Figure 2 displays the volatility, as measured by the standard deviation of returns, for five crypto assets available for investment in 401(k) plans for the years 2021 to 2023.[62] Volatility for these crypto assets ranged from four times to 12 times greater than the volatility of the Standard and Poor's 500 (S&P 500), which tracks the performance of the 500 largest publicly traded companies in the United States.[63] Compared to individual stocks, crypto asset volatility ranged from around two to seven times greater than the volatility of Google or Apple stock.[64] Crypto asset volatility ranged from around the same to approximately three times larger than Tesla, a newer company that is also among the top equity holdings of retirement plan participants.

[60]Our analysis covers all six crypto assets available for direct investment in 401(k) plans at the time of analysis: ada, bitcoin, DOT, ether, SOL, and USD Coin. USD Coin is a stablecoin that is pegged to the U.S. dollar. USD Coin does not exhibit similar traits to other crypto assets, so we exclude USD Coin from the discussion of our findings. There were five cryptocurrencies and one stablecoin available for direct investment in 401(k) plans, according to one platform's website as of August 5, 2024.

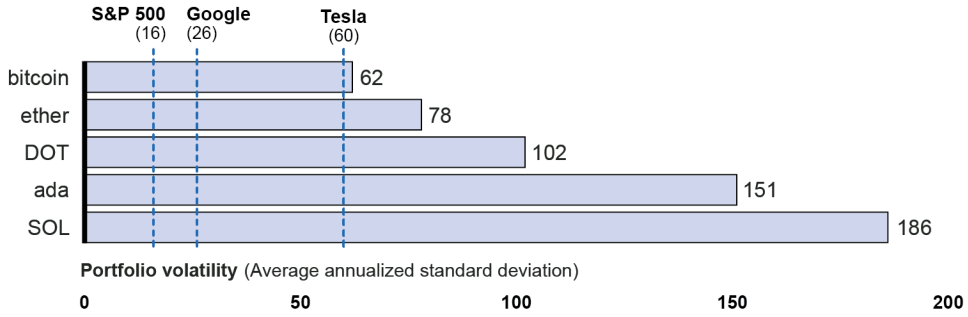
[61]Officials from SEC pointed out that the value of crypto assets can be driven by speculation, which could lead to heightened volatility.

[62]The standard deviation was calculated using monthly returns and converted to the annual level.

[63]The S&P 500 is an index and may have lower volatility than individual stocks.

[64]Apple, Google, and Tesla were among the top equity holdings of retirement plan participants who invested through the self-directed brokerage window of a prominent provider.

Figure 2: Average Annualized Standard Deviation of Crypto Asset Returns Currently Available for Investment in 401(k) Plans from 2021 to 2023



Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Standard deviation is a measure of volatility, and a higher standard deviation means more volatility in portfolio returns. Standard deviations are given as a return percentage. A portfolio with a high standard deviation means there could be large upward or downward swings in investment returns. The Standard and Poor's 500 (S&P 500) tracks the performance of the 500 largest publicly traded companies in the United States. Ada, bitcoin, DOT, ether, and SOL are crypto assets that were available for direct investment in 401(k) plans at the time of analysis.

For the crypto assets we analyzed from 2011 to 2023, volatility has generally been higher earlier in these crypto assets' lifetimes. For example, from 2021 to 2023, the three newest crypto assets experienced the highest volatility and bitcoin had the lowest volatility, as shown in figure 2. In bitcoin's early years, it had volatility even greater than that of the newer crypto assets, at 26 times greater than that of the S&P 500.[65] Bitcoin is the first-developed crypto asset with the longest history, but it still had volatility four times greater than the S&P 500 more than a decade after its inception.

Outside of crypto assets' risks, our interviews with stakeholders, including industry and academic researchers, and our quantitative analysis did not find any one group of assets as being directly comparable to crypto assets.[66] For example, nine of 17 interviewees stated crypto assets were not directly comparable to any other group of assets, while 10 interviewees listed assets that had some traits similar to crypto assets, including commodities, venture capital, and emerging markets, among others. Commodities follow a shortage cycle, venture capital funds have high volatility and the potential for high returns, and emerging market

[65]This comparison is based on annualized monthly volatility for the years 2011 to 2013 for bitcoin and the S&P 500.

[66]In addition to industry and academic researchers, we interviewed firms that develop crypto asset investment options.

investments have a significant potential to lose their value, as one interviewee described. Crypto assets are further distinguished from other assets because their treatment under existing law varies depending on their unique facts and circumstances and will differ depending on, for example, if they are offered and sold as commodities, securities, or something else.

Crypto assets' role in retirement portfolios and impact on portfolio diversification is also unclear, according to our interviews with industry stakeholders and researchers. A portfolio diversifier is an asset that is not strongly positively correlated with the other assets in a portfolio.[67] Portfolio diversification is a key risk mitigation practice in managing investment portfolios, including retirement portfolios. Portfolio diversification seeks to minimize risk while also maximizing return on the entire portfolio. Over crypto assets' brief history, their correlation with traditional financial markets (stock and bonds) has been low. However, our interviews with industry stakeholders, researchers, and firms that develop crypto asset investment options indicate that the correlations have risen over time, particularly during the COVID-19 pandemic.[68]

When compared to gold—an asset sometimes used to diversify investment portfolios—all five crypto assets we reviewed had higher correlations with the S&P 500 than gold did in most years since their inception. Correlations with traditional financial markets that are higher than those of other portfolio diversifiers potentially reduce the role of crypto assets as portfolio diversifiers. Additionally, since crypto assets present volatile returns, a higher correlation between crypto assets and traditional investments could introduce larger losses to a portfolio during market downturns.

Our analysis indicates crypto assets' high potential returns can come with considerable risks. Specifically, our historical analysis covering five crypto assets available for direct investment in 401(k) plans for the years 2011 to 2023, indicated that most of these crypto assets experienced much higher returns for most of their lifetime relative to the S&P 500, gold, Apple,

[67]Correlation describes how closely the prices of two assets move together. Positive correlation means when the price of one asset increases, the price of the other asset tends to increase. Strongly positively correlated assets in a portfolio can react the same way to market shocks and make a nondiversified portfolio vulnerable to similar risks, such as a market downturn.

[68]Industry stakeholders have noted crypto assets have experienced spikes in correlations with various assets, such as gold or technology stocks, at different points in time.

Google (Alphabet), and Amazon. However, to understand the trade-off between the risk and return of an investment in these five crypto assets, we calculated risk-adjusted returns. Risk-adjusted returns compare the return of an investment with the additional risk that investment brings.[69] Over each of these crypto assets' brief history, the risk-adjusted returns have been negative in a few years, but have been generally higher than the S&P 500.[70] Risk-adjusted returns provide a convenient way to capture both risk and return in one number, but they are not a one-size-fits-all performance measure. A participant's actual risk tolerance may be higher or lower than what is implicit in risk-adjusted return metrics.

Further, through our interviews with industry and academic researchers and firms that develop crypto asset investment options among others, we found there is no standard approach for projecting potential future returns of crypto assets as long-term investments.[71] Interviewees listed some mathematical and statistical models as potential options but cite crypto assets' short and volatile history relative to traditional assets and uncertain regulatory environment as challenges for these approaches.

Short term historical analyses have been another common approach for evaluating the potential effects of crypto assets' future investment performance on investment portfolios, according to our interviews with industry researchers and firms that develop crypto asset investment options, among others. In some of these analyses, researchers compare a portfolio's historical performance to what the portfolio's performance would have been if it had an investment in a crypto asset. However, past performance and risk cannot consistently predict future performance and risk, especially among novel assets like crypto assets. As a result, these

[69]We calculated two measures of risk-adjusted returns: Sharpe ratios and Sortino ratios. For our historical analysis, we calculated both ratios using geometric and arithmetic mean returns and found largely the same pattern. We calculated the risk-free rate for the historical analysis using the Chicago Board Options Exchange Interest Rate 10-Year Treasury Note.

[70]Negative risk-adjusted returns indicate the asset performed worse than a risk-free asset, implying crypto asset returns may not compensate for the additional risk. The risk-adjusted returns cover all full years of our analysis. The analysis years vary for each crypto asset since they have different dates of origin. For example, bitcoin price data has been available since 2010, while other crypto assets like SOL and DOT began in 2020.

[71]Our interviews with industry and academic researchers and firms that develop crypto asset investment options suggest valuing crypto assets broadly is a challenge. But, given we are interested in their potential effects on 401(k) plans, we focus on their potential effects on portfolio performance in the long run.

analyses may have limitations for evaluating the potential effect of crypto assets in the long run.

Our findings cover five crypto assets available for direct investment in 401(k) plans at the time of analysis, but there is wide variability across crypto assets in their performance, purpose, and other characteristics. For example, out of the estimated 24,000 crypto assets listed on an independent crypto asset data aggregator since 2014, more than half no longer existed in 2023.[72] In addition, our historical analysis evaluates the performance and risk of crypto assets until 2023, the latest complete year of data available at the time of our analysis. However, the crypto asset landscape is ever changing, including the collapse of certain crypto asset trading platforms, SEC's 2024 approval of the listing and trading of spot bitcoin ETPs, and ongoing litigation brought by SEC alleging certain offers and sales of crypto assets were not registered under federal securities law or made pursuant to a valid exemption, and certain crypto asset intermediaries are operating in an unregistered capacity.[73]

Bitcoin Investment in a 401(k) Plan Could Lead to Significant Variability in Investment Returns

Using a simulation technique to estimate the potential effects of adding varying amounts of bitcoin to an illustrative 401(k) portfolio, we found high portfolio allocations to bitcoin lead to lower projected risk-adjusted returns and potentially higher losses compared to little or no allocation to bitcoin.[74] The simulation enables us to describe a range of potential

[72]According to CoinGecko, which tracks over 12,000 different crypto assets across more than 900 exchanges worldwide.

[73]For the collapse of crypto asset market participants, see GAO-23-105346. There have also been indictments and/or conviction of several of crypto asset investment option founders, including FTX, Binance, and Terraform Labs. For ongoing litigation see, e.g. *Securities and Exchange Commission v. Coinbase, Inc. and Coinbase Global, Inc.*, 1:23-cv-04738 (S.D.N.Y. filed June 6, 2023); *SEC v. Binance Holdings Limited, BAM Trading Services, Inc., BAM Management US Holdings Inc., and Changpeng Zhao*, No. 1:23-cv-01599, (D.D.C. filed June 5, 2023); *SEC v. Payward Inc.,* No. 23-cv-6003 (N.D. Cal. filed Nov. 20, 2023).

[74]These estimates are for a 20-year investment for a mid-career (age 45) individual. These findings assume bitcoin return and standard deviation will be similar to its recent history in the near term, but then will phase in to those similar to gold after the twelfth simulation year. We use bitcoin for the simulation because, as the first crypto asset, it has the longest price history. Bitcoin also has a large market share relative to other crypto assets and we identified it as a crypto asset offered in 401(k) plans. See app. I and app. III for a full description of our methodology.

outcomes that can occur under different assumptions and scenarios.[75] This is particularly useful when there is a high degree of uncertainty, as is the case with bitcoin. However, simulation results rely heavily on the characteristics of the underlying assumptions.[76]

Our simulation assumptions are based on historical risk and returns as well as the potential risks and returns of bitcoin, informed by opinions from industry and academic researchers and firms that develop crypto asset investment options. We used bitcoin for the simulation because as the first crypto asset, it had the longest price history. For a risky and novel asset like bitcoin, historical risks and returns alone will not provide a complete picture of potential future risks and returns. For example, from 2011 to 2023, bitcoin annual returns ranged from -73 percent to 5,870 percent compared with -50 percent to 118 percent for Amazon.[77] Our simulation of 401(k) balances requires us to make various model assumptions, such as mean returns, volatilities, correlations, starting account balances, and cash flows into and out of the account.[78] One such assumption for the portfolio we report on is that bitcoin would have near-

[75]Monte Carlo analysis is a forward-looking simulation technique commonly used to simulate market returns. Monte Carlo simulation uses random sampling to generate a large number of possible outcomes when the potential for random variables is present. The outcomes are then analyzed to estimate the frequency of occurrence based on input assumptions. One of the key advantages of Monte Carlo simulation is that it accounts for inherent uncertainty and randomness present in the market.

[76]See app. III for sensitivity analyses of these assumptions, including specifications where bitcoin has lower return in the first 12 years of the simulation.

[77]Amazon was among the top equity holdings of retirement plan participants who invested through the self-directed brokerage window of a prominent provider.

[78]Our projections assume the median account balance for an investor's age group at the start of the analysis, annual contribution amounts equal to the average percent of the IRS maximum contribution for an investor's age group, a 4-year cycle for bitcoin returns including a high-return year, two medium-return years, and a low-return year; a baseline portfolio of a TDF; historical TDF returns that reflect the glidepath nature of TDF returns by becoming less risky over time; normally distributed returns; historical correlations between bitcoin and TDF returns; and a 2 percent fee for bitcoin and a 0.32 percent fee for the TDF. Fees for approved ETPs are lower than 2 percent. A lower fee for bitcoin would increase bitcoin's return, but it would not likely change the variability in projected median retirement savings across the different bitcoin allocations. See app. I and app. III for a full description of our methodology.

term returns and volatility similar to its recent history, but long-run returns and volatility similar to that of gold.[79]

Our primary finding, that large allocations of bitcoin lead to significant variability in risk and return, is not sensitive to changes in our assumptions. We report our findings for a mid-career participant relative to an illustrative 401(k) portfolio with no investment in bitcoin and refer to this portfolio as our baseline portfolio. For more information about the simulation assumptions and sensitivity analyses, see appendix III.

In our simulation, any allocation to bitcoin increases portfolio risk, but risk-adjusted returns can be marginally higher than the baseline portfolio for lower allocations to bitcoin. The projected volatility and maximum loss are worse with any allocation to bitcoin relative to the baseline portfolio.[80] However, even small allocations to bitcoin increase the projected median annual return, as measured by the internal rate of return of the portfolio.[81]

To aid in understanding how the added risk relates to the added return, we calculate risk-adjusted returns.[82] In our simulation, the risk-adjusted return for a mid-career participant is marginally better for low allocations to bitcoin and worse for high allocations to bitcoin relative to the baseline portfolio. That is, our simulation indicates the return gained from a small investment in bitcoin provides some compensation for the additional volatility, but this is not the case for high allocations. While small

[79]Industry and academic researchers, firms that develop crypto asset investment options, and our quantitative analysis indicated that bitcoin has followed a 4-year cycle. We model this cycle, which includes three growth years and one down year. We define long run as after 12 years out of the 20-year simulation period. This enables us to have three complete cycles where bitcoin starts from an average return and volatility based on its recent performance and then phases into the average return and volatility of gold, and two complete cycles where bitcoin has the average return and volatility of gold. Our assumptions rely on historical risk and return along with industry-informed potential risk and return, but past performance is no guarantee of future results.

[80]Volatility refers to the standard deviation. The projected maximum loss is the maximum loss from the highest point to the lowest point over the 20-year investment period. Maximum loss, also known as maximum drawdown, is a measure of downside risk, and a high maximum loss means a larger down movement.

[81]The internal rate of return is a measure of average annual return of a portfolio that takes into account the amount and timing of cash flows into or out of the portfolio. It is also known as the dollar-weighted return. Generally, investors prefer a higher internal rate of return. See app. III for more information.

[82]For measures of risk-adjusted returns, we use a variation of the Sharpe and Sortino ratios that use the internal rate of return. See app. III for more information.

allocations of bitcoin yield marginally better risk-adjusted returns, the simulation assumes the portfolio's bitcoin allocation is held, and annually rebalanced, consistently for 20 years. However, holding a volatile asset like bitcoin during downturns may be difficult for investors.[83] Additionally, as investors approach retirement, holding a large allocation of bitcoin puts them at a higher risk of losing savings without much time to recover.

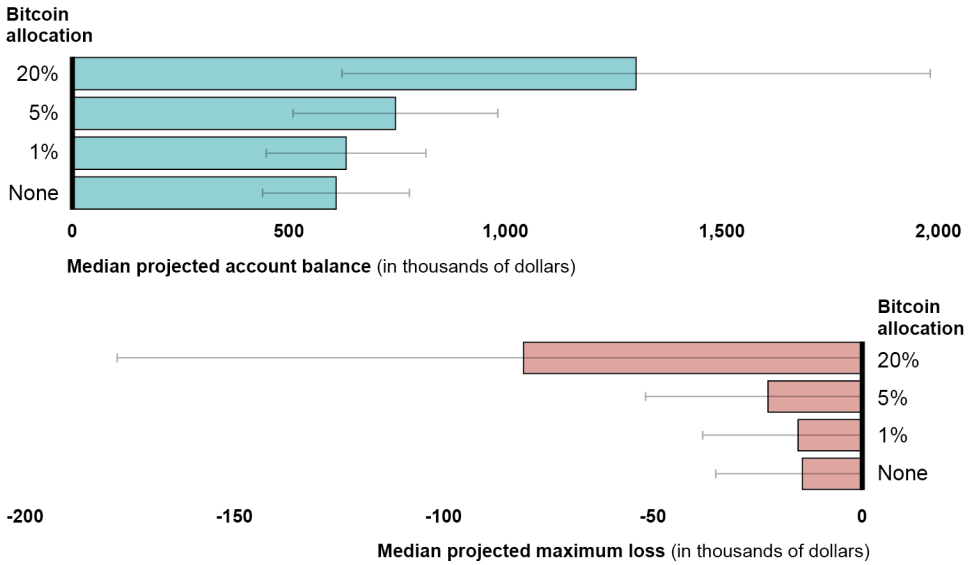
In the long term, our simulation indicates large portfolio allocations to bitcoin are associated with better median internal rates of return and account balances, but also higher risk. The simulation projects low allocations of bitcoin could lead to median account balances and internal rates of return that are marginally higher than a 401(k) portfolio without bitcoin, after 20 years.[84] Meanwhile, a portfolio with a 20 percent allocation to bitcoin could significantly increase the projected median account balance (see fig. 3) and almost doubles the median internal rate of return.[85] Additionally, higher projected median account balances for high allocations of bitcoin come with additional risks. Portfolios with a 20 percent allocation to bitcoin are projected to have maximum losses over five times as high as the baseline portfolio (see fig. 3), have volatility over twice as high as the baseline portfolio, and have risk-adjusted returns 28 percent lower than the baseline portfolio.

[83]Morningstar, "*Bad Timing Cost Investors One Fifth of Their Funds' Returns*" (2023). Accessed on March 14, 2024, https://www.morningstar.com/funds/bad-timing-cost-investors-one-fifth-their-funds-returns.

[84]We report on median account balances rather than on the average account balances because the distribution of projected account balances indicates that average account balances are being pulled up by a small subset of simulation outcomes with large projected account balances. The distribution of projected account balances shifts to the right and has a longer right tail as the bitcoin allocation increases. A distribution with a long right tail means that there are some very high values to the right of the median, which will make the average significantly higher than the median.

[85]The simulation results are based on a variety of assumptions including, but not limited to, assuming the current regulatory environment, investor sentiment, and technological advancement will maintain the status quo in the future. These findings rely partly on historical performance, but past performance is no guarantee of future results.

Figure 3: Projected Median Account Balance and Projected Median Maximum Loss of a Simulated Illustrative 401(k) Portfolio with Different Allocations to Bitcoin after 20 Years



Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Figure represents the median of 10,000 projected portfolio returns for a mid-career participant after a 20-year investment, assuming bitcoin returns have long run return and volatility similar to gold. Maximum loss, also known as maximum drawdown, is a measure of downside risk, and a high maximum loss means a larger down movement. The lines represent the standard deviations of the simulated results. Our analysis does not constitute and should not be viewed as a definitive method of evaluating the long-term effect of crypto assets.

Risks of investing in crypto assets are exacerbated without annual portfolio rebalancing, especially for large allocations to bitcoin. Rebalancing is the practice of periodically adjusting your asset allocation to maintain your target asset allocation. Rebalancing may reduce risk exposure, particularly for portfolios that include volatile assets. Our simulation assumes the portfolio is rebalanced annually.[86] To investigate the influence that annual rebalancing has on our findings, we performed a sensitivity check with no rebalancing. Not rebalancing a portfolio can lead to very large projected ending account balances compared to annual rebalancing. However, not rebalancing can reduce the median projected internal rate of return and risk-adjusted returns.

[86]Periodic rebalancing tends to keep portfolio risk in check while minimizing time spent managing the portfolio. For more information see app. III.

The risks of not rebalancing are particularly acute for large allocations to bitcoin. For example, for large allocations to bitcoin with no portfolio rebalancing, the median projected internal rate of return is almost half as high as a portfolio with annual rebalancing. Further, a portfolio without rebalancing has nearly double the projected median volatility and over triple the projected maximum loss for large allocations of bitcoin. Importantly, for most investments, rebalancing relies on investor action and is uncommon among most investors in nonmanaged accounts.[87]

Our analysis does not constitute, nor should it be viewed as, a definitive method of evaluating the long-term effect of crypto assets. The simulation should be interpreted carefully, as our approach was not designed to provide precise predictions. Our simulation is based on the historical and potential risks and returns of bitcoin and therefore does not apply to crypto assets generally. Crypto asset returns in general will be lower than crypto asset returns of surviving assets. Many elements can influence the future return of bitcoin, including but not limited to the regulatory environment, investor sentiment, and technological advancement. This analysis assumes these current market conditions will continue in the future and bitcoin is readily available for trading. We previously reported crypto assets and related products presented significant risks and challenges—including volatility, cybersecurity, and theft risk—that might limit their potential benefits to investors.[88] The simulation does not attempt to model the risk of a complete loss in bitcoin investment resulting from these potential risks. Returns would likely be lower if these risks were included in the model. Additionally, this analysis does not take into account externalities of crypto assets, such as strains to the electric grid, which could lower the social benefit of owning bitcoin.[89] See appendix III for more information regarding the analysis.

[87]Only 3 percent of nonmanaged plan participants rebalanced their accounts in 2022, according to Vanguard's *How America Saves* (2023) report.

[88]GAO-23-105346.

[89]The White House and the U.S. Energy Information Administration reported on the climate and energy implications of crypto assets. The reports found crypto assets could require considerable amounts of electricity usage, which could result in greenhouse gas emissions. The total global electricity usage for crypto assets exceeds the total annual electricity usage of many individual countries, and crypto assets were estimated to be responsible for 0.4 to 0.8 percent of total U.S. greenhouse gas emissions.

Fiduciaries Offering Crypto Assets Must Meet ERISA Requirements with Respect to 401(k) Investment Options, Providers, and Transactions

ERISA Requires Fiduciaries to Select and Monitor the Investment Options Offered in a 401(k) Plan Core Investment Lineup

When selecting 401(k) plan core investment options, ERISA requires fiduciaries to consider whether a particular investment in the plan's lineup is reasonably designed with respect to the risk of loss versus the opportunity for gain.[90] In its Compliance Assistance Release 2022-01, EBSA stated that a 401(k) fiduciary's consideration of whether to include an option for participants to invest in crypto assets remained subject to ERISA's exacting fiduciary responsibilities. EBSA officials told us the agency did not maintain separate regulatory regimes for different types of assets. Fiduciaries are responsible for overseeing the selection and monitoring of each option within the lineup, with appropriate considerations regarding, among other things, risk, potential returns, and reasonableness of fees for each option. In addition, ERISA requires fiduciaries to avoid prohibited transactions associated with assets in 401(k) plans, regardless of whether crypto assets are offered as investment options.[91]

[90]29 C.F.R. § 2550.404a-1(b)(2); see also 29 C.F.R. § 2550.404c-1(d)(2)(iv).

[91]Fiduciaries of ERISA-covered plans, including 401(k) plans, must avoid certain types of transactions (prohibited transactions) to prevent plans from dealing with parties who may be in a position to exercise influence over the plan. For instance, providers of crypto asset investment options to 401(k) plans may target their offerings to participants in plans that are sponsored by crypto asset companies. One provider we identified markets its products and services in part to companies involved in distributed ledger and similar technologies. Similarly, executives at a prominent 401(k) plan provider told us that a key factor in their decision to offer a bitcoin option stemmed from requests from crypto asset companies involved with bitcoin. These companies include bitcoin mining companies (companies that verify bitcoin transactions) and companies that invest heavily in bitcoin. The fiduciaries involved must make sure they have a process to ensure they do not engage in prohibited transactions, even inadvertently.

Also in its Compliance Assistance Release 2022-01, EBSA cautioned plan fiduciaries to exercise extreme care before adding a crypto asset option to a 401(k) plan's core investment lineup. Reasons for caution included investment volatility, custodian and recordkeeping concerns, and valuation concerns. Several of the stakeholders we interviewed told us that EBSA's caution was appropriate given that crypto assets were an emerging asset type. For instance, a lead executive of a national association of investment consultants to retirement plans said EBSA's guidance was well timed and effectively informed fiduciaries about the potential risks associated with crypto asset investment. Representatives of a plan sponsor association told us Compliance Assistance Release 2022-01 did not set a higher fiduciary responsibility threshold for crypto assets versus other investment options. They found the release appropriate and compared it to when EBSA published guidance in the past when mutual funds were being introduced as 401(k) investment options under ERISA.

The simulation we presented earlier demonstrates that investment return for crypto asset investment options may be volatile and that there can be tradeoffs between risk and return. Balancing the two may be difficult for fiduciaries, in part, because, as EBSA states in Compliance Assistance Release 2022-01, there exist many uncertainties associated with valuing crypto assets. This lack of clarity could add to the complexity of decisions fiduciaries need to make to meet ERISA requirements when offering crypto asset investment options. For example:

- Fiduciaries who add a crypto asset investment option might consider how it adheres to provisions under ERISA that allow fiduciaries to limit their liabilities if their core investment lineup meets certain conditions.[92] Officials of an organization that represents large 401(k) plans told us this could be a particular challenge for fiduciaries since they would need to justify that a single-asset investment option met these ERISA provisions.[93]
- Additionally, as we reported earlier, although crypto assets could be seen as potential portfolio diversifiers, their rising correlation with

[92]Fiduciaries can limit their liabilities under ERISA if they provide at least three different designated investment alternatives that give participants a reasonable chance of diversifying their assets and they give participants control to select among them, among other conditions. See 29 C.F.R. § 2550.404(c)-1.

[93]See 29 U.S.C. § 1104(a)(1)(B)-(C) and (c). Our analysis of crypto asset investment options available through self-directed brokerage windows revealed that many were single-asset investments.

traditional financial market assets potentially reduced their benefit as diversifiers. An attorney we interviewed said plan sponsors should educate themselves on any new asset type they wanted to add to a 401(k) lineup if they did not already have expertise on that asset type. In its Compliance Assistance Release 2022-01, EBSA stated that "it can be extraordinarily difficult, even for expert investors," to evaluate crypto assets, underscoring the need for sponsors to become educated on crypto assets, as well as the markets and intermediaries involved in trading those assets, prior to adding them to their core lineup.

- Finally, ERISA requires fiduciaries to consider the appropriateness of crypto asset trading platforms as service providers to crypto asset investment options included in 401(k) plan core investment lineups. For example, the crypto asset investment option we identified as designed solely for core investment lineups makes use of multiple crypto asset trading platforms to seek best pricing, among other things.

We have previously reported that crypto asset trading platforms have yet to realize their potential to produce cost savings and other financial benefits, and they have also negatively affected consumers and investors.[94]

We have also reported that some platforms might be susceptible to illicit trading practices.[95] Several federal government agencies, international bodies, and researchers, have expressed similar concerns about

[94]GAO-23-105346. For example, we reported that during turmoil in the crypto asset markets in May and November 2022, several prominent crypto asset trading platforms limited or froze customer withdrawals, resulting in financial harm to customers.

[95]GAO-23-105346. We also cited the Financial Action Task Force's conclusion that crypto asset trading platforms pose an emerging terrorist finance vulnerability because they are accessible from anywhere and it is often difficult for enforcement agencies to identify the beneficiary. See GAO, *Financial Technology: Additional Steps by Regulators Could Better Protect Consumers and Aid Regulatory Oversight*, GAO-18-254 (Washington, D.C.: Mar. 22, 2018). We have also provided examples of how crypto assets are used to pay off cyber threat actors targeting critical infrastructure with ransomware. See GAO, *Critical Infrastructure Protection: National Cybersecurity Strategy Needs to Address Information Sharing Performance Measures and Methods*, GAO-23-105468 (Washington, D.C.: Sept. 26, 2023); and GAO, *Ransomware: Federal Agencies Provide Useful Assistance but Can Improve Collaboration*, GAO-22-104767 (Washington, D.C.: Sept. 14, 2022).

vulnerabilities associated with the trading of crypto assets.[96] In June, 2023, SEC filed an enforcement action against a platform that acts as a service provider to crypto asset investment options we identified for,

[96]For example, in March 2023, SEC staff issued an Investor Alert cautioning that the commingling of broker-dealer, exchange, and custodial functions by crypto asset trading platforms could create conflicts of interest and risks for investors. In the alert, SEC staff warned that using crypto asset trading platforms that are not registered with SEC as national securities exchanges could leave investors without protections from rules that protect against illicit trading practices, such as wash sales—also known as wash trading—and front running. Wash trading is the simultaneous or near-simultaneous purchase and sale of assets without an actual change in beneficial ownership, thereby artificially creating the appearance of trading volume in an asset. Front running is the trading of a financial asset by someone who has knowledge of a future transaction to exploit the price movement from that transaction. According to the Investor Alert, none of the major crypto asset entities are registered with SEC as a broker-dealer, exchange, or investment adviser—so investors may not get the protections afforded by the rules applicable to these entities. See SEC, Office of Investor Education and Advocacy, *Exercise Caution with Crypto Asset Securities: Investor Alert* (Washington, D.C.: Mar. 23, 2023). The Investor Alert represents the views of the staff of the Office of Investor Education and Advocacy. It is not a rule, regulation, or a statement of the Commission.

Also see: U.S. Department of Treasury, *Crypto Assets: Implications for Consumers, Investors, and Businesses* (Washington, D.C.: Sept. 2022); U.S. Department of Treasury, Financial Crimes Enforcement Network, *Financial Trend Analysis: Ransomware Trends in Bank Secrecy Act Data Between January 2021 and June* 2021 (Vienna, VA: 2021); Financial Stability Board, *The Financial Stability Implications of Multifunction Crypto-Asset Intermediaries* (Basel, Switzerland: Nov. 28, 2023); Financial Industry Regulatory Authority, *FINRA Provides Update on Targeted Exam: Crypto Asset Communications* (Washington, D.C.: Jan. 2024); *Crypto Wash Trading*, Cong, Lin William et al, National Bureau of Economic Research Working Paper No. 30783 (Cambridge, MA: Dec. 2022); U.S. Securities and Exchange Commission, *Digital Asset and "Crypto" Investment Scams – Investor Alert* (Washington, D.C.: Sept. 1, 2021).

among other alleged activity, carrying out the functions of a broker, exchange, and clearing agency without registering each with SEC.[97]

ERISA Requires Fiduciaries to Select and Monitor Providers Who Offer Investment Options outside of 401(k) Plan Core Investment Lineups

Unlike for investment options within a core lineup where fiduciaries are required to select and monitor the options, for investment options outside a core lineup, plans select service providers to make investment options available to participants, through investment arrangements such as self-directed brokerage windows. ERISA requires fiduciaries to prudently select and monitor 401(k) plan providers, including those who provide services associated with self-directed brokerage windows or similar plan arrangements, before selecting a provider (see fig. 4).[98] Many of the crypto asset investment options we identified are offered on at least one of two prominent self-directed brokerage window platforms available to 401(k) plans.[99] In addition, as with options offered within a plan's core

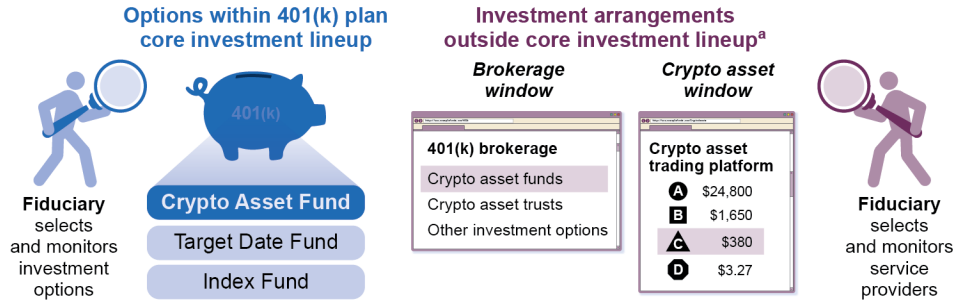
[97]See *SEC v. Coinbase, Inc. and Coinbase Global, Inc.*, 1:23-cv-04738 (S.D.N.Y., filed June 6, 2023). See also *SEC v. Payward Ventures, Inc.*, No. 23-cv-6003 (N.D. Cal., filed Nov. 20, 2023); *SEC v. Coinbase*, 2024 WL 1304037 (S.D.N.Y. Mar. 27, 2024) (denying, in part, Coinbase's motion to dismiss because SEC's complaint plausibly supports the claim that Coinbase operated as an unregistered intermediary of securities). The SEC Chair has stated he believes that the commingling of exchange, broker-dealer, custodial, and other services within crypto-asset intermediaries creates conflicts of interest and risks for investors that SEC does not allow in other marketplaces. See, for example, Gensler, Gary, Chair, Securities and Exchange Commission, "We've Seen This Story Before," Remarks before the Piper Sandler Global Exchange & Fintech Conference (June 8, 2023). In addition to those cases listed, SEC has charged other crypto-asset trading platforms (and, in certain cases, particular individuals associated therewith), alleging that they were operating as an unregistered national securities exchange, broker, dealer, and/or clearing agency. See, for example, *SEC v. Binance Holdings Limited, BAM Trading Services, Inc., BAM Management US Holdings Inc., and Changpeng Zhao*, No. 1:23-cv-01599, (D.D.C. filed June 5, 2023) (alleging that Binance and BAM Trading, under Zhao's leadership and control, have offered three essential securities market functions—exchange, broker-dealer, and clearing agency—on the Binance Platforms without registering with the SEC). This claim survived defendant's motion to dismiss because at least one token and certain investment programs were plausibly alleged by SEC to be offered as investment contracts, according to the court (while other counts were dismissed, including allegations that certain programs, tokens, and stablecoins were offered and sold as unregistered securities. *SEC v. Binance Holdings Limited, BAM Trading Services, Inc., BAM Management US Holdings Inc., and Changpeng Zhao*, No. 1:23-cv-01599, (D.D.C. June 28, 2024).

[98]See 29 C.F.R. § 2550.404a-5(f); see also U.S. Department of Labor, Employee Benefits Security Administration, *Field Assistance Bulletin No. 2012-02R: Fee Disclosure Guidance* (Washington, D.C.: Jul. 30, 2012).

[99]As of October 2024, we identified 69 crypto asset investment options available to 401(k) plans. This included direct investment in six crypto assets, including one stablecoin. It also included 62 ETPs, funds, and trusts that could be offered through a self-directed brokerage window. Only one option we identified was available solely for use in a 401(k) plan core investment lineup.

investment lineup, fiduciaries must avoid prohibited transactions with respect to service providers when offering when offering self-directed brokerage windows or similar plan arrangements.

Figure 4: Fiduciary Responsibilities under ERISA for 401(k) Investment Options within and outside a Core Investment Lineup



Source: GAO analysis of the Employee Retirement Income Security Act of 1974 (ERISA), industry documents, and media reports. | GAO-25-106161

Note: Target Date Funds allocate assets over time based on participants' targeted retirement dates. Index funds are passive funds that seek to replicate the performance of a market index instead of outperform it. Self-directed brokerage windows, referred to by a variety of names, including brokerage accounts and brokerage windows, are arrangements under which 401(k) participants may select investments beyond those designated by plan fiduciaries. Crypto assets are generally private-sector digital instruments that depend primarily on encryption and distributed ledger or similar technology to conduct and record transfers of value without a central authority, such as a bank. Crypto asset trading platforms facilitate transactions and allow users to trade one crypto asset for another, or for fiat currency (government-issued legal tender such as the U.S. dollar). Trusts are entities that create a fiduciary relationship between grantors, who generally own the assets initially contributed to the trust, and investors, who are entitled to receive benefits from the trust, such as investment returns.

[a]Service providers described self-directed brokerage windows and crypto asset windows as offering investment arrangements apart from 401(k) plans' core investment lineups. However, officials from the Department of Labor's Employee Benefits Security Administration told GAO that fiduciaries were responsible for deciding whether features such as self-directed brokerage windows and crypto asset windows, or any of the crypto asset investment options they offer, should be included in their plans' core investment lineups.

In 2010, EBSA issued regulations that required the disclosure of certain plan and investment-related information, including fee and expense information, to participants and beneficiaries in 401(k) plans, including those that offer self-directed brokerage windows.[100] The final rule reiterated that nothing in the regulation would relieve a fiduciary of its responsibilities to prudently select and monitor providers of services to the plan or designated investment alternatives offered under the plan. In 2012, EBSA published a bulletin that stated fiduciaries of plans with self-directed brokerage windows or similar plan arrangements that enabled

[100]Fiduciary Requirements for Disclosure in Participant-Directed Individual Account Plans, 75 Fed. Reg. 64,910 (Oct. 20, 2010).

participants and beneficiaries to select investment beyond those designated by the plan were still bound by ERISA statutory duties of prudence and loyalty to participants. These include taking into account the nature and quality of services provided in connection with the window or arrangement.[101] In 2021, EBSA issued a publication outlining the steps fiduciaries should take to monitor service providers, including reviewing performance, policies, and practices. This 2021 publication further stated that fiduciaries should also check the fees being charged to participants and follow up on participant complaints.[102]

EBSA officials told us that, unlike requirements for core investment lineups, EBSA generally had not required fiduciaries to evaluate each investment option available to participants through self-directed brokerage windows. However, in Compliance Assistance Release 2022-01, EBSA cautioned that plan fiduciaries allowing investments through brokerage windows "should expect to be questioned about how they can square their actions with their duties of prudence and loyalty in light of the risks," described in the compliance assistance release. Some stakeholders we interviewed told us EBSA's guidance had been interpreted by some fiduciaries as a warning that EBSA had changed fiduciary requirements under ERISA with respect to arrangements for investing outside core 401(k) investment lineups. Industry stakeholders and associations representing service providers sent letters to EBSA expressing concerns that Compliance Assistance Release 2022-01 could potentially change fiduciary responsibilities. However, a 2023 court decision subsequently noted that the release left responsibilities under ERISA unchanged.[103]

EBSA cautioned fiduciaries to consider the extent to which crypto asset providers might be operating outside of existing regulatory frameworks or

[101]U.S. Department of Labor, Employee Benefits Security Administration, Field Assistance Bulletin No. 2012-02R (Washington, D.C.: July 30, 2012), Q&A 39.

[102]U.S. Department of Labor, Employee Benefits Security Administration, *Meeting Your Fiduciary Responsibilities* (Washington, D.C.: Sept. 2021).

[103]In 2022, a 401(k) plan provider that offered participants crypto assets through brokerage windows sued DOL alleging the compliance assistance release was arbitrary and capricious, and injurious to its business. The U.S. District Court for the District of Columbia dismissed the lawsuit, holding that the provider did not have standing in the case and Compliance Assistance Release 2022-01 was not subject to judicial review. Regarding fiduciary responsibilities under ERISA, the court noted, "the Release does not purport to change the status quo [and] it leaves the existing law in place." *ForUsAll, Inc. v. Dep't. of Labor*, 691 F. Supp. 3d 14, 30 (D.D.C. Aug. 29, 2023).

not complying with such frameworks. It cited concerns raised by the Financial Industry Regulatory Authority (FINRA) that crypto assets had "been used in illegal activity, including drug dealing, money laundering, and other forms of illegal commerce."[104] Agency officials and stakeholders we interviewed noted that regulation was evolving and that participants needed to use caution if they invested outside of a 401(k) plan's core investment lineup without the fiduciary protections afforded to core lineup options. In these instances, participants could bear losses if nefarious activity negatively affects their assets.

Further, if fiduciaries typically do not evaluate each option offered through a brokerage window, participants assume greater risk for such options. For example, while fiduciaries must monitor the fees charged by a self-directed brokerage window provider (e.g., a maintenance fee or trading fees), they may not necessarily evaluate the fees charged by asset managers of investment options offered though brokerage windows.[105] As noted earlier, fees for crypto asset investment options vary widely, ranging from 0.19 to 2.50 percent annually. Also, as presented earlier, participants will need to distinguish between different types of investment options, some of which involve features that can cause price distortions. In 2024, FINRA published results of a targeted exam of crypto asset investment option disclosures. Its review of disclosures revealed instances of false and misleading statements or claims regarding crypto assets including unclear explanations of how they work and their core features and risks to participants.[106]

[104]Financial Industry Regulatory Authority, "Bitcoin Basics." Accessed May 28, 2024, https://www.finra.org/investors/insights/bitcoin-basics. FINRA is overseen by SEC. Among other things, it writes and enforces rules governing the ethical activities of registered broker-dealer firms and registered brokers in the United States.

[105]In informational guidance to fiduciaries, one provider of self-directed brokerage windows stated that plan fiduciaries would likely have no obligation to monitor the investments offered through a window. However, the provider cautioned fiduciaries that if they monitor performance and investment data for their plans' self-directed brokerage windows, they could subject themselves to claims that the investments offered through these windows have been designated as part of the plans' core investment lineups. The guidance concludes that, for this reason, plan fiduciaries may want to avoid specific reviews of performance and investment data concerning options available through a self-directed brokerage window.

[106]Financial Industry Regulatory Authority, *FINRA Provides Update on Targeted Exam: Crypto Asset Communications*, (Washington, D.C.: Jan. 2024).

Data Availability and Regulatory Uncertainty Have Limited Federal Oversight of Crypto Asset Investment Options in 401(k) Plans

EBSA Lacks Data to Identify Crypto Asset Investments in 401(k) Plans and Assess Their Effects on Participant Savings

EBSA does not collect comprehensive data that would enable the agency to easily identify 401(k) plans that may offer participants access to crypto assets. Officials told us that they periodically analyzed Form 5500 filings to find plans that had crypto asset exposure. Specifically, officials told us they searched filings of larger 401(k) plans' financial information on Form 5500 Schedule H and its attached schedule of assets for certain names of investments related to crypto assets.[107] However, as previously mentioned, there are limitations to using these filings to identify plans that invest in crypto assets. For instance, according to EBSA officials, 401(k) plans that file schedule H are not required to identify investments in assets made through self-directed brokerage windows.[108]

Furthermore, in 2014, we found limitations with the Form 5500 Series that made it difficult to gain insights into plan investments, their structure, and their level of associated risk.[109] Appendix II provides additional detail on these limitations. Our prior report recommended DOL consider revisions to the Form 5500 Series that would provide more transparency and detail

[107]Plans with 100 or more participants that meet certain requirements file Schedule H, Financial Information. The schedule requires these larger plans to report, among other things, plan assets (i.e. participant savings), by asset type. The attached schedule of assets generally requires plans to list investments.

[108]Additionally, according to EBSA officials, 401(k) plans with fewer than 100 employees are not required to identify investments on Form 5500-SF, or if filing Form 5500, on Schedule I, Financial Information—Small Plan. However, EBSA officials noted that if such small plans file audit reports, these audit reports would yield greater detail on plan assets.

[109]GAO-14-441.

into plan investments, among other things.[110] DOL has taken steps to improve Form 5500 Series reporting, but the recommendation has not been fully implemented.[111] DOL has yet to address these deficiencies, for example by revising Schedule H plan asset categories to better match current investment vehicles or creating a standard, searchable format for schedules of assets attached to filings.

DOL's Spring 2024 semi-annual regulatory agenda includes an effort to modernize reporting requirements on the Form 5500 Series and make investment information more data minable to meet the needs of changing compliance projects, programs, and activities. This effort could address the limitations we identified in previous work.[112] As part of this effort, EBSA officials noted that they were considering previous proposals to improve the form, public comments received as part of those proposals, and other potential improvements.[113] DOL officials noted that as of May 2024, a draft notice of forms revision was under development, but a final decision had not been made on what financial transparency and data usability elements would be included. This means the rulemaking process could result in updates to the Form 5500 Series that could address limitations we have identified, such as exploring whether crypto asset investment options should be included in a list of investments that must be reported separately on attachments to Schedule H even if made

[110]We also recommended that DOL revise Schedule H plan asset categories to better match current investment vehicles and provide more transparency into plan investments and create a standard, searchable format for schedules of assets attached to Form 5500 filings.

[111]For example, most recently in 2023, DOL issued a final rule and form revisions to address consolidated Form 5500 Series reporting by certain defined contribution plan groups and reporting by multiple-employer plans (including pooled employer plans), among other things. The final rule and forms revisions are intended to improve reporting of certain plan financial information regarding audits and plan expenses and enhance the reporting of certain tax qualification and other compliance information by retirement plans. While a separate Form 5500 Series project is on DOL's semi-annual regulatory agenda that includes consideration of broader improvements to the form's reporting requirements, DOL has not reached a final decision on what financial transparency data and usability elements will be included in the broader improvement project.

[112]GAO-14-441.

[113]According to officials, DOL will consider previous financial transparency proposals to the Form 5500 from 2016 and 2021. See *Annual Reporting and Disclosure*, 81 Fed. Reg. 47,496 (Jul. 21, 2016) and *Revision of Annual Information Return/Reports*, 86 Fed. Reg. 73,976 (Dec. 29, 2021).

through self-directed brokerage windows.[114] Officials also indicated that EBSA had been focusing its regulatory resources on the multiple regulatory, guidance, and report projects it was assigned under the SECURE 2.0 Act of 2022.[115]

The emergence of a new asset category—crypto assets—has further emphasized the need to improve the Form 5500 Series. We maintain that DOL should implement our recommendation from 2014 that would, among other things, align asset classes on the Form 5500 with the way 401(k) plans invest and so provide regulators and researchers expanded detail on 401(k) plan investment.

Limitations in Form 5500 Series data complicate, but do not preclude, EBSA's investigative efforts. For example, we previously reported that attachments to Schedule H containing data on investments in plans with 100 or more participants were not captured in a searchable format. EBSA officials told us that to address this limitation, they worked with a research firm to obtain a version of data accompanying schedule H that the research firm had reformatted to make searchable. EBSA has incorporated investigative efforts concerning plans that offer crypto asset investment options into its oversight plans in the following ways:

- Crypto assets were included in an ongoing national enforcement project that aims to promote prudent and loyal processes for investment selection, monitoring, and valuation.[116] Under this project, officials said they expected regional offices to examine plan sponsors' rationale for including crypto asset investment options in plans and structuring the investments in a way that meets ERISA's prudence and loyalty standards. None of the regional office plans for fiscal year 2024 that we reviewed identified crypto assets as a priority for the year.

[114]Plans that file Schedule H and its attachments must break out and report separately loans, employer securities, and certain other investments made through self-directed brokerage windows or similar plan arrangements.

[115]The SECURE 2.0 Act of 2022 was signed into law as part of the Consolidated Appropriations Act, 2023. Pub. L. No. 117-328, div. T, 136 Stat. 4459, 5275-404 (2022). It includes, among other things, requirements for DOL to review ERISA reporting and disclosure requirements. Additional agency responsibilities under the act include conducting studies, submitting reports to Congress, establishing a database for "lost" retirement savings, issuing multiple regulations, and providing other formal guidance.

[116]To set priorities, EBSA identifies national enforcement projects each fiscal year that receive special investigative emphasis from its regional offices.

- EBSA noted that it intended to investigate and examine crypto asset investments in 401(k) plans as an emerging issue over the coming years. In particular, EBSA has observed an increase in the marketing of crypto asset investments toward ERISA-covered plans and participants. As noted in a 2022 compliance assistance release, EBSA expects to conduct an investigative program aimed at plans that offer participant investments in cryptocurrencies and related products.[117]

EBSA has conducted few investigations of 401(k) plans with crypto asset exposure. As of December 2023, officials said that they had initiated around 11 investigations into plans that had investments in crypto assets that, for most of the plan investigations, totaled less than $100,000. Officials noted that EBSA's crypto asset investigative efforts primarily covered investments made through plans' core investment lineups, as opposed to arrangements such as a self-directed brokerage window. However, EBSA has found instances in which crypto assets were introduced into a plan through a window as well as through a core investment lineup. For example, EBSA officials told us they had two investigations into plans that offered a crypto asset window. As mentioned previously, EBSA officials told us that, regardless of how a 401(k) plan feature or investment option may be marketed, fiduciaries were responsible for determining—solely in the interest of participants and in adherence with requirements under ERISA—whether to adopt a feature or option as part of their investment lineup or an investment arrangement apart from the lineup. Based on their investigations, officials observed that overall plan exposure to these investments had been minimal. They also noted that, in at least one case, participants had sold their position by the time EBSA contacted the plan sponsor to discuss these investments.

[117]Compliance Assistance Release 2022-01

Continued Uncertainty about Whether Certain Crypto Assets Are Securities and How They Should Be Federally Regulated Could Impact 401(k) Participants

Crypto Assets' Uncertain Status as Securities

SEC has jurisdiction over activities involving securities, including crypto assets that are offered and sold as securities as defined in the federal securities laws as well as certain market participants involved with such crypto assets. However, uncertainty remains as to whether federal securities laws apply to the offer and sale of certain crypto assets, a determination made on the facts and circumstances relevant to each crypto asset. If a crypto asset is offered and sold as a security, then it falls within SEC's jurisdiction.[118]

If a crypto asset is offered and sold as a security under federal securities laws, its offer and sale must be registered with SEC, or exempt from registration, before the offer and sale can be conducted in interstate commerce.[119] Furthermore, market participants involved with these crypto asset securities—including broker-dealers, investment companies, certain investment advisers, clearing agencies, and securities exchanges—must also register with SEC, unless an exception or exemption applies.

[118]As discussed previously, the definition of security includes financial instruments such as stock and bonds as well as investment contracts, among others. The *Howey* Test and subsequent case law is used to determine if an asset, including a crypto asset, has been offered and sold as an investment contract and therefore is a security under federal securities laws. SEC staff have also issued a framework for analyzing whether a digital asset is offered and sold as an investment contract and whether offers or sales of a digital asset are securities transactions. See SEC, Strategic Hub for Innovation and Financial Technology, *Framework for "Investment Contract" Analysis of Digital Assets* (Washington, D.C.: Apr. 3, 2019). This framework represents the views of SEC staff in the Strategic Hub for Innovation and Financial Technology. It is not an SEC rule, regulation, or statement, and SEC neither approved nor disapproved its content.

[119]As of June 2023, SEC staff identified nine firms that either registered their crypto asset tokens or coins as a class of securities or registered the offer and sale of their crypto asset tokens under the federal securities laws or qualified an offering statement pursuant to an exemption from registration. GAO, *Financial Technology: SEC Should Prepare a Workforce Plan, Document Oversight Controls, and Set Goals for Innovation Office*, GAO-24-106635 (Washington, D.C.: Dec. 15, 2023).

Registration with SEC requires issuers and national securities exchanges, among other registered entities, to adhere to requirements intended to protect investors and promote market integrity. For example, a platform that offers trading of crypto asset securities and meets the federal definition of an exchange is expected to register with SEC as a national securities exchange (or operate pursuant to an exemption) and follow rules to prevent fraud, deception, or manipulation of trading on the exchange.[120]

SEC has initiated enforcement actions against crypto asset market participants to address alleged lack of compliance with registration and other requirements. As of October 2024, SEC had initiated over 160 enforcement actions related to crypto assets, including those against crypto asset trading platforms allegedly functioning as unregistered national securities exchanges.[121] While a number of courts have agreed with SEC that certain offers and sales of crypto assets in question constituted, or may constitute, the offer and sale of securities as investment contracts under the *Howey* test, courts have not been uniform in their interpretations. In one recent case, the court ruled that the offer and sale of the crypto asset in question constituted an unregistered offer and sale of a security under the federal securities laws when sold to

[120]An exchange means any organization, association, or group of persons, whether incorporated or unincorporated, that constitutes, maintains, or provides a marketplace or facilities for bringing together purchasers and sellers of securities or for otherwise performing with respect to securities the functions commonly performed by a stock exchange as that term is generally understood, and includes the marketplace and the market facilities maintained by such exchange. 15 U.S.C. §§ 78c(a)(1). SEC defined certain terms used in the statutory definition of "exchange" in Exchange Act Rule 3b-16. Rule 3b-16 provides a functional test to assess whether an organization, association, or group of persons meets the definition of exchange. SEC regulations at 17 C.F.R. § 240.3b-16 provides a functional test to assess whether an organization, association, or group of persons meets the definition of exchange. An organization, association, or group of persons that meets the definition of exchange must register with SEC as a national securities exchange or operate pursuant to an exemption from such registration. 15 U.S.C. § 78f. One of those exemptions is for Alternative Trading Systems (ATS). To meet this exemption, an organization, association, or group of persons must comply with Regulation ATS, which requires, among other things, meeting the definition of an alternative trading system and registering as a broker-dealer. 17 C.F.R. § 240.3a1-1(a)(2), 17.C.F.R. § 242.300 – 242.304. In 2022, SEC proposed to, among other things, amend Rule 3b-16. When reopening the comment period for its proposed rules amending the rule defining certain terms used in the statutory definition of exchange, SEC stated the estimated total number of new rule 3b-16(a) systems that trade crypto asset securities would be 15–20. See *Supplemental Information and Reopening of Comment Period for Amendments Regarding the Definition of "Exchange"*, 88 Fed. Reg. 29448, 29465 (May 5, 2023).

[121]See https://www.sec.gov/securities-topics/crypto-assets.

institutional investors in private transactions, but in contrast, did not constitute the offer and sale of a security when sold through the secondary markets or other distributions (e.g., sold to investors on public crypto asset trading platforms).[122] Another court in the same district held that the offer and sale of the crypto assets in question may constitute the offer and sale of securities irrespective of whether they are sold directly to institutional investors or on the secondary market. As a result, the court denied a motion to dismiss SEC's complaint, maintaining that SEC adequately made a case that the assets were offered and sold as securities, and later granted summary judgement to SEC as to these claims.[123]

Impact on Plans with Investments in Unregistered Securities

According to EBSA, the exact issues that any individual 401(k) plan would face if SEC or a court determined that a crypto asset available as part of a 401(k) plan was offered and sold in an unregistered security offering would depend on facts and circumstances. For instance, officials told us that in some plans, all participants may be accredited investors. According to SEC officials, this may allow them to invest in unregistered securities if the offering meets the conditions of an applicable exemption. In other cases, EBSA officials said plan fiduciaries might need to work with their attorneys, monitor regulatory activity, and take any steps necessary to safeguard plan assets if they determined participants had invested in unregistered securities offerings. Fiduciaries may ultimately have to decide whether to participate in settlements or lawsuits on behalf of participants. Before engaging in such actions, fiduciaries would need to weigh the costs to the plan against the likelihood and amounts of potential recoveries.

SEC's Division of Examinations' fiscal year 2024 examination priorities report noted that a possible area for examination included broker-dealers and investment advisers that offer, sell, or recommend crypto assets,

[122]S*EC v. Ripple Labs Inc.,* 682 F. Supp. 3d 308 (S.D.N.Y. 2023). See also *SEC v. Binance Holdings Limited, BAM Trading Services, Inc., BAM Management US Holdings Inc., and Changpeng Zhao*, No. 1:23-cv-01599, (D.D.C. June 28, 2024)(partially granting defendant's motion to dismiss certain SEC claims relating to secondary sales of BNB tokens, offers and sales of BUSD stablecoins, and offers and sales made in connection with the Simple Earn token lending program, finding that the secondary offers and sales of BNB, by sellers other than Binance, did not constitute investment contracts under *Howey* and accordingly, were not transactions involving securities under federal securities law).

[123]S*EC v. Terraform Labs Pte. Ltd. and Do Hyeong Kwon,* 684 F. Supp. 3d 170 (S.D.N.Y. 2023), 708 F. Supp. 3d 450 (S.D.N.Y. 2023).

particularly to retail investors (including older investors) if the investments involve retirement assets.[124]

Federal Regulatory Gaps in Oversight of Crypto Assets

As noted above, if a crypto asset is offered and sold as a security under federal securities laws, SEC will have regulatory and enforcement authority over the transactions and entities or participants involved therein, consistent with those laws. However, in the case of spot markets for nonsecurity crypto assets, we have previously reported a federal regulatory gap in oversight.[125] As a result, spot markets for nonsecurity crypto assets are not comprehensively subject to rules, requirements, and practices intended to protect investors and promote market integrity.

Our prior report recommended that Congress consider legislation that (1) designates a federal regulator to provide comprehensive oversight of these spot markets and (2) provides consistent and comprehensive oversight of stablecoin arrangements.[126] Stakeholders we spoke to also cited regulatory uncertainty—such as whether certain crypto assets were offered and sold as unregistered securities—as a key factor when deciding whether to offer crypto asset investment options in 401(k) plans.

Legislation introduced in the 118th Congress has aimed to close these regulatory gaps by bringing certainty to the treatment and regulation of crypto assets and stablecoin arrangements.[127] In addition, members of Congress introduced other crypto asset–related legislation in the 118th Congress. For example, one bill seeks to address issues such as the comingling of customer funds with institutional funds by crypto asset trading platforms.[128] Another bill pertains to disclosures in crypto asset

[124]See https://www.sec.gov/files/2024-exam-priorities.pdf. This statement represents the view of the staff of the SEC's Division of Examinations. It is not a rule, regulation, or statement of SEC. SEC has neither approved nor disapproved its content. This statement, like all staff statements, has no legal force or effect. It does not alter or amend applicable law, and it creates no new or additional obligations for any person.

[125]GAO-23-105346. Participants in these markets are generally subject to registration and oversight by the Financial Crimes Enforcement Network for Bank Secrecy Act and related anti–money laundering regulations.

[126]GAO-23-105346. As mentioned above, at least one provider offering crypto asset investment options in its 401(k) plans includes a stablecoin as one available crypto asset.

[127]See Financial Innovation and Technology for the 21st Century Act, H.R. 4763, 118th Cong. (2023); Lummis-Gillibrand Responsible Financial Innovation Act, S. 2281, 118th Cong. (2023); Clarity for Payment Stablecoins Act of 2023, H.R. 4766, 118th Cong. (2023); and Lummis-Gillibrand Payment Stablecoin Act, S. 4155, 118th Cong. (2024).

[128]PROOF Act, S. 3087, 118th Cong. (2023).

advertisements to consumers.[129] However, none of these bills had become law as of October 30, 2024.

The complex federal regulatory regime for certain types of crypto assets, along with a lack of comprehensive oversight over spot markets for nonsecurity crypto assets, adds to the challenges 401(k) participants may have to navigate in allocating their long-term retirement savings. We have reported that a shift in the nation's system of employer-sponsored pensions from defined benefit to DC plans has increased participant control, but it also increased risks and responsibilities workers face in planning and managing their retirement.[130] As we stated earlier, to invest in crypto assets, participants may have to take primary responsibility for selecting and monitoring investment options if they use arrangements outside their 401(k) plans' core investment lineups. Participants using self-directed brokerage windows and similar plan arrangements cannot assume their plan fiduciaries have taken the steps ERISA requires for options on the core investment lineup. In addition to these potential complications, uncertainty around crypto assets may make it difficult for participants to understand investor protections that may or may not be in place and evaluate risks associated with investments in crypto assets.

Agency Comments

We provided a draft of this report to the Department of Labor, Securities and Exchange Commission, and Commodity Futures Trading Commission for their review and comment. The agencies provided technical comments, which we incorporated as appropriate.

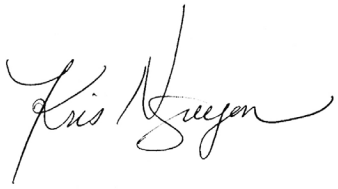
As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 28 days from the report date. At that time, we will send copies to the appropriate congressional committees, the Secretary of Labor, the Chair of the Securities and Exchange Commission, the Chair of the Commodity Futures Trading Commission, and other interested parties. In addition, the report will be available at no charge on the GAO website at http://www.gao.gov.

[129]Responsible Digital Advertising Act of 2023, S. 1357, 118th Cong. (2023).

[130]GAO, *The Nation's Retirement System: A Comprehensive Re-evaluation Is Needed to Better Promote Retirement Security*, GAO-18-111SP (Washington, D.C.: Oct. 18, 2017). We said Congress should consider establishing an independent commission to examine and recommend improvements to the U.S. retirement system. The Senate introduced legislation that would establish a commission, but no additional action has been taken.

If you or your staff have any questions about this report, please contact us at (202) 512-7215 or nguyentt@gao.gov, or at (202) 512-8678 or clementsm@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix IV.

Sincerely,



Tranchau (Kris) T. Nguyen
Director, Education, Workforce, and Income Security

Michael E. Clements
Director, Financial Markets and Community Investment

Appendix I: Objectives, Scope, and Methodology

This report examines (1) the presence of crypto asset investment options in 401(k) plans, (2) the potential effects of crypto asset investment options on 401(k) participant savings, (3) how fiduciaries meet their responsibilities under the Employee Retirement Income Security Act of 1974 (ERISA), and (4) the extent to which crypto asset investment options in 401(k) plans are overseen by federal regulators.

To answer all our objectives, we conducted 28 interviews with a range of stakeholders to get a variety of perspectives on crypto asset investment options in 401(k) plans:

- We interviewed officials from the Department of Labor's (DOL) Employee Benefits Security Administration (EBSA) about their guidance, oversight, and investigations of 401(k) plans with respect to crypto asset investment options. We interviewed officials from the U.S. Securities Exchange Commission (SEC) and the Commodity Futures Trading Commission (CFTC) about (1) their oversight of securities markets (such as those for stocks and bonds) and derivatives markets (such as those for futures contracts), respectively, and (2) their guidance and enforcement actions with respect to crypto assets.
- To obtain input from a breadth of 401(k) plan fiduciaries, participants, and providers, we interviewed associations that represent: plan sponsors, who initiate 401(k) plans and may serve as the fiduciary named in 401(k) plan documents; other fiduciaries to plans, such as Chief Investment Officers; participants, along with other individual investors and consumers; and an array of service providers to 401(k) plans.[1]
- Similarly, to obtain perspectives from an array of crypto asset companies, we interviewed two associations that represent companies in the crypto asset sector. For technical insights, we interviewed one academic and two industry researchers who have published research or reports on crypto assets as an investment option, or on valuing alternative assets and other retirement investments.

[1]Service providers represented by the associations we interviewed included: record keepers that maintain platforms for offering investment options to 401(k) participants and documenting their transactions; investment consultants that recommend investment options to plan fiduciaries; and asset managers that offer investment options to 401(k) participants and other investors.

- Lastly, we interviewed 401(k) service providers with varying positions on crypto assets, including record keepers and asset managers that both do and do not offer access to crypto asset investment options. We also interviewed: attorneys to 401(k) plans from two firms recognized in industry lists of law firms that focus on employee benefits and ERISA; investment consultants with experience advising on portfolios that include an allocation to crypto assets; two providers of self-directed brokerage windows to 401(k) and other retirement plans; and officers from two crypto asset trading platforms that place and execute orders to trade crypto assets, and serve as custodian for these crypto assets, on behalf of 401(k) participants.

To examine the availability of crypto asset investment options in 401(k) plans, we evaluated data from EBSA's publicly available Form 5500 Series, the predominant source of information on 401(k) plan investments. To assess the reliability of Form 5500 Series data, we reviewed relevant documentation describing tests and checks EBSA performs on counts of participants, plans, and assets. We also obtained written responses from EBSA officials about the data and analyzed selected filings for 2022. We identified limitations that prevented us from systematically measuring the use of crypto asset investment options in 401(k) plans, and that EBSA officials told us complicate their investigations of 401(k) plans for crypto assets. We report these limitations in appendix II. Despite these limitations, we concluded Form 5500 Series data were sufficiently reliable for reporting on the size of the 401(k) market as measured by counts of plans, participants, and assets, and for providing context on the limited presence of crypto assets, relative to other types of assets held in 401(k) plans.

In addition to Form 5500 Series data, we reviewed private and proprietary sources of data but concluded they would not add substantively to our review. For example, we searched for data on 401(k) plan investment in subscription data services and databases maintained by research firms, but concluded they either did not have the data we needed or derived these data in part from Form 5500 Series filings. We also met with a representative of an analytics firm that researches retirement markets but determined these data would not substantially add to our review, given the nascent presence of crypto assets in 401(k) plans.

To supplement limited Form 5500 Series data on 401(k) plan use of crypto asset investment options, we obtained data from key 401(k) service providers through two efforts. First, we partnered with an industry association to survey 28 record keepers to 401(k) and other retirement

plans. We fielded the survey from July to September 2023 and received responses from 13 record keepers that reported serving about 55 percent of all 401(k) plans, 52 percent of all 401(k) participants, and 65 percent of all 401(k) assets, based on totals EBSA reported for 2022.[2] We cannot generalize findings from this survey to all record keepers or to the 401(k) market. Second, we obtained data on the availability and use by 401(k) participants, as of February 2024, of crypto asset investment options we identified from two providers of self-directed brokerage windows, described in testimony to an advisory council to EBSA as prominent service providers to 401(k) and other retirement plans. To identify crypto asset investment options, we reviewed asset managers' marketing materials and filings with SEC. We also reviewed a list of crypto asset investment options EBSA officials developed. Finally, we reviewed relevant industry and media reports.

To examine the potential effects of crypto asset investment options on 401(k) participant savings, we analyzed projected returns from hypothetical 401(k) investment portfolios, assuming varying allocations to a crypto asset. Our quantitative analysis includes a historical analysis and a forward-looking Monte Carlo simulation. The historical analysis uses monthly pricing data from Yahoo! Finance and Investing.com.[3] Our historical analysis reports the annualized return, standard deviation, and geometric and arithmetic Sharpe and Sortino ratios for ada, bitcoin, DOT, ether, and SOL.[4] We also performed a Monte Carlo simulation to provide an illustrative example of the potential effects of adding various allocations of bitcoin to a standard 401(k) portfolio consisting of a target date fund (TDF).[5] Our simulation projects measures of performance and

[2]See U.S. Department of Labor, Employee Benefits Security Administration, *Private Pension Plan Bulletin, Abstract of 2022 Form 5500 Annual Reports, Data Extracted on 7/8/2024*, Version 1.0 (Sept. 2024).

[3]Yahoo! Finance data were downloaded on April 17, 2024. Investing.com data were downloaded on April 16, 2024, and April 26, 2024, for gold and bitcoin respectively.

[4]We use bitcoin data from Investing.com because the earliest available bitcoin pricing on Yahoo! Finance was 2014, but bitcoin pricing data became available in 2010. We analyzed the six crypto assets available for direct investment in 401(k) plans at the time of analysis: ada, bitcoin, DOT, ether, SOL, and USD Coin. USD Coin is a stablecoin that is pegged to the U.S. dollar. USD Coin does not exhibit similar traits to other crypto assets, so we exclude USD Coin from the discussion of our findings.

[5]In addition to interviews with industry and academic researchers, our quantitative analysis was informed by a literature review of statistical methods used to evaluate investment returns for crypto assets and other investment options in the long run. The literature review identified 24 research papers, 11 of which provided insight to current research in the space.

risk, including median projected account balances and median projected maximum losses.

To determine the reliability of these data, we reviewed related documentation and tested for missing values, outliers, and errors. We assessed the reliability of all the data we used during this review and determined they were sufficiently reliable for the purposes of reporting performance and risk measures and using some of these measures as inputs for the simulation.

Our Monte Carlo simulation uses bitcoin and a target date fund as inputs for our illustrative portfolio. We used bitcoin for the simulation because as the first crypto asset, it had the longest price history. It also has a large market share relative to other crypto assets. Further, we identified bitcoin as a crypto asset offered in 401(k) plans. Bitcoin data cover the years 2010 to 2022, the last full year at the time of the analysis. We selected three vintages of a TDF as our comparison portfolio because TDFs are commonly used for retirement investment. The TDFs used are Vanguard's Target Retirement Funds for the target years 2020, 2030, and 2045. As a sensitivity test for our TDF selection, we also constructed a hypothetical TDF using capital market assumptions for U.S. equities and U.S. bonds from Morningstar and BlackRock. The TDFs and bitcoin returns are net of fees.

We made several decisions regarding bitcoin for the Monte Carlo simulation. First, we allowed the maximum bitcoin allocation to be 20 percent because it was the maximum allocation offered for 401(k) plans at the time of analysis. Second, we imposed that bitcoin returns were cyclic. Through interviews with stakeholders and our quantitative analysis, we found bitcoin follows a 4-year cycle, with 3 growth years and 1 down year. The growth years include 1 very strong positive return (hot) year and 2 positive return (warm) years. One strongly negative (cold) year follows these growth years. We modeled this cycle and included sensitivity checks of our simulation if the cycle were to change or stop. Third, the simulation uses bitcoin returns from the most recent cycle (2019–2022) to define our starting return and standard deviation for the hot, warm, and cold periods.[6] Lastly, for our primary specification, we allowed bitcoin's return and standard deviation to trend toward that of

[6]Given the changing crypto asset landscape, we used the most recent bitcoin cycle because it was the most mature cycle and would be the most representative. Bitcoin data are from investing.com.

gold in the long run (after 12 years).[7] We based this assumption from interviews with seven industry stakeholders, including two researchers, who compared bitcoin to gold because they were both commodities. Given the uncertainty in bitcoin's long run return, we included two additional specifications for the future risk and return of bitcoin.[8]

We simulated the risk and return of a portfolio with various allocations to bitcoin for early-career (age 30), mid-career (age 45), and late-career participants (age 60). To define the average annual return and standard deviation of the baseline TDF portfolio for early-, mid-, and late-career participants, we evaluated TDFs with different target dates for calendar years 2015–2019. We use TDF returns prior to the COVID-19 pandemic to avoid potentially biasing our results with the unique market conditions of the pandemic. We linearly reduced the average return and standard deviation as the participant aged to the next career stage to reflect the glidepath nature of TDFs.

For each career stage we made assumptions about the starting account balance, annual contribution, length of time invested, and the correlation of the TDF with bitcoin. The account balance starting points are informed by median account balances by age group reported by Vanguard.[9] For annual contributions, we assumed participants at each career stage contributed a percent of the IRS maximum contribution that corresponds to the average amount contributed for their age group.[10] For the length of time invested, we simulated the mid-career and late-career participants until retirement, for 20 years and 5 years, respectively. Given concerns about using limited historical data to simulate bitcoin beyond 20 years, we

[7]For the purposes of this analysis, we considered the beginning of round four (simulation year 13) to be the long run. That is, at year 13 in our simulation, we imposed a geometric average return of 10 percent annual return, similar to that of gold for the years 2003–2023. We also reduced the annual standard deviation to be similar to that of gold.

[8]For one scenario, we imposed bitcoin's return would be the geometric mean of zero after simulation year 12 and set bitcoin's standard deviation to that of the 2019–2022 bitcoin cycle. For the second scenario, we allowed bitcoin to maintain its return and standard deviation from the most recent bitcoin cycle (2019–2022).

[9]Vanguard, *How America Saves* (2022).

[10]Calculated using the Internal Revenue Service's maximum deferral limit and Statistics of Income Individual Information Return Form W-2 Statistics, 2008–2018. Our simulation does not consider employer contributions or catch-up contributions, nor does it allow for leakage through early withdrawals or loans. Individuals would have larger contributions if we accounted for employer contributions. To illustrate how larger contribution amounts could affect our findings, we performed a sensitivity analysis where we doubled the annual contribution amount, see app. III for more detail.

simulated the early-career participant for 20 years (approximately 15 years before retirement). For the correlation between bitcoin and the TDF, we applied the correlation coefficient of the annual returns of each TDF (target dates 2020, 2030, and 2045) and bitcoin for the years 2015–2019.

In addition to the sensitivity tests mentioned above regarding the risk and return assumptions for bitcoin and the TDF, we tested the sensitivity of our findings to our assumptions for the sequence of bitcoin returns, the distribution of returns, the rebalancing strategy, and the frequency of simulation (monthly returns instead of annual returns). Our finding—that high portfolio allocations to bitcoin could lead to significant variability in risk and return—was not sensitive to these tests.

While we designed our simulation approach and underlying assumptions to account for the inherent uncertainties associated with bitcoin and data limitations, we could not eliminate the possibility that the actual impact of bitcoin on retirement savings could be outside the range of our estimates. Our findings represent one reasonable approach to estimating the potential impact of investments in bitcoin on retirement savings, but there is no standard approach to modeling this new asset, and other researchers may take different approaches and produce a different range of potential outcomes. We discuss the potential effects of each of our assumptions on the findings in the sensitivity tests in appendix III.

To determine the extent of federal oversight over crypto asset investment options in 401(k) plans, we reviewed EBSA, SEC, and CFTC guidance, EBSA enforcement priorities, applicable laws and regulations, and federal regulators' actions pertaining to crypto asset–related persons and entities. We reviewed our previous reports on EBSA enforcement efforts and federal oversight of blockchain technology in finance.[11] We also reviewed proposed legislation introduced in the 118th Congress (from January 2023 through October 2024) related to regulatory oversight responsibilities for crypto assets and stablecoin arrangements, among other relevant proposed legislation related to crypto assets. We reviewed select court cases pertaining to crypto assets and their treatment under federal securities laws. Lastly, we reviewed 2023 SEC press releases and associated enforcement actions related to cases in which SEC alleged that certain crypto asset trading platforms were operating as unregistered

[11]GAO-24-105667 and GAO-23-105346.

exchanges, unregistered brokers, unregistered dealers, unregistered clearing agencies, or some combination of these.

Appendix II: Limitations in Form 5500 Data

In prior reports and in this review, we identified limitations in the Department of Labor's (DOL) Form 5500 Series data that prevented us, in this review, from systematically measuring the presence of crypto asset investment options in 401(k) plans, as discussed in objective 1. Officials from DOL's Employee Benefits Security Administration (EBSA) confirmed that these limitations also complicated their investigations of crypto asset investment options in 401(k) plans, as discussed in objective 4. For example, table 3 illustrates that Form 5500 filings only provide data on investments of 401(k) plans with 100 or more participants. Even among this subset of larger 401(k) plans, Form 5500 filings capture only limited data on plan assets, either by type or by investment.

Table 3: Limitations in U.S. Department of Labor (DOL) Form 5500 Series Filings

Issues identified in 2014[a]	**Effects on Form 5500 Series data**
Lack of detail on the types of assets in plans with less than 100 participants. *Schedule I (Financial Information—Small Plan) generally does not require plans to identify participant investments by type or asset class.*[b]	DOL's Employee Benefits Security Administration (EBSA) lacks critical data to spot risky investments in most 401(k) plans. *In 2014 and 2022, approximately 88 percent of 401(k) plans had fewer than 100 participants.*[c]
Incomplete detail on asset types in plans with 100 or more participants. *Schedule H (Financial Information) asset classes are outdated and do not align with the way 401(k) plans invest, causing over-reliance on a broad "Other" category.*	EBSA faces challenges in accurately assessing the level of risk in plans that account for most 401(k) participants and assets. According to EBSA officials, fiduciaries for these plans would be expected to group investments in crypto assets together with asset classes that are generally considered to be less risky, such as municipal securities. *In 2014 and 2022, plans with 100 or more participants accounted for more than 85 percent of all 401(k) participants and assets.*
Schedule of assets for plans with 100 or more participants not standardized or searchable.	EBSA worked with outside researchers to access larger plans' schedules of assets in a searchable format. *EBSA officials told us that, given limitations with Schedule H, they used larger plans' schedules of assets to identify crypto asset investment options.*
Issue identified in this review	**Effects on 5500 data**
Limited detail on investments through self-directed brokerage windows on schedules of assets attached to Schedule H. *Form 5500 filing instructions generally allow plans to report assets through self-directed brokerage windows in the aggregate, as one investment.*[d]	EBSA is generally unable to identify crypto asset investment options by name unless fiduciaries include them in their 401(k) plans' core investment lineups. *Only one of the 69 crypto asset investment options we identified was available solely for 401(k) plan core investment lineups.*

Source: DOL and prior GAO reporting. | GAO-25-106161

Note: Form 5500 refers to the Form 5500, Annual Return/Report of Employee Benefit Plan. Form 5500-SF refers to Form 5500-SF, Short Form Annual Return/Report of Small Employee Benefit Plan. Form 5500 Series refers to the series of forms, schedules and attachments jointly developed by DOL, the Internal Revenue Service, and the Pension Benefit Guaranty Corporation for employee benefit plans to satisfy annual reporting requirements under Title I and Title IV of the Employee Retirement Income Security Act.

[a]GAO, *Private Pensions: Targeted Revisions Could Improve Usefulness of Form 5500 Information*, GAO-14-441, (Washington, D.C.: June 5, 2014).

[b]EBSA officials said most plans with fewer than 100 participants file Form 5500-SF. This filing does not require detail on plan investments. Officials said EBSA required some small plans to file a Form 5500 instead of a Form 5500-SF, but these plan plans file Schedule I instead of Schedule H. Schedule I does require plans to report separately the value of participant investment in the following asset types: partnership or joint venture interests, employer real property, real estate (other than employer real property), employer securities, participant loans, loans (other than to participants), and tangible personal property.

[c]For 2014 data, see U.S. Department of Labor, Employee Benefits Security Administration, *Private Pension Plan Bulletin, Abstract of 2014 Form 5500 Annual Reports, Data Extracted on 6/30/2016*, Version 1.0 (Sept. 2016). For 2022 data, see U.S. Department of Labor, Employee Benefits Security Administration, *Private Pension Plan Bulletin, Abstract of 2022 Form 5500 Annual Reports, Data Extracted on 7/8/2024*, Version 1.0 (Sept. 2024). These were the most recent and complete data available as of October 2024.

[d]Filing instructions require plans to report certain investments separately, including loans, partnership or joint venture interests, real property, employer securities, or investments that could result in a loss exceeding the value of the participant's account balance.

The appearance of crypto assets as a new asset type exacerbates a limitation in Form 5500 reporting on plan assets by type that we previously recommended DOL address.[1] We previously reported that the categories used to aggregate plan assets by type on Schedule H, Financial Information—filed by plans with 100 or more participants—do not align with current plan investments. One result is an expansive "Other" asset category that may obscure the presence of riskier investments in plans by combining them with lower-risk investments. EBSA officials told us that because Schedule H lacks a separate field for crypto assets, plans likely include crypto asset investment options in the Other category when filling out Schedule H.

In our current review we identified an additional limitation in Form 5500 data that is specific to the reporting of investments outside 401(k) plans' core investment lineups. EBSA generally allows administrators of plans with 100 or more participants to report these investments as a single total on Schedule H and the accompanying schedule of assets, with certain exceptions cited in a note to table 3 above. As a result, we could not use Form 5500 filings to compile a comprehensive list of crypto asset investment options in which participants invest, or of the amount of any such investments.

As reflected on the Spring 2024 semi-annual regulatory agenda, EBSA plans to undertake regulatory action intended to improve Form 5500

[1]GAO-14-441.

data.[2] EBSA officials told us they will consider improvements EBSA proposed in 2016 and 2021 as well as public comments on them and potential improvements to the earlier proposals.[3] EBSA officials told us they have yet to determine which proposed improvements will be included in their pending regulatory action.

[2]U.S. Department of Labor, Employee Benefits Security Administration, *Improvement of the Form 5500 Series and Implementing Related Regulations Under the Employee Retirement Income Security Act of 1974 (ERISA)*, Regulation Identifier Number 1210-AC01 (Washington, D.C.: 2024).

[3]See 81 Fed. Reg. 47,496 (July 21, 2016); 86 Fed. Reg. 51,488 (Sept. 15, 2021).

Appendix III: Monte Carlo Simulation

Monte Carlo Simulation Assumptions

The Monte Carlo simulation required us to make a variety of assumptions about the future risks and returns of bitcoin, the target date fund (TDF) portfolio, starting account balances and annual contributions, and portfolio fees, among others.[1] Additionally, our analysis replaces investments in a TDF with an investment in bitcoin. In practice, an investor may add bitcoin to a more risky or less risky asset than a TDF. Table 4 describes the assumptions for early, mid, and late career participants that were static across all years of the simulation. We provided sensitivity checks of the TDF risk and return assumptions, bitcoin sequence of returns, rebalancing strategy, and the probability distribution of returns.

Table 4: Bitcoin and Target Date Fund Static Simulation Assumptions

Assumption	Early career (Age 30)	Mid career (Age 45)	Late career (Age 60)	Source
Starting account balance	$14,000	$62,000	$90,000	Median account balances derived from Vanguard's *How America Saves* (2022).
Bitcoin sequence of returns	Warm-Warm-Hot-Cold	Warm-Warm-Hot-Cold	Warm-Warm-Hot-Cold	Bitcoin's historical pattern of returns. Hot refers to highly positive return and cold refers to low return.
Risk-free return assumption	1.86%	1.86%	1.86%	Market Yield on U.S. Treasury Securities at a 10-Year Constant Maturity from the Federal Reserve Economic Data.
Target year of target date fund	2045	2030	2020	Vanguard target retirement funds years 2015–2019 from Yahoo! Finance.
Rebalancing strategy for the bitcoin/target date fund mix	Annual	Annual	Annual	Target date funds (TDF) are automatically rebalanced periodically.
Probability distribution of returns	Normal distribution	Normal distribution	Normal distribution	One interview and our own analysis suggest that in more recent years bitcoin returns have been normally distributed.
Annual fees	2% bitcoin 0.32% TDF	2% bitcoin 0.32% TDF	2% bitcoin 0.32% TDF	According to Morningstar, the average year-end asset-weighted expense ratio for a TDF in 2022 was 0.32 percent. According to interviews and review of industry documentation, the annual fee for bitcoin at the time of analysis was around 2 percent, excluding trading.
Length of time invested	20	20	5	Based on time until retirement (age 65) or a maximum of 20 years, given data limitations.

Source: GAO analysis of Investing.com data, Yahoo! Finance data, and interviews and industry documentation. | GAO-25-106161

Note: Table displays the Monte Carlo simulation assumptions that are constant across all years of the simulation. The target year of the target date fund is the through date. TDFs that use a *through*

[1]The Monte Carlo analysis follows a random walk and the next sample is not dependent on the existing sample.

retirement glide path have an investment mix that shifts up to and past the target date. TDFs that use a *to* retirement glide path have an investment mix that shifts until it reaches the target date and does not shift past that date.

We made additional assumptions that vary across a participant's career stage and simulation years, including future bitcoin and TDF return and standard deviation, correlations, and contribution amount. It should be noted that our assumptions and findings were partly a result of bitcoin's short history at the time of analysis. The appropriateness of our assumptions may differ in the future as bitcoin continues to mature. We provided sensitivity tests of the contribution amount and the future risks and returns of bitcoin. Table 5 presents the TDF, bitcoin, and correlation assumptions for early, mid, and late career participants for each year of the simulation. The shaded values of return and standard deviation were derived from the data, while the other values were linearly interpolated or extrapolated to model the glidepath nature of a TDF.

Table 5: Return, Standard Deviation, and Correlation Assumptions for a Target Date Fund and Bitcoin by Career Stage and Simulation Year

	Target date fund return, standard deviation, and correlation with bitcoin assumptions												Bitcoin return and standard deviation assumptions	
	Early-career participant				Mid-career participant				Late-career participant					
Simulation year	Age	R	SD	Corr.	Age	R	SD	Corr.	Age	R	SD	Corr.	R	SD
1	30	9.2%	10.7%	0.56	45	7.9%	8.9%	0.54	60	6.6%	8.4%	0.48	77%	79%
2	31	9.1%	10.6%	0.56	46	7.8%	8.9%	0.54	61	6.5%	8.3%	0.48	77%	79%
3	32	9.0%	10.5%	0.56	47	7.7%	8.8%	0.54	62	6.4%	8.1%	0.48	302%	80%
4	33	8.9%	10.3%	0.56	48	7.6%	8.8%	0.54	63	6.2%	8.0%	0.48	-64%	53%
5	34	8.8%	10.2%	0.56	49	7.6%	8.8%	0.54	64	6.1%	7.8%	0.48	55%	58%
6	35	8.7%	10.1%	0.56	50	7.5%	8.7%	0.54	65	6.0%	7.7%	0.48	55%	58%
7	36	8.7%	10.0%	0.56	51	7.4%	8.7%	0.54					227%	69%
8	37	8.6%	9.9%	0.56	52	7.3%	8.7%	0.54					-53%	42%
9	38	8.5%	9.7%	0.56	53	7.2%	8.6%	0.54					33%	37%
10	39	8.4%	9.6%	0.56	54	7.1%	8.6%	0.54					33%	37%
11	40	8.3%	9.5%	0.56	55	7.0%	8.6%	0.54					152%	58%
12	41	8.2%	9.4%	0.56	56	7.0%	8.5%	0.54					-42%	31%
13	42	8.1%	9.3%	0.56	57	6.9%	8.5%	0.54					10%	16%
14	43	8.0%	9.1%	0.56	58	6.8%	8.5%	0.54					10%	16%
15	44	8.0%	9.0%	0.56	59	6.7%	8.4%	0.54					76%	47%
16	45	7.9%	8.9%	0.54	60	6.6%	8.4%	0.48					-31%	20%

Simulation year	Target date fund return, standard deviation, and correlation with bitcoin assumptions												Bitcoin return and standard deviation assumptions	
	Early-career participant				Mid-career participant				Late-career participant					
	Age	R	SD	Corr.	Age	R	SD	Corr.	Age	R	SD	Corr.	R	SD
17	46	7.8%	8.9%	0.54	61	6.5%	8.3%	0.48					10%	16%
18	47	7.7%	8.8%	0.54	62	6.4%	8.1%	0.48					10%	16%
19	48	7.6%	8.8%	0.54	63	6.2%	8.0%	0.48					76%	47%
20	49	7.5%	8.8%	0.54	64	6.1%	7.9%	0.48					-31%	20%

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Table displays return (R) and standard deviation (SD) assumptions of the target date fund (TDF) and bitcoin for each year of the simulation for early-, mid-, and late-career participants. Returns and standard deviations are given as percents. For the target date funds, shaded values represent return and standard deviations derived from the data; the other values were linearly interpolated or extrapolated. For bitcoin, the assumptions are divided into a series of 4-year cycles. The first cycle is based on bitcoin performance over the period 2019–2022. The fourth and fifth cycles are based on long-term historical averages for gold, but retaining the 4-year cycle associated with bitcoin. In cycles four and five, the geometric mean of the return assumption is set to equal to the long-term return on gold. The second and third cycles phase in from the first to the fourth. Interviews with industry and academic researchers and firms that develop crypto asset investment options suggested that bitcoin might behave like gold in the long term; alternative long-term assumptions for bitcoin are discussed in the sensitivity section. The table also reports the correlation (corr.) assumption between the relevant target date fund and bitcoin, derived from data for the years 2015–2019.

Table 6 displays the annual contribution amount for each career stage and the simulation year. The contribution amount was derived from the average percent contributed for a particular age group, according to the Internal Revenue Service.[2] We assumed the maximum deferral limit would increase by 500 dollars each year.[3]

Table 6: Annual Contribution Amounts for Each Simulation Year by Participant Career Stage

Simulation year	Early-career participant				Mid-career participant				Late-career participant			
	Age	Percent	IRS Max	Contrib.	Age	Percent	IRS Max	Contrib.	Age	Percent	IRS Max	Contrib.
1	30	19%	$22500	$4275	45	35%	$22500	$7875	60	42%	$22500	$9450
2	31	19%	$23000	$4370	46	35%	$23000	$8050	61	42%	$23000	$9660
3	32	19%	$23500	$4465	47	35%	$23500	$8225	62	42%	$23500	$9870
4	33	19%	$24000	$4560	48	35%	$24000	$8400	63	42%	$24000	$10080
5	34	19%	$24500	$4655	49	35%	$24500	$8575	64	42%	$24500	$10290

[2]Calculated using the Internal Revenue Service's maximum deferral limit and Statistics of Income Individual Information Return Form W-2 Statistics, 2008–2018.

[3]The maximum contribution increased by an average of 500 dollars for the years 2012–2022, the most recent period available at the time of analysis.

Simulation year	Early-career participant				Mid-career participant				Late-career participant			
	Age	Percent	IRS Max	Contrib.	Age	Percent	IRS Max	Contrib.	Age	Percent	IRS Max	Contrib.
6	35	29%	$25000	$7250	50	35%	$25000	$8750	65	41%	$25000	$10250
7	36	29%	$25500	$7395	51	35%	$25500	$8925				
8	37	29%	$26000	$7540	52	35%	$26000	$9100				
9	38	29%	$26500	$7685	53	35%	$26500	$9275				
10	39	29%	$27000	$7830	54	35%	$27000	$9450				
11	40	29%	$27500	$7975	55	41%	$27500	$11275				
12	41	29%	$28000	$8120	56	41%	$28000	$11480				
13	42	29%	$28500	$8265	57	41%	$28500	$11685				
14	43	29%	$29000	$8410	58	41%	$29000	$11890				
15	44	29%	$29500	$8555	59	41%	$29500	$12095				
16	45	35%	$30000	$10500	60	42%	$30000	$12600				
17	46	35%	$30500	$10675	61	42%	$30500	$12810				
18	47	35%	$31000	$10850	62	42%	$31000	$13020				
19	48	35%	$31500	$11025	63	42%	$31500	$13230				
20	49	35%	$32000	$11200	64	42%	$32000	$13440				

Source: GAO analysis of Internal Revenue Service data. | GAO-25-106161

Note: Table displays the annual contribution amounts (contrib.) for each year of the simulation by participant career stage. The contribution was calculated using the Internal Revenue Service's maximum deferral limit (IRS max) and Statistics of Income Individual Information Return Form W-2 Statistics, 2008–2018.

Monte Carlo Simulation Results

The Monte Carlo simulation highlights the variation in investment returns and risk depending on the portfolio allocation to bitcoin. Table 7 presents the median projected Sharpe and Sortino ratios, maximum loss (maximum drawdown), internal rate of return (IRR), and ending account balance, by career stage and bitcoin allocation. Across all career stages, the portfolio with a 20 percent allocation to bitcoin had a projected median maximum loss at least three times greater than that of the baseline (TDF) portfolio. The projected median internal rate of return and ending account balances were also higher than the baseline portfolio for the highest allocation of bitcoin for each career stage.

However, for the early-career and mid-career participants, the risk-adjusted returns given by the Sharpe and Sortino ratios, were lower for the highest allocation to bitcoin relative to the baseline portfolio. This suggests that for some investors, the additional risk may not be worth the

additional return.[4] For low allocations (1 percent and 5 percent) to bitcoin, the risk-adjusted returns were marginally better than the baseline portfolio. For the late-career participant, the Sharpe and Sortino ratios were higher for a 20 percent allocation to bitcoin than lower allocations; this was driven by our assumption that bitcoin would experience high returns in the first four simulation years and outcomes for the late-career participant are only simulated for 5 years. However, the Sharpe and Sortino ratios may not be the most relevant metric for a late-career investor as these investors may be more risk averse than the average investor. Additionally, adding a large allocation of a volatile asset to a 401(k) plan puts investors close to retirement at a higher risk of losing savings without much time to recover.

Table 7: Median of Projected Estimates from Monte Carlo Simulation for Early-, Mid-, and Late-Career Participants

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
Early-Career Participant					
Baseline	0.46	4.02	3.03%	8.06%	$380,247
	(0.20)	(925.49)	(4.61)	(2.33)	(103,695)
1% bitcoin	0.47	4.20	3.19%	8.34%	$392,448
	(0.20)	(193.07)	(4.69)	(2.37)	(109,213)
5% bitcoin	0.46	3.85	4.81%	9.33%	$438,830
	(0.18)	(1673.14)	(5.26)	(2.51)	(133,327)
20% bitcoin	0.37	2.21	15.41%	12.69%	$650,366
	(0.13)	(31.25)	(9.27)	(3.41)	(314,393)
Mid-Career Participant					
Baseline	0.49	2.53	4.99%	6.61%	$609,029
	(0.24)	(792.92)	(4.64)	(2.02)	(170,720)
1% bitcoin	0.50	2.58	5.04%	6.89%	$631,839
	(0.24)	(1793.85)	(4.74)	(2.08)	(185,601)
5% bitcoin	0.52	2.73	6.43%	8.14%	$746,682

[4]The Sharpe ratio takes into account the standard deviation of returns: it reflects both upward and downward deviation from the mean. The Sortino ratio only takes into account the downside deviation from the risk-free rate. The Sortino ratio will be lower than the Sharpe ratio if there is a large downside deviation or if the returns are negatively skewed. We calculated the Sharpe and Sortino ratios using the internal rate of return to reflect the impact of cash flows (contributions into the account) on overall portfolio performance. The risk-free rate was calculated from the Market Yield on U.S. Treasury Securities at a 10-Year Constant Maturity from the Federal Reserve. Some Sortino ratios have large standard deviations relative to the median, meaning there was wide variation across the 10,000 projections of the Sortino ratio.

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
	(0.21)	(629.83)	(5.16)	(2.19)	(238,418)
20% bitcoin	0.40	1.81	17.60%	12.14%	$1,301,687
	(0.14)	(4.64)	(9.15)	(3.11)	(680,740)
Late-Career Participant					
Baseline	0.49	1.40	0.00%	6.15%	$198,113
	(0.56)	(474.82)	(2.51)	(3.51)	(31,962)
1% bitcoin	0.56	1.74	0.00%	6.93%	$205,178
	(0.54)	(88.07)	(2.54)	(3.60)	(33,893)
5% bitcoin	0.64	2.70	0.00%	9.74%	$232,940
	(0.49)	(261.77)	(3.71)	(4.21)	(44,601)
20% bitcoin	0.55	2.52	8.10%	18.80%	$347,877
	(0.33)	(109.94)	(10.79)	(7.65)	(121,552)

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Notes: Median projected estimates from 10,000 projected portfolio returns for the Sharpe ratio, Sortino ratio, maximum loss from peak to trough (max drawdown), internal rate of return (IRR), and ending account balance. The simulation assumed bitcoin returns will have a long-term geometric mean similar to those of gold, and average standard deviations similar to those of gold, after the twelfth simulation year. For bitcoin, the assumptions are divided into a series of 4-year cycles. The first cycle is based on bitcoin performance over the period 2019–2022. The fourth and fifth cycles are based on long-term historical averages for gold but retaining the 4-year cycle associated with bitcoin. In cycles four and five, the geometric mean of the return assumption is set to equal to the long-term return on gold. The second and third cycles phase in from the first to the fourth. Interviews with industry and academic researchers and firms that develop crypto asset investment options suggested that bitcoin might behave like gold in the long term; alternative long-term assumptions for bitcoin are discussed in the sensitivity section. Sharpe and Sortino ratios were calculated using the internal rate of return. The Sortino ratios have large standard deviations relative to the median. Maximum drawdown and returns are given as percents. Standard deviations are in parentheses.

Monte Carlo Simulation Sensitivity Analyses

We implemented several robustness checks to test the sensitivity of our results to our Monte Carlo simulation assumptions. Overall, we found that while the projected estimates vary across the different sensitivity checks, our summary metrics generally qualitatively aligned with our primary specification and did not meaningfully change the primary finding that large allocations to bitcoin lead to significant variability in risk and return. Two specifications differ from the primary specification in their risk-adjusted returns: rebalancing and data frequency. Across all sensitivity checks, the impact of changing the assumptions tended to be greater for larger allocations of bitcoin (20 percent). We discuss the impacts of changing each assumption below.

Forward-Looking Capital Market Assumptions for the TDF Portfolio

As an alternative to TDF assumptions based on Vanguard TDF fund performance, we used published forward-looking capital market assumptions from Blackrock and Morningstar to derive long-run return

and standard deviation assumptions for stocks and bonds and the correlation between the two.[5] We assumed the early-career participant's (age 30) initial portfolio allocation was 80 percent stocks and 20 percent bonds, the mid-career participant's (age 45) initial portfolio allocation was 60 percent stocks and 40 percent bonds, and the late-career participant's (age 60) initial portfolio allocation was 30 percent stocks and 70 percent bonds. At the time of retirement (age 65), we assumed the portfolio's asset allocation would be 20 percent stocks and 80 percent bonds. We used the capital market assumptions to calculate assumed returns and standard deviations for a TDF portfolio consisting of these different proportions of stocks and bonds. For the mid-career participant, the return assumptions for each age are reported in table 8, the shaded values were calculated, and the other values were linearly interpolated or extrapolated.

Table 8: Average Return and Standard Deviation of the Target Date Fund Portfolio Derived from Capital Market Assumptions from Morningstar and Blackrock for a Mid-Career Participant

Simulation Year	Participant Age	Return	SD
1	45	5.7%	10.6%
2	46	5.6%	10.3%
3	47	5.6%	10.1%
4	48	5.5%	9.8%
5	49	5.4%	9.5%
6	50	5.4%	9.3%
7	51	5.3%	9.0%
8	52	5.2%	8.7%
9	53	5.1%	8.4%
10	54	5.1%	8.2%
11	55	5.0%	7.9%
12	56	4.9%	7.6%
13	57	4.9%	7.4%
14	58	4.8%	7.1%
15	59	4.7%	6.8%

[5]We used an average of the Blackrock and Morningstar return and standard deviation assumptions. The correlation between stocks and bonds was also informed by documentation from JP Morgan Chase and Co., AGR Capital Management, and Investopedia. We used correlation assumptions of negative 20 percent and positive 20 percent and used the average of the resulting TDF portfolio returns and standard deviations.

Simulation Year	Participant Age	Return	SD
16	60	4.7%	6.5%
17	61	4.6%	6.3%
18	62	4.6%	6.1%
19	63	4.5%	6.0%
20	64	4.5%	5.8%

Source: GAO analysis of Morningstar, Blackrock, JP Morgan Chase and Co., AGR Capital Management, and Investopedia documentation. | GAO-25-106161

Note: Table displays return and standard deviation (SD) assumptions for each year of the simulation for mid-career participants. Returns and standard deviations are given as percents. Shaded values represent calculated return and standard deviations. The other values were linearly interpolated or extrapolated.

Using the capital market assumptions for the TDF return and standard deviation, we simulated returns and risks of a portfolio with varying allocations of bitcoin; our primary findings were not affected by this alternative set of TDF assumptions. The simulation with capital market-based assumptions yielded slightly lower median projected returns and ending account balances than our primary specification (see table 9). The median projected risk-adjusted returns were also lower than our primary specification. The Sharpe ratio for a 20 percent allocation to bitcoin was marginally higher than the baseline portfolio, while in our primary specification the Sharpe ratio for a 20 percent allocation was lower than the baseline portfolio. The median projected maximum loss was similar to our primary specification based on Vanguard Target Retirement Funds.

Table 9: Median of Projected Estimates from Monte Carlo Simulation for Mid-Career Participant Using Capital Market Assumptions for Target Date Fund Risk and Return

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
Baseline	0.30	1.41	5.08%	4.61%	$470,551
	(0.21)	(31.67)	(4.56)	(1.80)	(111,901)
1% bitcoin	0.32	1.54	5.08%	4.90%	$488,587
	(0.21)	(82.50)	(4.61)	(1.86)	(122,540)
5% bitcoin	0.37	1.82	6.74%	6.21%	$578,149
	(0.18)	(67.82)	(5.24)	(2.00)	(16,517)
20% bitcoin	0.34	1.41	18.79%	10.45%	$1,025,855
	(0.13)	(2.71)	(9.67)	(3.02)	(510,679)

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Median projected estimates from 10,000 projected portfolio returns for the Sharpe ratio, Sortino ratio, maximum loss from peak to trough (max drawdown), internal rate of return (IRR), and ending account balance for a mid-career individual. The simulation assumed bitcoin returns and standard deviation follow a 4-year cycle that began with bitcoin performance over the period 2019–2022 and

phased into the geometric mean return and standard deviation similar to the long-term return and standard deviation of gold. Interviews with industry and academic researchers and firms that develop crypto asset investment options suggested that bitcoin might behave like gold in the long term; alternative long-term assumptions for bitcoin are discussed in the sensitivity section. Sharpe and Sortino ratios were calculated using the internal rate of return. Some Sortino ratios have large standard deviations relative to the median. Maximum drawdown and returns are given as percents. Standard deviations are in parentheses.

Bitcoin Return Assumptions

Industry and academic researchers and firms that develop crypto asset investment options and our quantitative analysis indicated that bitcoin has followed a 4-year cycle. We modeled this cycle which includes three growth years and one down year. The driving force behind this cycle could be the bitcoin halving cycle. The bitcoin halving cycle is the process that every 4 years the amount of bitcoin earned for mining transactions is cut in half.[6]

Our primary specification assumed that bitcoin would have geometric average return and standard deviation similar to that of gold after the third cycle, or the twelfth simulation year. Interviews with industry and academic researchers and firms that develop crypto asset investment options have also supported the potential for bitcoin to potentially have an average real return of zero and large standard deviation or for bitcoin to potentially maintain its high returns and high standard deviation from the most recent bitcoin cycle (2019–2022).[7] We simulated the TDF portfolio with various allocations of bitcoin using the go-to-zero assumption and the historical assumption for the future bitcoin return and standard deviation. Table 10 shows the bitcoin return and standard deviation for each year of the simulation for the go-to-zero scenario and the historical scenario.

Table 10: Return and Standard Deviation of Bitcoin for Go-to-Zero Scenario and Historical Scenario

Bitcoin return cycle	Simulation year	Geometric mean of zero		Bitcoin historical performance (2019–2022)	
		Return	SD	Return	SD
1	1	77%	79%	77%	79%
	2	77%	79%	77%	79%
	3	302%	80%	302%	80%
	4	-64%	53%	-64%	53%

[6]One interviewee suggested the cycle is related to technological innovation or market disruption followed by over reaction by investors resulting in a crash.

[7]To be even more conservative on the go-to-zero scenario, we used a long-run assumption that the nominal mean return would phase to zero by the fourth cycle.

Bitcoin return cycle	Simulation year	Geometric mean of zero		Bitcoin historical performance (2019–2022)	
		Return	SD	Return	SD
2	5	51%	79%	77%	79%
	6	51%	79%	77%	79%
	7	261%	80%	302%	80%
	8	-64%	53%	-64%	53%
3	9	25%	79%	77%	79%
	10	25%	79%	77%	79%
	11	220%	80%	302%	80%
	12	-64%	53%	-64%	53%
4	13	0%	79%	77%	79%
	14	0%	79%	77%	79%
	15	178%	80%	302%	80%
	16	-64%	53%	-64%	53%
5	17	0%	79%	77%	79%
	18	0%	79%	77%	79%
	19	178%	80%	302%	80%
	20	-64%	53%	-64%	53%

Source: GAO analysis of Investing.com data. | GAO-25-106161

Note: Table displays return and standard deviation (SD) assumptions for each year of the simulation for the go-to-zero scenario and the historical scenario.

The simulation that assumed bitcoin had a geometric mean of zero after twelve years, yielded lower median projected risk-adjusted returns (5 and 20 percent allocations) and larger maximum loss than our primary specification, but the pattern of results across bitcoin allocations remained similar to that of our primary specification (see table 11).

Table 11: Median of Projected Estimates from Monte Carlo Simulation Allowing Average Bitcoin Return to Approach Zero with Large Standard Deviation

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
Baseline	0.49	2.53	4.99%	6.61%	$609,029
	(0.24)	(792.92)	(4.64)	(2.02)	(170,720)
1% bitcoin	0.51	2.58	5.35%	7.00%	$641,874
	(0.24)	(162.27)	(4.89)	(2.10)	(192,642)
5% bitcoin	0.49	2.12	9.31%	8.41%	$775,091
	(0.22)	(59.90)	(6.29)	(2.50)	(285,445)
20% bitcoin	0.32	1.02	31.68%	11.92%	$1,290,719

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
	(0.16)	(1.06)	(12.53)	(4.58)	(1,168,778)

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Median projected estimates from 10,000 projected portfolio returns for the Sharpe ratio, Sortino ratio, maximum loss from peak to trough (max drawdown), internal rate of return (IRR), and ending account balance for a mid-career individual. For bitcoin, the assumptions are divided into a series of 4-year cycles. The first cycle is based on bitcoin performance over the period 2019–2022. The fourth and fifth cycles are based on long-term historical averages for gold but retaining the 4-year cycle associated with bitcoin. In cycles four and five, the geometric mean of the return assumption is set equal to zero. The second and third cycles phase in from the first to the fourth. Interviews with industry and academic researchers and firms that develop crypto asset investment options suggested that bitcoin might end up with zero real return. To be even more conservative on this sensitivity scenario, we used a long-run assumption that the nominal mean return would phase to zero by the fourth cycle. Sharpe and Sortino ratios were calculated using the internal rate of return. Some Sortino ratios have large standard deviations relative to the median. Maximum drawdown and returns are given as percents. Standard deviations are in parentheses.

The simulation that allowed bitcoin to continue the historical return and standard deviation from its most recent cycle yielded higher risk-adjusted returns (1 and 5 percent allocations) and higher ending account balances, but the standard deviation of the ending account balance was also larger relative to our primary specification (see table 12). Similar to the above analysis of the go-to-zero scenario, the historical scenario highlights the difference between small and large allocations of bitcoin.

Table 12: Median of Projected Estimates from Monte Carlo Simulation Using the Historical Bitcoin Return and Standard Deviation

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
Baseline	0.49	2.53	4.99%	6.61%	$609,029
	(0.24)	(792.92)	(4.64)	(2.02)	(170,720)
1% bitcoin	0.55	2.94	4.92%	7.49%	$684,737
	(0.25)	(449.77)	(4.77)	(2.10)	(203,091)
5% bitcoin	0.66	3.32	7.88%	10.76%	$1,071,320
	(0.22)	(89.15)	(5.97)	(2.44)	(400,084)
20% bitcoin	0.38	1.18	26.04%	15.18%	$4,401,221
	(0.23)	(1.16)	(10.50)	(7.57)	(3,792,890)

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Median projected estimates from 10,000 projected portfolio returns for the Sharpe ratio, Sortino ratio, maximum loss from peak to trough (max drawdown), internal rate of return (IRR), and ending account balance for a mid-career individual. For bitcoin, the assumptions are divided into a series of 4-year cycles. Each cycle year is based on bitcoin's performance over the period 2019–2022. We perform this sensitivity test to estimate an upper bound of bitcoin's potential performance. Sharpe and Sortino ratios were calculated using the internal rate of return. Some Sortino ratios have large standard deviations relative to the median. Maximum drawdown and returns are given as percents. Standard deviations are in parentheses.

Rebalancing

Table 13 displays the Monte Carlo simulation statistics with no portfolio rebalancing.[8] We found our results were sensitive to removing annual portfolio rebalancing and not rebalancing amplified risks. Rebalancing ensures the asset allocations in a portfolio remain at their intended allocation and high growth assets do not take over the portfolio. Not rebalancing can result in lower median projected returns (5 and 20 percent allocations) and risk-adjusted returns than annual rebalancing, especially at larger allocations of bitcoin. For a 20 percent allocation to bitcoin, the median projected maximum loss was over three times as large as the portfolio with annual rebalancing. Without rebalancing, the standard deviation of the projected median account balances was also over six times as large as the portfolio with annual rebalancing (20 percent allocation), further demonstrating the additional variability associated with not rebalancing the portfolio. Rebalancing may serve as an important risk management strategy since not rebalancing bitcoin can increase risks compared to annual rebalancing.

Table 13: Median of Projected Estimates from Monte Carlo Simulation without Rebalancing

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
Baseline	0.49	2.53	4.99%	6.61%	$609,029
	(0.24)	(792.92)	(4.64)	(2.02)	(170,720)
1% bitcoin	0.42	1.61	8.95%	6.97%	$638,967
	(0.21)	(86.51)	(10.39)	(2.50)	(304,827)
5% bitcoin	0.27	0.71	28.40%	7.32%	$674,702
	(0.15)	(2.34)	(17.70)	(3.60)	(1,096,418)
20% bitcoin	0.14	0.34	58.53%	7.22%	$738,552
	(0.10)	(0.44)	(17.85)	(4.84)	(4,307,899)

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Median projected estimates from 10,000 projected portfolio returns for the Sharpe ratio, Sortino ratio, maximum loss from peak to trough (max drawdown), internal rate of return (IRR), and ending account balance for a mid-career individual. The simulation assumed bitcoin returns and standard deviation follow a 4-year cycle that began with bitcoin performance over the period 2019–2022 and phased into the geometric mean return and standard deviation similar to the long-term return and standard deviation of gold. Interviews with industry and academic researchers and firms that develop crypto asset investment options suggested that bitcoin might behave like gold in the long term; alternative long-term assumptions for bitcoin are discussed in the sensitivity section. Sharpe and Sortino ratios were calculated using the internal rate of return. Some Sortino ratios have large standard deviations relative to the median. Maximum drawdown and returns are given as percents. Standard deviations are in parentheses.

[8]Annual contributions were invested in accordance with the initial portfolio asset allocation.

Contribution Amount

Doubling the annual contribution amount to proxy for employer contributions led to higher projected median account balances, but similar variation across the different allocations of bitcoin relative to our preferred specification (see table 14).

Table 14: Median of Projected Estimates from Monte Carlo Simulation with Doubled Contributions

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
Baseline	0.42	3.01	3.72%	6.68%	$1,004,165
	(0.21)	(136.91)	(4.39)	(2.09)	(261,844)
1% bitcoin	0.43	3.07	3.80%	6.93%	$1,034,794
	(0.21)	(1701.10)	(4.50)	(2.15)	(282,194)
5% bitcoin	0.44	3.16	5.21%	8.11%	$1,192,514
	(0.18)	(107.64)	(4.92)	(2.25)	(351,592)
20% bitcoin	0.36	1.91	16.35%	11.94%	$1,935,400
	(0.12)	(11.74)	(8.93)	(3.14)	(920,577)

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Median projected estimates from 10,000 projected portfolio returns for the Sharpe ratio, Sortino ratio, maximum loss from peak to trough (max drawdown), internal rate of return (IRR), and ending account balance for a mid-career individual. The simulation assumed bitcoin returns and standard deviation follow a 4-year cycle that began with bitcoin performance over the period 2019–2022 and phased into the geometric mean return and standard deviation similar to the long-term return and standard deviation of gold. Interviews with industry and academic researchers and firms that develop crypto asset investment options suggested that bitcoin might behave like gold in the long term; alternative long-term assumptions for bitcoin are discussed in the sensitivity section. Sharpe and Sortino ratios were calculated using the internal rate of return. The Sortino ratios have large standard deviations relative to the median. Maximum drawdown and returns are given as percents. Standard deviations are in parentheses.

Sequence Order

We altered the sequence of bitcoin returns in bitcoin's return cycle (warm, hot, and cold years) and found results are not sensitive changes in the sequence of bitcoin returns. For our primary specification, a cycle began with 2 positive return (warm) years, a strongly positive return (hot) year, then a strongly negative return (cold) year.[9] We altered this sequence in two ways. First, we allowed the investment to begin in a cold year, followed by 2 warm years, then a hot year, and second, we allowed the investment to begin in a hot year, followed by a cold year, then 2 warm years. The sequencing did not have a large effect on the projected median ending account balances (see table 15). The best-performing sequence begins on a cold year and ends on a hot year, while the worst-

[9]Bitcoin's historical return cycle has been 2 warm years, a hot year, and a cold year for two of its three past cycles. For the most recent cycle, bitcoin's return cycle was warm, hot, warm, cold.

performing sequence begins on a warm year and ends on a cold year. These findings mirror the high-level take-away of our primary specification, that high allocations to bitcoin could lead to significant variability in risks and returns and did not meaningfully alter our findings.

Table 15: Median of Projected Estimates from Monte Carlo Simulation with Alternative Return Sequences

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
Cold-Warm-Warm-Hot					
Baseline	0.49	2.53	4.99%	6.61%	$609,029
	(0.24)	(792.92)	(4.64)	(2.02)	(170,720)
1% bitcoin	0.51	2.65	4.97%	6.96%	$637,719
	(0.24)	(50.13)	(4.67)	(2.05)	(184,241)
5% bitcoin	0.54	2.93	6.12%	8.39%	$772,488
	(0.22)	(131.77)	(5.20)	(2.23)	(252,276)
20% bitcoin	0.43	2.10	16.13%	12.71%	$1,414,606
	(0.14)	(12.20)	(8.48)	(3.19)	(760,935)
Hot-Cold-Warm-Warm					
Baseline	0.49	2.53	4.99%	6.61%	$609,029
	(0.24)	(792.92)	(4.64)	(2.02)	(170,720)
1% bitcoin	0.51	2.63	5.08%	6.93%	$635,669
	(0.24)	(377.61)	(4.77)	(2.07)	(184,411)
5% bitcoin	0.50	2.75	6.42%	8.12%	$744,707
	(0.21)	(105.67)	(5.24)	(2.20)	(236,650)
20% bitcoin	0.39	1.84	17.20%	11.98%	$1,272,198
	(0.13)	(5.66)	(8.94)	(3.13)	(667,890)

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Median projected estimates from 10,000 projected portfolio returns for the Sharpe ratio, Sortino ratio, maximum loss from peak to trough (max drawdown), internal rate of return (IRR), and ending account balance for a mid-career individual. The simulation assumed bitcoin returns and standard deviation follow a 4-year cycle that began with bitcoin performance over the period 2019–2022 and phased into the geometric mean return and standard deviation similar to the long-term return and standard deviation of gold. Interviews with industry and academic researchers and firms that develop crypto asset investment options suggested that bitcoin might behave like gold in the long term; alternative long-term assumptions for bitcoin are discussed in the sensitivity section. Sharpe and Sortino ratios were calculated using the internal rate of return. The Sortino ratios have large standard deviations relative to the median. Maximum drawdown and returns are given as percents. Standard deviations are in parentheses.

Sequence Return Pattern

Similarly, we altered the bitcoin return sequence by allowing for 2 cold years instead of 2 warm years (i.e., replacing one of the 2 warm years with a second cold year) and found lower median projected ending account balances, lower returns, lower risk-adjusted returns, and similar

variation across the different allocations of bitcoin relative to our primary specification (see table 16). Lower Sharpe and Sortino ratios and higher maximum drawdown for a 20 percent allocation to bitcoin is consistent with our primary finding indicating high allocations to bitcoin could lead to significant variability in risks and risk-adjusted returns.

Table 16: Median of Projected Estimates from Monte Carlo Simulation Allowing for 2 Cold Years

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
Baseline	0.49	2.53	4.99%	6.61%	$609,029
	(0.24)	(792.92)	(4.64)	(2.02)	(170,720)
1% bitcoin	0.49	2.46	5.14%	6.71%	$617,234
	(0.24)	(139.71)	(4.75)	(2.08)	(180,483)
5% bitcoin	0.44	2.14	7.17%	7.21%	$659,985
	(0.20)	(123.26)	(5.22)	(2.18)	(205,848)
20% bitcoin	0.23	0.88	20.95%	8.10%	$743,496
	(0.12)	(1.30)	(9.01)	(3.01)	(353,379)

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Median projected estimates from 10,000 projected portfolio returns for the Sharpe ratio, Sortino ratio, maximum loss from peak to trough (max drawdown), internal rate of return (IRR), and ending account balance for a mid-career individual. The simulation assumed bitcoin returns and standard deviation follow a 4-year cycle that began with bitcoin performance over the period 2019–2022 and phased into the geometric mean return and standard deviation similar to the long-term return and standard deviation of gold. Interviews with industry and academic researchers and firms that develop crypto asset investment options suggested that bitcoin might behave like gold in the long term; alternative long-term assumptions for bitcoin are discussed in the sensitivity section. Sharpe and Sortino ratios were calculated using the internal rate of return. Some Sortino ratios have large standard deviations relative to the median. Maximum drawdown and returns are given as percents. Standard deviations are in parentheses.

Remove Cycle

For our last sensitivity test of the bitcoin return cycle, we removed the 4-year cycle after the twelfth simulation year and allowed the return and standard deviation to be constant for the remaining years of the simulation. Removing the cycle led to qualitatively similar results across the different portfolio allocations to bitcoin compared to our primary specification. The data showed the hot year returns steeply declined over bitcoin's lifetime, which if continued could lead to no discernable return cycle. To estimate the potential effect of weakening our assumption that the return cycle will continue for 20 years, we removed the return cycle after the twelfth year of the simulation.

Table 17 presents simulation results after removing the bitcoin return cycle. Removing the return cycle removed the large variability in returns that characterized bitcoin's historical returns. Overall, the results were

similar to the primary specification. While the magnitudes of the outcomes vary, we saw that the highest allocation to bitcoin yielded much higher maximum loss than lower bitcoin allocations.

Table 17: Median of Projected Estimates from Monte Carlo Simulation Removing the Bitcoin Cycle after Year Twelve

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
Baseline	0.49	2.53	4.99%	6.61%	$609,029
	(0.24)	(792.92)	(4.64)	(2.02)	(170,720)
1% bitcoin	0.50	2.67	4.98%	6.91%	$633,878
	(0.24)	(229.94)	(4.70)	(2.05)	(184,529)
5% bitcoin	0.51	2.77	6.24%	8.03%	$736,091
	(0.21)	(3378.80)	(5.21)	(2.16)	(230,644)
20% bitcoin	0.40	1.91	16.48%	11.74%	$1,229,283
	(0.13)	(9.74)	(9.28)	(2.99)	(598,045)

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Median projected estimates from 10,000 projected portfolio returns for the Sharpe ratio, Sortino ratio, maximum loss from peak to trough (max drawdown), internal rate of return (IRR), and ending account balance for a mid-career individual. The simulation assumed bitcoin returns and standard deviation follow a 4-year cycle that began with bitcoin performance over the period 2019–2022 and phased into the geometric mean return and standard deviation similar to the long-term return and standard deviation of gold. The fourth and fifth cycles of the simulation do not model the bitcoin return cycle. Interviews with industry and academic researchers and firms that develop crypto asset investment options suggested that bitcoin might behave like gold in the long term; alternative long-term assumptions for bitcoin are discussed in the sensitivity section. Sharpe and Sortino ratios were calculated using the internal rate of return. The Sortino ratios have large standard deviations relative to the median. Maximum drawdown and returns are given as percents. Standard deviations are in parentheses.

Return Distribution

The simulation results were not sensitive to the choice of distribution for returns (see table 18). Our primary analysis assumed bitcoin and TDF returns follow a normal distribution. Some asset classes may have return distributions with fat tails that are not normally distributed. Overall, when we used a T-distribution instead of a normal distribution, we found the projected estimates are similar to our primary analysis.

Table 18: Median of Projected Estimates from Monte Carlo Simulation Using a T-Distribution

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
Baseline	0.44	1.89	7.03%	6.56%	$605,219
	(0.24)	(44.29)	(6.99)	(2.26)	(191,141)
1% bitcoin	0.47	2.12	6.74%	6.86%	$629,573
	(0.25)	(210.66)	(6.93)	(2.29)	(204,908)

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
5% bitcoin	0.52	2.67	6.73%	8.15%	$748,458
	(0.22)	(460.77)	(6.64)	(2.21)	(239,840)
20% bitcoin	0.42	2.02	15.76%	12.28%	$1,325,374
	(0.13)	(20.98)	(8.78)	(2.92)	(627,522)

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Median projected estimates from 10,000 projected portfolio returns for the Sharpe ratio, Sortino ratio, maximum loss from peak to trough (max drawdown), internal rate of return (IRR), and ending account balance for a mid-career individual. The simulation assumed bitcoin returns and standard deviation follow a 4-year cycle that began with bitcoin performance over the period 2019–2022 and phased into the geometric mean return and standard deviation similar to the long-term return and standard deviation of gold. Interviews with industry and academic researchers and firms that develop crypto asset investment options suggested that bitcoin might behave like gold in the long term; alternative long-term assumptions for bitcoin are discussed in the sensitivity section. Sharpe and Sortino ratios were calculated using the internal rate of return. The Sortino ratios have large standard deviations relative to the median. Maximum drawdown and returns are given as percents. Standard deviations are in parentheses.

Frequency of simulation

Instead of using annual measures of return and risk, which may smooth volatility, we performed the simulation using monthly return and risk and found the estimates were empirically similar to our primary analysis (see table 19). Annual returns and standard deviations may smooth volatility, potentially understating the effect of bitcoin on portfolio risk. We performed a sensitivity analysis using monthly returns and standard deviations for bitcoin and the TDF to see how sensitive our primary findings were to the frequency of the data selected. This specification led to higher median projected Sharpe ratios across all allocations to bitcoin compared to our primary specification. The projected median Sortino ratios were lower than our primary specification across all allocations to bitcoin, suggesting the downside deviation was larger using monthly returns rather than annual returns. Importantly, these findings indicate that we were not smoothing away relevant volatility by using annual returns.

Table 19: Median of Projected Estimates from Monte Carlo Simulation Using Monthly Data

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
Baseline	0.66	1.32	8.34%	6.09%	$579,029
	(0.21)	(0.49)	(2.20)	(1.59)	(128,824)
1% bitcoin	0.72	1.48	8.13%	6.53%	$614,324
	(0.21)	(0.50)	(2.19)	(1.59)	(137,439)
5% bitcoin	0.85	1.82	8.68%	8.13%	$762,588
	(0.20)	(0.54)	(2.40)	(1.76)	(197,783)

Allocation to bitcoin	Sharpe	Sortino	Max drawdown	IRR	Ending account balance
20% bitcoin	0.79	1.68	18.80%	13.25%	$1,566,936
	(0.18)	(0.54)	(4.44)	(3.46)	(1,116,433)

Source: GAO analysis of Investing.com and Yahoo! Finance data. | GAO-25-106161

Note: Median projected estimates from 10,000 projected portfolio returns for the Sharpe ratio, Sortino ratio, maximum loss from peak to trough (max drawdown), internal rate of return (IRR), and ending account balance for a mid-career individual. The simulation assumed bitcoin returns and standard deviation follow a 4-year cycle that began with bitcoin performance over the period 2019–2022 and phased into the geometric mean return and standard deviation similar to the long-term return and standard deviation of gold. Interviews with industry and academic researchers and firms that develop crypto asset investment options suggested that bitcoin might behave like gold in the long term; alternative long-term assumptions for bitcoin are discussed in the sensitivity section. The reported metrics are annualized. Sharpe and Sortino ratios were calculated using the internal rate of return. Maximum drawdown and returns are given as percents. Standard deviations are in parentheses.

Appendix IV: GAO Contacts and Staff Acknowledgments

GAO Contacts

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Staff Acknowledgments

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