Richmond Journal of Law & Technology Volume XXVIII, Issue 4

DIGITAL ASSET VALUATION

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Cite as: Wulf A. Kaal et. al., *Digital Asset Valuation*, 28 RICH. J.L. & TECH. 657 (2022).

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ABSTRACT

Existing valuation metrics for legacy assets only limitedly apply in the context of digital assets. The valuation infrastructure in the current legal, accounting, technology, and back-office framework, in combination with the immaturity of the digital asset market, create an environment of digital asset valuation uncertainty. This article evaluates the existing asset valuation methods and their limited application to digital assets before contrasting new and evolving digital asset valuation trends.

I. INTRODUCTION

[1] Digital asset valuation is subject to uncertainties. Digital assets are often exposed to significant price volatility, which are liquidity shortcomings that lead to pricing inaccuracies. Ever since the emergence of the digital asset market in 2009,[1] established digital assets, such as Bitcoin, experienced pricing uncertainties. Since its inception, the price of Bitcoin has varied largely and frequently depending on trading location.[2]

[2] Pricing inadequacies are at the forefront of the issues that undermine the evolution of the digital asset market. The complex valuation infrastructure in the current legal, accounting, finance, technology, and back-office frameworks, in combination with the immaturity of the digital asset market, create an environment where digital asset valuation continues to be a mystery. Digital asset managers cannot be certain they are valuing their assets correctly, and their investors may not be satisfied with either their managers' valuation efforts, or the methodology that supports them. While many traditional assets also cannot be fully assessed, the lack of valuation accuracy for financial reporting is made worse by the lack of established pricing standards for digital assets.

[3] The definition of fair value under existing accounting terminology may not apply to digital assets.[3] As a result, the correct valuation of digital assets may not be possible for financial reporting issues. Worse even, digital assets may not meet the definition of financial instruments under established

[1] Wulf A. Kaal, *Digital Asset Market Evolution*, 46 J. CORP. L. 909, 910 (2021).

[2] Sid Clarkmore, *Why is BTC-E Bitcoin Cheaper and Lower in Price Than Other Markets?*, HEAVY (Sep. 2, 2021, 11:50 PM), https://heavy.com/tech/2013/11/btc-e-bitcoin-cheaper-lower-price-less-cost/ [https://perma.cc/6TUR-QV6F].

[3] FIN. ACCT. STANDARDS BD., STATEMENT OF FINANCIAL ACCOUNTING STANDARDS NO. 157: FAIR VALUE MEASUREMENTS (2006) [hereinafter FASB 157] (Fair value is market-based, focusing on exit rather than entry price. Factors include assumptions about risk and restrictions on asset sale and use. As such, liquidity (the degree to which an asset can be quickly purchased or sold) significantly impacts fair value.).

accounting standards. Yet, in lieu of parallel accounting terminology for digital assets, current practices necessitate the application of existing terminology, such as fair value.

[4] It is unclear how digital assets may be priced in fair valuation metrics under existing accounting terminology. Fair value is defined as the exit price of a given asset at the time of sale in an orderly market.[4] Assets can be categorized into three classes or levels in order to help categorize fair value of an asset, reflecting the level of judgment in estimating fair values in order from most to least liquid.

[5] Assets in the level one category generally are liquid exchange-traded assets that have reliable observable inputs.[5] Bitcoin and Ethereum are the most liquid digital assets and could qualify as a level one asset. Similarities can be drawn between traditional dual-listed securities and Bitcoin and Ethereum. Typically, an asset will be listed on multiple exchanges to provide the market with more liquidity.[6] For traditional markets, when a security is dual-listed, the bid-ask spread decreases because additional liquidity is being injected into the market.[7] This differs from the crypto market, where the difference between the two exchanges can reach up to 5% during peak trading times.[8] As markets continue to develop, this market arbitrage should continue to reduce.

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[4] *IFRS 13 Fair Value Measurement*, INT'L FIN. REPORTING STANDARDS FOUND. (2021), https://www.ifrs.org/issued-standards/list-of-standards/ifrs-13-fair-value-measurement/ [https://perma.cc/SQ4V-DHTH]; PwC, Fair Value Measurements 1-2 (Mar. 31, 2022), https://viewpoint.pwc.com/dt/us/en/pwc/accounting_guides/fair_value_measureme/assets/pwcfairvalueguide0322.pdf [https://perma.cc/Y2V4-FGT8].

[5] FASB 157, *supra* note 3.

[6] *Profiting From Price Differences Across Crypto Exchanges*, CRYPTOPEDIA (Apr. 7, 2021), https://www.gemini.com/cryptopedia/crypto-arbitrage-crypto-exchange-prices [https://perma.cc/P76R-BJNL].

[7] *Id.*

[8] *Id.*

[6] Level two encapsulates semi-liquid or illiquid assets but allows asset managers to extrapolate price based on comparable assets.[9] In order to determine fair value of a level two asset, asset managers may consider a quoted price for a similar asset or liability in an active market or quoted prices for identical/similar assets or liabilities in markets that are not active (i.e., in which there are few transactions for the asset or liability, the prices are not current, or price quotations vary over time or among market makers (some brokered markets), or in which little information is released publicly (a principal-to-principal market)).

[7] Level three uses unobservable inputs that are developed internally from the reporting entity's point of view.[10] The assessment of market participant assumptions is based on the most up-to-date information. These inputs are used when there is little, if any, market activity for the asset or liability at the measurement date.

[8] Depending on their liquidity, altcoins and securities tokens may generally qualify for levels two or three.[11] Level three permits the use of proprietary pricing models for assets that do not qualify for level two. Digital asset exchanges do not have closing prices, therefore, digital asset managers cannot simply use the closing price for a given asset.

[9] Digital asset valuation methodologies vary significantly. Tradeoffs between methodologies grant some valuation discretion to digital asset managers. For instance, while some managers may use the price on their favored cryptocurrency exchange when quoting level one securities, others might take an aggregate price from multiple exchanges.[12] The lack of standards for digital asset valuation leads to uncertainty and confusion

[9] FASB 157, *supra* note 3.

[10] *Id.*

[11] *Id.*

[12] *See IFRS 13—Fair Value Measurement*, DELOITTE, https://www.iasplus.com/en/standards/ifrs/ifrs13 [https://perma.cc/F5GK-UZEZ] (explaining that for level two inputs, it includes "quoted prices for similar assets or liabilities in active markets.").

among investors and managers. Further, digital asset valuation is critical to the establishment of these products as legitimate financial assets.[13] Digital currencies are an emerging asset class, and an emergent derivatives market is slowly evolving for digital currencies.[14] Certainly, the industry would benefit from uniform standards for digital asset valuation.

II. DIGITAL ASSET VALUATION

A. Digital Asset Valuation Issues in Practice

[10] Digital asset valuation issues are affecting business decisions for digital asset startups and are already leading to litigation.[15] The existing litigation record on digital asset valuation provides an early indicator on digital asset valuation issues that may require further clarification.

1. Market Arbitrage Issues

[11] The concept of arbitrage, which is common in traditional markets, has begun to creep into the crypto markets.[16] Traditionally, when securities are bought and sold for different prices at the same time, individuals look

[13] *Why and how to value Digital Assets/Online Presence of a company?*, INVESTPLIFY (May 13, 2019), https://investplify.com/why-and-how-to-value-digital-assets-online-presence-of-a-company/ [https://perma.cc/F95R-NGXC].

[14] Adam S. Hayes, *Cryptocurrency Value Formation: An Empirical Study Leading to a Cost Production Model for Valuing Bitcoin*, 34 TELEMATICS & INFORMATICS 1308, 1308 (2017).

[15] Jeff Novel, *Is Crypto a Currency or Security? Litigation Involving the SEC May Provide Guidance*, KANE RUSSEL COLEMAN LOGAN (Nov. 4, 2021), https://www.krcl.com/insights/is-crypto-currency-or-security-litigation-involving-the-sec-may-provide-guidance [https://perma.cc/CF89-G475].

[16] Andrew Bloomenthal, *What is Arbitrage?*, INVESTOPEDIA (Aug. 23, 2021), https://www.investopedia.com/ask/answers/what-is-arbitrage/ [https://perma.cc/4YZQ-ZQR5] ("Arbitrage occurs when a security is purchased in one market and simultaneously sold in another market, for a higher price.").

to cover the spread by arbitrage trading.[17] This has become one of the key indicators of an inefficient market.

[12] Arbitrage trading happens as a result of asymmetries of information across the different exchanges. These asymmetries arise for many reasons, including imperfect disclosures or insights into whether a company has a willingness to take on debt. When market efficiency decreases, arbitrage traders can take advantage of market conditions.[18]

[13] One of the most prominent examples of arbitrage happened on the South Korean exchange Bithumb. On December 15, 2017, Coinbase traded one bitcoin for roughly $18,500.[19] The same day, Bithumb hit $21,000 per Bitcoin.[20] Traders who were able to time their trades correctly made roughly 14% just by providing additional liquidity to the Bithumb market.[21]

[14] It is unlikely any South Korean investor was able to take advantage of this opportunity in exchanges using USD because of the hurdles they would have to go through before being able to access the US exchange Coinbase. The Korean investor would have needed to transfer Korean currency (Won) to United States dollars to match the functional currency used by Coinbase.[22] This requires a reliance on the foreign exchange

[17] *Id.*

[18] *Id.*

[19] *Explorer*, BLOCKCHAIN, https://www.blockchain.com/prices/BTC?from=1483290000&to=1514739600&timeSpan=custom&scale=0&style=line [https://perma.cc/LK85-9RGD].

[20] *BTC/KRW Bitcoin Korean Won*, INVESTING, https://www.investing.com/crypto/bitcoin/btc-krw-historical-data [https://perma.cc/WP7Z-Z9C4].

[21] *See generally* Jake Frankenfield, *Kimchi Premium*, INVESTOPEDIA (July 26, 2021), https://www.investopedia.com/terms/k/kimchi-premium.asp [https://perma.cc/AM9B-YV43] (explaining the arbitrage opportunity created by the gap in cryptocurrency prices in South Korean exchanges compared to foreign exchanges).

[22] *Id.*

market, adding fees to the transaction. Additionally, South Korean regulators enforce capital controls that would have made it difficult to move a large sum of money out of the country.[23]

[15] Before any money can be moved out of South Korea, regulators must approve the transfer.[24] Regulators have traditionally blocked crypto transactions because they do not align with current Korean financial regulations or anti-money laundering regulations.[25]

[16] Arbitrage traders may be providing markets with otherwise-unavailable liquidity. On the other hand, if these markets were more open and had greater clarity on outstanding legal issues, there may be less arbitrage opportunity in the market.

2. Private Investment Fund Valuation Issues

[17] Exchanges are not the only areas that have seen issues with crypto valuation. Indeed, the private investment fund space has also run into valuation issues. For example, Polychain Capital was one of the first digital asset funds involved in litigation over the valuation of its digital assets.[26] In 2017, Mr. Greenhouse, an investor in Polychain Capital who gained over 2000 percent through his investment in Polychain Capital, sued the fund over the fund's asset valuation.[27]

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[23] *Id.*

[24] *Id.*

[25] Troy Stangarone, *South Korea Tightens Regulations on Cryptocurrencies*, THE DIPLOMAT (July 3, 2021), https://thediplomat.com/2021/07/south-korea-tightens-regulations-on-cryptocurrencies [https://perma.cc/R5NL-KBF3].

[26] Greenhouse v. Polychain Fund I LP, No. 2018-0214-JRS, 2019 WL 2290245, at *1 (Del. Ch. May 29, 2019).

[27] Defendants' Answer to Verified Complaint for Inspection of Partnership Books And Records at 3, Greenhouse v. Polychain Fund I LP, No. 2018-0214-JRS, 2019 WL 2290245, at *1 (Del. Ch. May 29, 2019).

[18] Several events precipitated Mr. Greenhouse's decision to sue Polychain Capital. According to Greenhouse, Polychain Capital's employees made contradictory statements regarding the valuation of digital assets.[28] Polychain Capital had assured Mr. Greenhouse that the fund's most liquid assets would be valued for redemption and that there would be a framework to value less-liquid assets.[29] Later, he was told the illiquid assets would be placed in side pockets[30] and excluded from the redemption until they were deemed to be liquid by Polychain Capital.[31] Mr. Greenhouse

[28] *Greenhouse*, 2019 WL 2290245 at *2 ("Plaintiff notified Polychain Capital that he intended to make a full redemption of his capital account. He alleges that he based this decision on assurances from Joseph Eagan, Polychain Capital's Chief Operating Officer, that the Fund's most liquid assets would be valued for redemption at prices as of December 31, 2017, and that there would be a framework to value less liquid assets . . . . Two days after Plaintiff determined to withdraw, Polychain Capital's chief of staff, Caroline Jaquiss, informed Plaintiff that his redemption would be valued 'under the old terms,' and that no assets would be side-pocketed.").

[29] *Id.* (citing Compl. ¶¶ 10, 14–15).

[30] *Id.* at *2 n.8 (citing Henry Ordower, *Demystifying Hedge Funds: A Design Primer*, 7 U.C. DAVIS BUS. L.J. 323, 328 (2007) ("A "side pocket" is a type of account used by hedge funds to separate illiquid, hard-to-value assets from liquid assets. Funds treat side pocket accounts in various ways depending on the fund's investment goals and the nature of the assets placed in the accounts: '(i) some funds estimate the value of side pocket positions and include a payment for them in the redemption price; (ii) more often, funds permit investors to redeem the liquid portion of their interests but retain the investor in the fund with respect to the investor's share of illiquid positions; (iii) other funds exclude side pocket value from the redemption proceeds for investors wishing to redeem from the fund before the illiquid positions are sold, so that the redeeming investor simply relinquishes any interest in the side pocket; (iv) in order to avoid harsh results, managers occasionally create a separate class of fund interests with some investors only sharing in the liquid positions in the fund's portfolio, while others, with a longer-term appetite for commitment, participate in the side pocket portion of the fund as well.'")

[31] On December 13, 2017, counsel for Polychain Capital contacted Greenhouse via email. The Court opinion reveals that this email "largely confirmed Eagan's prior assurances concerning the valuation procedures." The email explained that all assets would be priced as of December 31, 2017, certain less liquid assets would be priced at affair market value as determined in Polychain's discretion, and others would continue to be held at cost. *Id.* at *2 n.14.

requested full withdrawal before Polychain Capital had designated any side pockets. As result, Polychain Capital determined that Mr. Greenhouse's redemption would be valued without the benefit of excluding less-liquid assets from the valuation process until their liquidity improved.[32] Upon request, Polychain Capital told Mr. Greenhouse that the fund's asset valuation policy would not be disclosed.[33] Polychain Capital then denied Mr. Greenhouse's requests for information and his request to suspend his redemption.[34] Mr. Greenhouse's capital account with Polychain Capital was redeemed, and he received a wire transfer for the withdrawal amount without receiving any documentation or valuation explanation.[35] The fund

[32] *Id*. at *2 (citing Compl. ¶ 17).

[33] *Greenhouse*, 2019 WL 2290245 at *3 (citing Compl. ¶¶ 18, 19).

[34] *Id.* ("In the following weeks, counsel for Plaintiff sought information regarding the valuation policy but was told the policy would not be disclosed. Hoping to reach an agreement on the side pockets or at least on a more beneficial procedure for valuing Plaintiff's interests, Plaintiff's counsel requested on December 26, 2017, that Polychain suspend Plaintiff's redemption request. Polychain refused."

[35] *Id.* ("On January 25, 2018, Plaintiff received an investor statement indicating that his account had been fully redeemed; four days later, he received and accepted a wire transfer for the withdrawal. Polychain withheld 5% of Plaintiff's capital account as an audit holdback per the LPA."

denied subsequent requests to review its books and records.[36]

[19] In 2018, Mr. Greenhouse filed an action to enforce his rights as limited partner in Polychain Capital.[37] Polychain Capital argued that at the time Mr. Greenhouse filed his complaint, he had already withdrawn from the partnership and fully redeemed his partnership interest, that he was no longer a limited partner, and therefore he had no standing to inspect Polychain Capital's books and records.[38] Polychain Capital argued Mr. Greenhouse was instead at most a creditor with no inspection rights.[39] The complaint did not allege that Mr. Greenhouse resisted Polychain Capital's refusal to suspend his withdrawal from the partnership, or that he sought to return the distribution of his capital account when he received it.[40]

[36] *Id.* ("After his repeated efforts to obtain information through other means failed to yield results, on February 28, 2018, Plaintiff finally made a written demand to inspect Polychain's books and records under Section 17-305. The demand seeks all books and records from the time Plaintiff first invested to the date of his demand relating to: a. Any assets held by Polychain; b. Any transactions Polychain consummated with any person, entity, and/or investee, regarding any assets held by Polychain, including, without limitation, any SAFT entered into with any enterprise; c. Any performance, management, or consulting fees and their calculation paid by Polychain to anyone, including the General Partner; d. The mathematical methodology used in respect of Mr. Greenhouse's account statements and/or redemption; e. Any side deals or binding side letters Polychain and/or the General Partner entered into with any person, including, without limitation, any limited partner, if such side deals or letters affected or could have possibly affected the value of Mr. Greenhouse's interest in Polychain; and f. Any agreements or engagements with any third parties (paid or otherwise) that might have affected the treatment of Mr. Greenhouse's interest or its value.)

[37] The lawsuit was filed under 6 Del. C. § 17-305 in the Court of Chancery seeking an order to compel Polychain and Polychain 2030 "summarily to make available to Mr. Greenhouse for inspection and copying certain books and records as demanded by Mr. Greenhouse." Verified Complaint for Inspection of Partnership Books and Records ¶ 1, Greenhouse v. Polychain Fund I LP, Case No. 2018-0214-JRS, 2019 WL 2290245 (Del. Ch. May 29, 2019).

[38] *Greenhouse*, 2019 WL 2290245, at *3.

[39] *Id.*

[40] *Id.* at *4.

Therefore, the court was not persuaded by Mr. Greenhouse's oral arguments and concluded that these facts "do not change the fact that he has withdrawn from the partnership and no longer has rights as a limited partner."[41] The court concluded that Mr. Greenhouse did not retain an equity interest in the partnership and was not entitled to inspect the partnership's books and records.[42]

[20] In sum, the court concluded that only current limited partners can inspect records and that limited partners who have withdrawn from the partnership have rights and remedies as creditors of the partnership but no longer maintain an equity interest that entitle them to rights as limited partners.[43] The Court found that Polychain Capital correctly responded that the cash distribution was in satisfaction of what was owed to Mr. Greenhouse and that the distribution was Mr. Greenhouse's pro rata share of additional assets that could not be valued when Mr. Greenhouse withdrew from the fund, but that could be valued as of January 30, 2019.[44] The cash distribution made to Mr. Greenhouse did not indicate an equity

[41] *Id.* at *4.

[42] *Id.*

[43] *Greenhouse*, 2019 WL 2290245, at *1, *6 ("Under the [DRULPA], once a partner withdraws, the partner becomes 'simply a contract claimant holding fixed rights,' and can sue in contract for failure to pay the value of its share as of the withdrawal date.") (quoting *Schuss v. Penfield P'rs, L.P.*, No. 3132-VCP, 2008 WL 2433842, at *4 (Del Ch. Jun. 13, 2008)).

[44] *Id.* at *7.

share in Polychain Capital.[45]

[21] Finally, whether Polychain Capital would have won its case had Mr. Greenhouse not redeemed his stake in its fund is unsettled. In either case, Polychain Capital would likely have made the same disclosures and valuation arguments.

B. Impact of Digital Asset Characteristics on Valuation

[22] Digital assets are often coded with hard caps, meaning that the set maximum number of digital assets that will be issued is absolute, in order to maintain a reliable positive value.[46] In order to hold issuers of privately issued money accountable to maintain a reliably positive value, the issuer of the "money" makes a commitment on either price or quantity of money units that will be issued.[47] The traditional solution is instantiated through

[45] *Id.* at *15 (explaining that equity interests of Polychain's remaining limited partners fluctuated with the value of the Fund but Greenhouse's "pro rata" share did not); *see also id.* at *7 ("Had the fund declined in value in the wake of his withdrawal, Plaintiff would readily distinguish himself from those limited partners saddled with cheaper assets and argue that his status as a fully redeemed partner requires that the Fund pay out the balance owed to him based on a valuation as of the date of his withdrawal. At best, the January 30, 2019, distribution suggests Plaintiff was invested in side pockets during his time as a limited partner, a fact that may be relevant to valuing his redemption but does nothing to support his claim of ongoing equity interest. … Moreover, Section 8.04 of the LPA makes clear that the purpose of the audit holdback is to cover any downward audit adjustment to the partnership's net asset value, thereby ensuring that the redeemed partner's redemption is consistent with the Fund's audited net asset value. According to the LPA, any unapplied portion of the audit holdback must be returned to the redeemed partner within the 30 days of the end-of-year audit. And that is precisely what happened; Plaintiff received the entirety of the holdback within 30 days of the completion of the Fund's 2017 annual audit. Nothing about that holdback resembles equity and, therefore, Polychain's decision to exercise its holdback right did not somehow extend Plaintiff's status as a limited partner.").

[46] *See* Hayes, *supra* note 14, at 1311.

[47] *See generally* Lawrence H. White, *What Kinds of Monetary Institutions Would a Free Market Deliver?*, 9 CATO J. 367 (1989).

price commitments, called redemption contracts, holding the issuer accountable through an enforceable money-back guarantee.[48] Such redemption contracts lack credibility.[49]

[23] By contrast, the pre-programmed smart contracts enabled by cryptocurrencies facilitate an enforceable and secure quantity commitment.[50] For instance, a programmed enforceable quantity commitment ensures a reliably positive value of Bitcoin.[51] Cryptocurrencies' observable source codes are fully transparent on their respective blockchain and are continuously verifiable.[52]

[24] The effect of supply limitations on digital assets is the subject of ongoing debate. Some argue that the limited supply of Bitcoins and its slow rate of growth will cause deflationary bias that will eventually counter the declining value of Bitcoin over time.[53] As cryptocurrencies deflate, users may begin hoarding. Capped supply makes it harder to prevent deflation or

[48] *See generally id.*

[49] *See generally id.*

[50] *See* Heather Hughes, *Blockchain and the Future of Secured Transactions Law*, 3.1 STAN. J. OF BLOCKCHAIN L. & POL'Y 21, 22 (2020).

[51] John P. Kelleher, *Why Do Bitcoins Have Value?*, INVESTOPEDIA (Mar. 15, 2022), https://www.investopedia.com/ask/answers/100314/why-do-bitcoins-have-value.asp [https://perma.cc/V6MQ-STS6].

[52] Ritchie S. King et al., *By Reading This Article, You're Mining Bitcoins*, QUARTZ (Dec. 17, 2013), https://qz.com/154877/by-reading-this-page-you-are-mining-bitcoins/ [https://perma.cc/T3NT-WZR5]; Francois R. Velde, *Bitcoin: A Primer*, 317 CHI. FED. LETTER (2013) (explaining how Bitcoin transfers are verified); Kevin Dowd & Martin Hutchinson, *Bitcoin Will Bite the Dust*, 35 CATO J. 357, 360 (2015) (explaining how Bitcoin transfers are observable and verifiable by miners).

[53] Matthew O' Brien, *Bitcoin Is No Longer a Currency*, ATLANTIC (Apr. 11, 2013), https://www.theatlantic.com/business/archive/2013/04/bitcoin-is-no-longer-a-currency/274859/ [https://perma.cc/39NZ-FACK].

hoarding.[54] Others argue that the quantity commitments in existing digital currencies will inevitably lead to a bubble, where the market price of digital assets still varies with demand and can be tied merely to tentative expectations of market valuation.[55] In the same vein, some academics argue that Bitcoin has no intrinsic value.[56]

[25] The cryptocurrency market growth in 2017 was driven by a combination of improved access, media attention, speculation, network mining activity, distrust of traditional banking, global instability hedging, and a demand effect from the market.[57]

[26] An agreed-upon reliable valuation method does not exist for cryptocurrencies in 2022.[58] Some academic valuation models are focused on the labor side of mining cryptocurrencies and may be indicative of prices.[59] Some base valuation metrics on regressions of market price against independent variables such as the market price of gold, occurrences of "bitcoin" in Google searches, and velocity of bitcoin measured by transaction data.[60] Other valuation models point out the importance of

[54] *Id.*

[55] *Id.*

[56] Hayes, *supra* note 14, at 1310.

[57] Ryan Clements, *Assessing the Evolution of Cryptocurrency: Demand Factors, Latent Value, and Regulatory Developments*, 8 MICH. BUS. & ENTREPRENEURIAL L. REV. 73, 75 (2018).

[58] *See 401(k) Plan Investments in "Cryptocurrencies"*, U.S. DEP'T LAB. (Mar. 10, 2022), https://www.dol.gov/agencies/ebsa/employers-and-advisers/plan-administration-and-compliance/compliance-assistance-releases/2022-01 [https://perma.cc/6FUV-8DH2].

[59] *E.g.*, Hayes, *supra* note 14, at 1315–19.

[60] *See* Jamal Bouoiyour & Refk Selmi, *What Bitcoin Looks Like?*, MUNICH PERS. REPEC ARCHIVE (Sept. 30, 2014), https://mpra.ub.uni-muenchen.de/58091/ [https://perma.cc/SF66-JZDH] (listing the independent variables).

considering altcoins in Bitcoin valuation strategy,[61] or develop a valuation model based on the cost of production of Bitcoin.[62]

III. TRADITIONAL ASSET VALUATION METRICS

[27] Whenever a new asset class comes to the market, practitioners look to apply legacy asset valuation methodologies.[63] Although these legacy valuation models and ideas often fall short in determining the true fair value of a new asset class, they do present an adequate starting point for a valuation analysis of a new asset. As efficiency continues to develop in the digital asset space, so should the accuracy of the digital asset valuation practice.[64]

[61] *See* Hayes, *supra* note 14, at 1310.

[62] *See id.* at 1315–17 (explaining the valuation method based on the cost of production).

[63] *See generally* Maartje Bus, *Size Matters: Does Crypto Stack Up to Other Asset Classes?*, BLOCKWORKS (Jan. 13, 2021, 8:59 AM), https://blockworks.co/size-matters-does-crypto-stack-up-to-other-asset-classes/ [https://perma.cc/UP2K-EVLX] (considering crypto as a new asset class); John Todaro, *Valuing Crypto Assets Using a DCF Model*, MEDIUM (June 21, 2018), https://medium.com/@john_19547/valuing-crypto-assets-using-a-dcf-model-bc6297b0bd25 [https://perma.cc/BPC7-CQSV] (discussing an example of a legacy asset valuation methodology used on crypto-assets).

[64] *See* Marc Hochstein, *Crypto Long & Short: How Do You Measure Relative Value in Crypto?*, COINDESK (Sept. 14, 2021, 9:37 AM), https://www.coindesk.com/markets/2021/08/08/crypto-long-short-how-do-you-measure-relative-value-in-crypto/ [https://perma.cc/Q3UF-WKT2] (explaining the difficulties of applying traditional equity market metrics to the relatively novel market of cryptocurrencies); Willy Woo, *Is Bitcoin in a Bubble? Check the NVT Ratio*, FORBES (Sept. 29, 2017, 8:01 AM), https://www.forbes.com/sites/wwoo/2017/09/29/is-bitcoin-in-a-bubble-check-the-nvt-ratio/?sh=79e72dc46a23 [https://perma.cc/WN5G-N74T] (discussing how in traditional stock markets, company earnings are compared to stock price to consider whether the company is being over-valued, whereas cryptocurrencies are not tied to a company, so the author conceptualized the Network Value to Transactions (NVT) Ratio as a corollary to company earnings to consider whether cryptocurrencies are in a bubble).

[28] Fair value is "the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date."[65] Fair value measurements "provide[] information about what an entity might realize if it sold an asset or might pay to transfer a liability."[66] The fair value standards outlined in ASC 820 and IFRS 13 "provide authoritative guidance on fair value measurement,"[67] "establish[ing] a . . . framework applicable to all fair value measurements under US GAAP and IFRS . . . ."[68] These standards require "fair value [to] be measured based on an 'exit price' [the price to sell an asset or transfer a liability] . . . determined using several key concepts."[69] Fair market value is the legal standard for valuation, but it has real-world problems.[70]

[29] Objectivity and observability are at the core of fair market valuation.[71] Where inputs are less observable, a higher degree of disclosure is required[72] to explain the "fair value of the entire asset" or "the significant input(s) to the fair value measurement."[73] The highest priority level of inputs (level one) includes observable inputs reflecting unadjusted quoted

[65] PwC, *supra* note 4, at 1-2.

[66] *Id.*

[67] *Id.*

[68] *Id.* at 1-4.

[69] *Id.*; *see also Statements on Standards for Valuation Services*, ASS'N. INT'L. CERTIFIED PRO. ACCTS. (June 2007), https://www.aicpa.org/resources/download/statement-on-standards-for-valuation-services-vs-section-100 [https://perma.cc/A973-B2XL] [hereinafter AICPA].

[70] *See* Z. Christopher Mercer & Terry S. Brown, *Fair Market Value vs. The Real World*, BUS. VALUATION REV., Mar. 1999, at 16.

[71] *See* PwC, *supra* note 4, at 4-24 to 4-25.

[72] *Id.*

[73] *See id.* at 4-37.

prices for identical assets or liabilities in active markets.[74] An active market is defined as "a market in which transactions for the asset or liability take place with sufficient frequency and volume to provide pricing information on an ongoing basis."[75] Level two inputs are those "other than quoted prices . . . [which] are observable for the asset or liability either directly or indirectly."[76] Level three inputs are unobservable, such as "a reporting entity's or other entity's own data."[77]

[30] Observability is not to be confused with risk level. For example, although US Treasury securities are perceived as risk-free because they do not trade in an active market, they are more accurately categorized as level two.[78]

[31] ASC 820 methodologies are applied to debt and equity investments,[79] derivatives,[80] financial assets/liabilities eligible for fair value option,[81] financial instruments, hybrid financial instruments, and stock compensation.[82] IFRS valuation is applied to financial instruments and revenue.[83] There are exceptions to these generalities for scope and

[74] *Id.* at 4-24.

[75] *Id.* at 4-28; *cf. id.* at 4-38 (listing the factors that indicate an *inactive* market).

[76] PwC, *supra* note 4, at 4-24.

[77] *Id.*

[78] *Id.* at 4-32.

[79] *Id.* at 6-5; *see also id.* at 6-5 to -6 (discussing valuation of equity investments).

[80] *Id.* at 6-17 (discussing the valuation of derivative assets and liabilities).

[81] *See* PwC, *supra* note 4, at 5-7, 6-3 (discussing the fair value option).

[82] *Id.* at 2-2.

[83] *Id.* at 2-3.

practicability.[84] Market participant assumptions, which continue to evolve, are also important to fair market valuation.[85]

[32] Traditional asset valuation methods do not easily lend themselves to digital asset valuations. Stocks and cryptocurrencies are both traded on markets with fluctuating prices. Although they seem similar in context to warrant similar regulation, they differ in their potential for abuse, their nature, acceptance, and use.[86]

[33] Three basic concepts form the foundation for any given valuation analysis: (1) exit price, (2) market price, and (3) the underlying value of the asset if sold. Exit price, which is the price that would be received in a sale of assets and liabilities between market participants at the measured date, controls valuation when available.[87] When exit price is unavailable but market prices are available, market prices are the exclusive basis for valuation of assets that are actively traded (quoted).[88] Next, if the asset is an unquoted investment, a fair valuation first assumes the underlying business or investment sold at the measure date and then appropriately allocates the various interests (regardless of whether the underlying business is prepared for sale or whether the shareholders intend to sell in the near future).[89]

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[84] *Id.* at 2-4, 2-7.

[85] *Id.* at 1-5.

[86] James Royal, *Cryptocurrency vs. stocks: What's the better choice for you?*, BANKRATE (Feb. 16, 2022), https://www.bankrate.com/investing/crypto-vs-stocks/ [https://perma.cc/R2PZ-RP5C].

[87] FASB 157, *supra* note 3.

[88] *See generally* Laurence A. Friedman, *Exit-Price Liabilities: An Analysis of the Alternatives*, 53 ACCT. REV. 895, 904 (1978) (defining exit-price and briefly alluding to its impact on assets).

[89] *See* IFRS, EDUCATION: ILLUSTRATIVE EXAMPLES TO ACCOMPANY IFRS 13 FAIR VALUE MEASUREMENT 4, 9 (2013) (showing how to computations of an unquoted investment require and implement fair valuations).

[34] Thus, in the case of an unquoted asset, the goal in determining the value of a business is to discover the price that would be received to sell an asset or paid to transfer a liability in an ordinary transaction between market participants at a measurement date. The three most common legacy models to ascertain this value are the asset approach, market approach, and discounted cash flow approach. Traditionally, in a private market transaction, a business is valued through either a market approach or discounted cash flow.[90] A review of each will provide a starting point to understand past practices and explain adjustments that may be needed in the age of digital currencies.

A. Asset Approach

[35] The asset approach bases the value of a business on the fair value of its underlying assets less its standing liabilities.[91] The asset approach considers future returns exceeding net assets, focusing on liquidation-adjusted net assets, in contrast to the market and DCF approach, which take a returns-based approach.[92]

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[90] *See* Amber Hoover, *How to Value a Business: The Market Approach*, SPONSEL CPA GRP. (2022), https://www.sponselcpagroup.com/blog/how-to-value-a-business-the-market-approach/ [https://perma.cc/LS6U-EY9A] (market approach); *How does discounted cash flow (DCF) analysis work?*, PITCHBOOK (Oct. 8, 2021), https://pitchbook.com/blog/how-discounted-cashflow-analysis-works [https://perma.cc/53CP-UBUS] (discounted cash flow approach).

[91] Kevin Claypool, *Business Valuation: How to Determine Your Business's Value*, FIRST REPUBLIC (Feb. 9, 2022), https://www.firstrepublic.com/articles-insights/life-money/build-your-business/business-valuation-how-to-determine-your-businesss-value [https://perma.cc/639S-8WH5].

[92] *See* Jason Thompson, *How to Value a Business: The Asset Approach*, SPONSEL CPA GRP., https://www.sponselcpagroup.com/blog/how-to-value-a-business-the-asset-approach/ [https://perma.cc/QPE5-6FWP]; *cf. Business Valuation: The Asset-Based Approach*, EQVISTA (2022), https://eqvista.com/company-valuation/business-valuation-asset-based-approach/ [https://perma.cc/3NRX-T25V] (providing a case study which demonstrates how the asset approach creates an abundance of future returns).

[36] Using the liquidation approach, a business is valued as if it ceased operations, liquidated all its assets, and paid off all debts.[93] The value does not consider any ongoing business and only considers a disposition of assets.[94] It will only account for costs associated with winding up the business, such as commission related to sale of assets, prepayment penalties on debt, employee severance costs, and taxes on disposals and distributions.[95]

[37] The adjusted net asset approach starts at the book net asset value set out in company accounts.[96] Book values do not necessarily reflect the fair value because of depreciation taken on the assets. The estimated useful life of a given asset can differ from its actual useful life. As a result, the adjusted net asset approach attempts to revalue the balance sheet values by aligning them more with the current fair value of the assets. This is done by bringing in machinery experts to determine the depreciated replacement cost of the assets. However, the approach still fails to consider any intangible assets, because they are not represented on the balance sheet.[97]

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[93] *See* Jason Gordon, *Liquidation Value (Valuation) – Explained*, BUS. PROFESSOR (July 14, 2021), https://thebusinessprofessor.com/en_US/business-personal-finance-valuation/liquidation-value [https://perma.cc/N827-S4YE].

[94] *See* Dheeraj Vaidya, *Liquidation Value*, WALLSTREETMOJO, https://www.wallstreetmojo.com/liquidation-value/ [https://perma.cc/S8QB-ZJRC].

[95] *See* Kevin McLeod, *Liquidating a Company*, AABRS (Jan. 26, 2022), https://www.aabrs.com/services/advice/company-liquidation-guide-directors/ [https://perma.cc/KUY7-VGGJ]; *see also* Jake Frankenfield, *Cash Liquidation Distribution*, INVESTOPEDIA (Dec. 22, 2021), https://www.investopedia.com/terms/c/cash-liquidation-distribution.asp [https://perma.cc/9A49-H5DP].

[96] *See* Sean R. Saari, *An Explanation of the Asset Approach to Valuation*, MARCUM (Feb. 18, 2017), https://www.marcumllp.com/insights/an-explanation-of-the-asset-approach-to-valuation-v2 [https://perma.cc/7DA5-PPM6].

[97] *See generally* PwC, *supra* note 4, at 7-5 (providing an overview of asset valuation, including the distinction between an asset's estimated versus actual useful life).

[38] When using the asset approach, it is important to consider the need to engage specialists (machinery valuation, debt, pension, etc.), off balance sheet assets and liabilities, and tax considerations (triggering capital gains).[98] This approach is useful in the valuation of financial service firms. The asset approach can be a useful crosscheck to the returns-based approach discussed below.

B. Market Approach

[39] The market approach looks to peer companies' enterprise value based on the expectation that similar assets will sell for similar prices.[99] The market approach makes three key assumptions: (1) the company cash flow and earnings are similar; (2) the company will have a constant growth profile; and (3) the company will continue indefinitely.[100] To correctly utilize the market value approach, the valuer must understand the subject company, identify the compatibilities of peer companies, determine the appropriate multiple or maintainable base, and finally, make adjustments.[101]

[40] The first step in the market approach analysis is to understand the company being valued. The asset's growth potential and riskiness can be understood by analyzing business operations (type, scale of offering, and geographical diversification), historical and projected financial performance and position, quality and cyclicality of earnings (including

[98] Thompson, *supra* note 92.

[99] *See Market approach definition*, ACCOUNTINGTOOLS (July 23, 2021), https://www.accountingtools.com/articles/what-is-the-market-approach.html [https://perma.cc/DL5D-EFEG].

[100] *See generally* Matt Lawver, *Valuation Basics: Understanding the Market Approach*, VALUE SCOUT (Aug 12, 2021), https://getvaluescout.com/what-is-the-market-approach-method-of-business-valuation/ [https://perma.cc/43PS-8Y8L] (discussing when it is ideal to apply the market approach).

[101] *See Business Valuation: The Market Value Approach*, EQVISTA, https://eqvista.com/company-valuation/business-valuation-market-value-approach/ [https://perma.cc/J8QT-JXM8].

seasonality), capital structure, and the industry and sector within which the company operates (future outlook and key developments). Peer companies should have growth and risk trends similar to the valuation subject. In considering a similar sale, important factors include whether the transaction is in progress or completed, whether control was transferred, and the degree of synergies paid out.[102]

[41] The market approach is more subjective than the asset approach because it heavily considers other similar businesses that have been sold.[103] When using the market approach, a number of factors are typically considered.[104]

[42] When considering recent investments, the typical consideration is whether transactions were at arm's length or not.[105] If a company is planning

[102] *Understand the Market Approach in a Business Valuation*, MERCER CAP., https://mercercapital.com/article/understand-the-market-approach-in-a-business-valuation/ [https://perma.cc/BUP7-L3BC]; *see also 3 Approaches to Valuing a Business*, DANNIBLE & MCKEE (Jan 19, 2018), https://www.dmcpas.com/article/3-approaches-to-valuing-a-business/ [https://perma.cc/AXB3-HHGS]; Tom Allen, *An Overview of M&A Valuation Methods – The Right Price*, MIDAXO (Mar. 3, 2017), https://blog.midaxo.com/project/an-overview-of-mna-valuation-methodologies [https://perma.cc/8W4E-GYZY].

[103] *Compare Market Value Approach*, CORP. FIN. INST., https://corporatefinanceinstitute.com/resources/knowledge/valuation/market-approach-valuation/ [https://perma.cc/RS9P-7H9U] *with* Derek Oster, *The Asset Approach to Valuation*, MARCUM LLP (Sep. 28, 2020), https://www.marcumllp.com/insights/the-asset-approach-to-valuation [https://perma.cc/Z23W-RXNF] (explaining that the asset valuation approach uses only a company's balance sheet whereas the market value approach requires comparing companies and investments an investor considers similar).

[104] *See* CORP. FIN. INST., *supra* note 103 (listing the following seven factors for consideration: whether the companies are operating in the same industry; whether they are similar in size; whether they offer identical services or products; whether any of the companies are operating in multiple industries; the location of the companies; whether they are in competition for the same business; whether they have similar profits).

[105] *Arm's Length Transaction*, CORP. FIN. INST. (Oct. 16, 2019), https://corporatefinanceinstitute.com/resources/knowledge/deals/arms-length-transaction/ [https://perma.cc/M457-Q86G].

on acquiring another company through a transaction, it will be important to understand the disposition of the parties prior to the transaction.

C. Discounted Cash Flow Model

[43] The Discounted Cash Flow ("DCF") method is typically applied to valuation of future income, such as enterprise cash flows (or, less frequently, to equity cash flows).[106] Income expected in the future is of less value to its recipient today than income that the recipient expects today.[107] Therefore, expected net cash flows must be discounted to value future income today. The present value of future expected net cash flows is calculated using a discount rate.[108] The discount rate is "a rate of return that considers the relative risk of the cash flows and the time value of money."[109] Under a DCF analysis, the terminal value is the present value at the end of the projection period of all subsequent cash flows to the end of the life of the asset, or into perpetuity.[110] A DCF analysis estimates future cash flows and terminal value, discounting those amounts to present value at the calculated discount rate.[111] The DCF method factors in capitalization,[112]

[106] *See* Akhilesh Ganti *Terminal Value (TV)*, INVESTOPEDIA (Dec. 2, 2021), https://www.investopedia.com/terms/t/terminalvalue.asp [https://perma.cc/9ZSM-84QN].

[107] *Time Value of Money*, CORP. FIN. INST. (May 7, 2022), https://corporatefinanceinstitute.com/resources/knowledge/valuation/time-value-of-money/ [https://perma.cc/92UL-CYVU].

[108] *See* AM. SOC'Y APPRAISERS, ASA BUSINESS VALUATION STANDARDS 27 (2009) (defining Discounted Cash Flow Method).

[109] PwC, *supra* note 4, at 4-20.

[110] *See Terminal Value (TV)*, *supra* note 106.

[111] PwC, *supra* note 4, at 4-20.

[112] AICPA, *supra* note 69, at ¶ 33.

forecast assumptions,[113] forecast earnings or cash flows, and terminal value.[114]

[44] Cash flows from assets—after debt payments and after making reinvestments needed for future growth—flow to equity and constitute the cash flows available to all equity capital providers ("free cash flows").[115] The discount rate reflects the cost of raising equity financing.[116]

[45] When a DCF analysis is done in a currency that differs from the currency used in the cash flow projections, as in the case of a digital asset versus U.S. dollars or another fiat currency, the cash flows should be translated either using a discount rate appropriate for the foreign currency or using a currency exchange forward curve.[117] However, no such set discount rate or currency exchange forward curve is available for digital assets because they are not traded in exchange markets where closing prices are readily available and representative of fair value.[118]

[46] Digital assets exchanges are most comparable to principal-to-principal markets, where transactions (originations and resales) are negotiated independently with no intermediary.[119] There is often little

[113] *Id.*

[114] *Id.*

[115] *IFRS in Focus – Valuation Methodologies*, DELOITTE (Mar. 1, 2013), https://www.iasplus.com/en/publications/global/ifrs-in-focus/2013/ifrs-in-focus-ifrs13 [https://perma.cc/56LJ-5UB7].

[116] *Id.*

[117] PwC, *supra* note 4, at 4-24 (explaining that "a currency exchange forward curve can be used to translate the reporting currency projections and discount them using a discount rate appropriate for the foreign currency.")

[118] *Id.* at 4-29.

[119] *Id.* at 4-30.

publicly available information about principal-to-principal transactions, making this a relatively unobservable market.[120] If reporting entities use pricing services from third parties, the entity needs to confirm the prices were developed in accordance with the fair value standard.[121]

[47] A pre-adjustment value should be discounted for lack of marketability or liquidity.[122] Observability could have an indirect relationship with liquidity, but liquidity is not a differentiating factor between levels of inputs.[123] A quote for a non-liquid security from a dealer that is ready and able to transact is considered a level two asset.[124] Complex instruments (currency swaps and structured derivatives with longer-dated interest rates) and fixed income asset-backed securities are examples of instruments that are typically level three asset measurements.[125]

[48] To determine the value of a company, the first step is to determine the enterprise value using different valuation methodologies. One of these techniques involves adjusting the enterprise value for factors that a market participant would take into account, such as surplus assets or excess liabilities. The equity value formula is as follows:

Equity Value = Enterprise Value – (debt – (cash & Investment)[126]

[120] *Id.*

[121] *Id.* (citing ASC 820-10-35-54K and IFRS 13.B45).

[122] AICPA, *supra* note 69, at 13.

[123] PwC, *supra* note 4, at 4-28.

[124] *Id.* at 4-35.

[125] *Id.* at 4-37.

[126] *Enterprise Value vs Equity Value*, WALL ST. PREP, https://www.wallstreetprep.com/knowledge/common-topics-of-confusion-for-investment-banking-analysts [https://perma.cc/5R4S-ZNRB].

[49] After determining the enterprise value, that amount is attributed between the company's relevant financial instruments, weighted by priority. With this basic understanding of what the company is worth established, further valuation methods allow an evaluator to zero in on the company's true valuation.

[50] Under the discounted cash flow ("DCF") approach, the analysis forecasts the business's unlevered free cash flow into the future and discounts it back to today's Weighted Average Cost of Capital ("WACC"). After determining the valuation, additional adjustments are made for lack of control, lack of marketability, liquidity, and multiple classes of the assets.

1. Lack of Liquidity

[51] Traditionally, the concept of liquidity considers how easily an asset could readily be converted into a country's functional currency on demand.[127] By converting the asset into a functional currency, the individual can access more options in the market to exchange for a larger variety of goods or services. A country's functional currency has traditionally been viewed as the most liquid asset because it is the most common medium of exchange. Liquidity for any asset can change over time depending on the market size for the asset.

[52] Within the concept of liquidity, there is another concept called market liquidity, which refers to the extent to which an accessible market is available to an individual where assets are bought and sold at transparent prices.[128] To have strong market liquidity, there must be large trade volume within the market. In an exchange context, if the spread between bid and ask price becomes too large and trades are occurring at high volumes, the market will start to lose liquidity and the value of the asset will start to

[127] Adam Hayes, *Liquidity*, INVESTOPEDIA (Aug. 29, 2021), https://www.investopedia.com/terms/l/liquidity.asp [https://perma.cc/8NC9-F8SR].

[128] *Id.*

fall.[129] This results in investors giving up unrealized gain when trying to unload shares at that specific time. Arguably, it may be in an investors best interest to continue to hold the asset until the market becomes more liquid and they can freely exit without effectively being penalized by market conditions.

[53] In the private markets, lack of marketability for a security can detract from value and can become an issue upon exiting an investment. The market participant will typically apply a Discount for Lack of Marketability ("DLOM"). The DLOM considers whether a nonmarketable investment lacks a ready market and whether an illiquid investment is not actively traded or whether there are restrictions on accessing the market.[130] Typically, a minority interest will be considered nonmarketable for investment purposes and must be discounted accordingly.

[54] Marketability, an asset's capability and ease of transfer or salability, denotes the legal ability to sell or transfer ownership.[131] Liquidity refers to an asset holder's ability to readily convert an asset into cash without significant loss of principal.[132] In traditional stocks, liquidity drops rapidly

[129] *See generally* Huong Le & Andros Gregoriou, *How Do You Capture Liquidity? A Review of the Literature on Low-Frequency Stock Liquidity*, 34 J. ECON. SURVEYS 1170, 1170–71 (2020) ("[L]iquid stocks are defined as stocks which are able to trade large volume quickly at low cost with little price impact." The four dimensions of stock liquidity determined from this definition are "trading quantity (how much a security can be traded at a given cost), trading speed (how quickly can a security be traded at a given cost with given quantity), trading costs (all expenses related to the trade of a given quantity of a security), and price impact (how easy it is to trade a security of a given quantity with minimum impact on price)." A bid-ask spread measure implicitly "captures the transaction cost aspect of liquidity.").

[130] *See* Robert Reilly & Aaron Rotkowski, *The Discount for Lack of Marketability: Update on Current Studies and Analysis of Current Controversies*, 61 TAX LAW. 241, 245 (2007).

[131] Ashok Abbott, *Discount for Lack of Liquidity: Understanding and Interpreting Option Models*, 28 BUS. VALUATION REV. 144, 144 (2009).

[132] *Id.*

for larger trading volumes, which results in increasing bid-ask spreads, large price impact, and frequent market failure.[133] As one commentator eloquently stated, "A block of unregistered stock in a privately held business suffers from impairment in value from a lack of both marketability and liquidity."[134]

[55] In creating the appropriate model to discount the investment, several quantitative and qualitative factors are considered. Historically, valuation models consider the following:

- Function of the duration of the restriction (time);
- The inherent risk of the investment (volatility);
- Prospect of liquidity at a future date;
- Pool of potential buyers (the larger the pool of buyers, the smaller the discount);
- Whether there is an established market for the good or service;
- Potential future market growth;
- Restriction on transferability of the security;
- Number, extent, and terms of contractual agreements that impact the ability to purchase or sell the securities;
- Size/timing of any distributions that are to be made; and
- Concentration of ownership. [135]

[133] *Id.* at 145.

[134] *Id.*

[135] CHANDU CHILAKAPATI & ANDREW GALBRAITH, ALVAREZ & MARSAL, VALUATION SERVICES, RESTRICTED SHARES AS COMPENSATION: THE BENEFIT THAT BENEFITS ALL, https://www.alvarezandmarsal.com/sites/default/files/valuationservices_restrictedstock_final.pdf [https://perma.cc/4Q7H-FLW2]; John E. Elmore, *Determining the Discount for Lack of Marketability with Put Option Pricing Models in View of the Section 2704 Proposed Regulations*, WILLAMETTE: VALUATION PRACTICES AND PROCEDURES INSIGHTS, Winter 2017, at 32, 42; *see* Chris Mercer, *The Quantitative Marketability Discount Model's (QMDM) 20th Anniversary*, CHRIS MERCER: USEFUL BUS. VALUATION INFO. & INSIGHTS (Oct. 24, 2017), https://chrismercer.net/the-quantitative-marketability-discount-models-qmdm-20th-anniversary/ [https://perma.cc/GQA8-MCBX].

[56] Over time, three quantitative foundational models have been developed to determine the discount amount attributable to nonmarketable securities: (1) the prospective put model (which focuses on loss avoidance); (2) the Longstaff model (which focuses on unrealized gains); and (3) the quantitative marketability discount model (which focuses on income).

a. Prospective Put Model (PPM)

[57] A put option is an option to sell financial assets at an agreed price on or before a particular date.[136] The premium is the price of the option and represents the present value, at the risk-free rate, of the expected benefit from owning the option at maturity.[137] Thus, the ability to exercise this right results in a lack of marketability which must be discounted.[138]

[58] The holder of an asset faces two price risk components: 1) realized loss, and 2) opportunity loss that occurs when the asset increases in price during the period of illiquidity and then declines to a lower value before the asset can be liquidated.[139] A put option covers this risk, and the prospective put model, first described in 1993 by David Chaffe, includes compensation for both loss types.[140] Chaffe developed a model to measure this discount by dividing the value of the put at the time period of restriction by the current value of the stock.[141]

[136] Elmore, *supra* note 135, at 33.

[137] Abbot, *supra* note 131, at 146.

[138] *See* Elmore, *supra* note 132, at 32.

[139]Abbot, *supra* note 131, at 146.

[140] *Id.*

[141] Elmore, *supra* note 135, at 34.

[59] The prospective put model focuses on loss avoidance[142] and estimates the discount for lack of marketability as the value of an at-the-money put with a life equal to the restriction divided by the marketable stock value.[143] This formula produces prices that vary directly with time and volatility and inversely with interest rate.[144] By calculating the purchase at the time-money put option, the buyer is guaranteed a price at minimum equal to today's stock value.

[60] Models based on put options are employed to measure price risk associated with lack of liquidity, where the put option premium is used to estimate the cost of liquidity.[145] Put option models estimate the price risk borne by an owner during the period of illiquidity.[146] This model has been widely used by market participants to determine the discount on nonmarketable security. However, this method can be inaccurate because investors do not have perfect market-timing ability.[147]

b. Longstaff Model

[61] A "lookback" option permits the option to be exercised prior to the expiration date, permitting the holder to look back at the end of the put option's life and retroactively exercise the option at the highest stock price during the holding period, yielding the maximum return.[148] Similarly, the

[142] *Id.* at 42.

[143] *See id.* at 34.

[144] *Id.* at 40 (illustrating that the price of the stock sales varies depending on the time and volatility).

[145] *See id.* at 33.

[146] Elmore, *supra* note 135 at 38–39.

[147] *Id.* at 44.

[148] *Id.* at 42.

Longstaff model[149] focuses on restricted transferability and unrealized gains[150] using a hypothetical "look-back" option to consider the upper bound in the discount for lack of marketability.[151]

[62] The Longstaff model assumes an investor has perfect timing, but is unable to exercise the option to benefit from that perfect timing due to a restriction period.[152] If an investor had perfect timing, Longstaff suggested, the value of marketability would be the present value of the incremental cash flow that the investor would receive if the marketability restriction were relaxed.[153] For an actual investor with imperfect market timing ability, the value of marketability would be less.[154] Therefore, the Longstaff model creates an upper bound on the value of marketability, providing a benchmark for estimating the valuation effects of marketability restrictions[155] representing the largest discount for lack of marketability that could be sustained in a market with rational investors.[156]

[63] Proponents suggest that this model is beneficial in that it can characterize whether the nonmarketable instrument can be hedged and whether its owner possesses any sort of skill related to the particular

[149] Francis A. Longstaff, *How Much Can Marketability Affect Security Values?*, 50 J. FIN. 5, 1767–68 (1995).

[150] Elmore, *supra* note 135, at 42; *see also* John D. Finnerty, *The Impact of Transfer Restrictions on Stock Prices*, (Oct. 2002), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=342840 [https://perma.cc/B5JM-KTFK].

[151] Elmore, *supra* note 135, at 42.

[152] *Id.*

[153] Longstaff, *supra* note 149, at 1769.

[154] *Id.*

[155] *Id.* at 1768.

[156] *Id.* at 1770.

instrument.[157] The Longstaff model's underlying assumptions are inconsistent with the reality of perfect timing as well as the assumed volatility level between ten to thirty percent, yet small stocks typically have volatility exceeding fifty percent.[158]

c. Quantitative Marketability Discount Model (QMDM)

[64] The QMDM approach takes an income-based approach for determining the lack of marketability at the shareholder level. Chris Mercer and Travis Harms developed the QMDM in the early 1990s[159] to employ the basic DCF model to value illiquid interests of closely held enterprises in the context of appraisals.[160] The QMDM is a shareholder-level discounted cash flow method under the income approach to valuation[161] where value is a function of expected cash flow, risk, and growth.[162] The model points out concerns over whether the security is held for a long period of time.

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[157] J. Gregory Vermeychuk, *Theoretical Models for Discount for Lack of Marketability (DLOM)*, MONTGOMERY INV. TECH. (Feb. 2015), http://www.fintools.com/wp-content/uploads/2015/02/MITI-White-Paper-Theoretical-Models-for-Discount-for-Lack-of-Marketability.pdf [https://perma.cc/WHU5-E3CH].

[158] Elmore, *supra* note 135 at 44.

[159] Z. Christopher Mercer, *The QMDM and Estimating Required Rates of Return for Restricted Stocks of Public Companies*, 20 BUS. VALUATION REV. 5, 5 (introducing the model publicly at the Join ASA/CICBV Conference in San Diego, California in 1994).

[160] Z. Christopher Mercer, *A Primer on the Quantitative Marketability Discount Model*, CPA J. (July 2003), http://archives.cpajournal.com/2003/0703/dept/d076603.htm [https://perma.cc/H3YC-U644].

[161] Mercer, *supra* note 135.

[162] *Id.*

[65] The underlying assumption behind the QMDM model is that investors in illiquid securities require higher rates of return than investors with liquid securities. The model also assumes the valuation was performed at the marketable minority level of value.

[66] To determine the applicable marketability discount, the QMDM considers the rate of return information provided by restricted stock transactions over relevant holding periods, estimating the value of illiquid interests based on the expectation of benefits over relevant expected holding periods using appropriate discount rates to equate with present values.[163] The model considers the following valuation inputs:

- Expected growth rate in value of the underlying enterprise;
- Expected dividend/distribution yield (expressed on a C corporation equivalent basis);
- Expected growth rate of distributions and dividends;
- Required holding period rate of return, or shareholders' discount rate; and
- Expected holding period or range of holding periods.[164]

[67] One major shortcoming of the QMDM is that it has not been accepted by courts in any case, but it has been mentioned explicitly in three tax cases from 2000, 2001, and 2006.[165] The QMDM has also been criticized for measuring minority discount, relying on arbitrary growth assumptions, and requiring additional assumptions.[166]

[163] Z. Christopher Mercer & Travis W. Harms, *Marketability Discount Analysis at a Fork in the Road*, 20 BUS. VALUATION REV. 21, 23 (2001).

[164] *Id.* at 31.

[165] *See* Janda v. C.I.R., Nos. 5100–99, 2001 WL 95127, at *4 (T.C. 2001); Weinberg v. C.I.R., No. 5076–97, 2000 WL 157919, at *8 (T.C. 2000); Temple v. U.S., 423 F.Supp.2d 605, 613 (E.D. Tex. 2006); *cf.* Z. Christopher Mercer, *Discounts on Real Estate Partnership Interest—IRS Loses on Minority Interest, Wins on Lack of Marketability*, 28 J. REAL EST. TAX'N 57 (2000) (discussing QMDM and tax court).

[166] Mercer & Harms, *supra* note 163 at 32–33.

IV. APPLICATION OF TRADITIONAL VALUATION METHODS TO DIGITAL ASSETS

[68] Traditional valuation methods only limitedly apply to digital assets. While there are large commonalities, the digital assets space requires a disparate analysis of digital asset pricing. Many factors impact the price of a digital asset, including supply and demand, number of competing digital assets, cost to produce the asset through mining, rewards issued to miners for verifying transactions to the blockchain, regulations governing sale and use, internal government, and news.

A. Market Pricing

[69] When available, exit or market prices control. In the case of exit prices, enough data is published by Bitcoin Charts to make it possible to calculate average Bitcoin prices, but such a resource is often not available for other cryptocurrencies.[167]

[70] In the market for digital assets, liquidity has traditionally been provided via centralized exchanges. Crypto exchanges share some similarities to traditional exchanges in that they only have limited offerings, they charge a fee for providing a market, and they help manage user accounts.[168] However, trade execution on digital assets exchanges is different from traditional exchanges. The main issue may be that the number of token holders has not continued to expand exponentially year over year.[169] Having a greater number of stakeholders may result in deeper liquidity—one of the key elements considered in determining how healthy

[167] Ashley Pittman, *The Evolution of Giving: Considerations for Regulation of Cryptocurrency Donation Deductions*, 14 DUKE L. & TECH. REV. 48, 57 (2015) (citing BITCOIN CHARTS).

[168] Nathan Reiff, *What Are Centralized Cryptocurrency Exchanges?*, INVESTOPEDIA (Aug. 27, 2021), https://www.investopedia.com/tech/what-are-centralized-cryptocurrency-exchanges/ [https://perma.cc/SD8Q-TFEU].

[169] *Id.*

a market is at any given time—in the market, which would in turn allow for seamless movement in and out of the market.

[71] Today, the most common way to enter and exit the digital asset market is through exchanges. Originally, digital assets could only be traded on a centralized exchange (such as Coinbase, Binance, or Kraken), where holders faced custody and intermediary issues.[170] In 2020, decentralized finance appeared, and along with it came decentralized exchanges. Decentralized exchanges (DEXes) are smart contracts that allow users to directly (peer-to-peer) buy, sell, or trade digital assets.[171]

[72] Digital assets are less liquid when individuals try to move large amounts at once. If an individual wants to sell a large number of tokens through an exchange, the individual should ensure they do not flood the market, causing price to drop on the exchange. Remedies or solutions include monitoring and buy-in.[172]

[73] To increase the trading volume, one solution is to have a federal governing authority, or a self-regulatory organization monitor the exchange to assure compliance with existing laws. Currently, there continues to be uncertainty surrounding the legality of many crypto exchanges from the role broker dealers play to what is considered a security under federal securities law.[173] The uncertainty surrounding these legal issues has a chilling effect

[170] *See, e.g.*, Kendall Little, *Want to Buy Crypto? Here's What to Look for In a Crypto Exchange*, NEXTADVISOR (Oct. 22, 2021), https://time.com/nextadvisor/investing/cryptocurrency/what-are-cryptocurrency-exchanges/ [https://perma.cc/ZR43-6JBT].

[171] William Peaster, *What is DeFi? Understanding Decentralized Finance*, DEFI PULSE (Aug. 31, 2021), https://www.defipulse.com/blog/what-is-defi [https://perma.cc/3WUT-FM4Y].

[172] *What Is Market Liquidity?*, CRYPTOPEDIA (Mar. 10, 2022), https://www.gemini.com/cryptopedia/what-is-liquidity-bid-ask-spread-slippage [https://perma.cc/VM69-6B5K].

[173] *See, e.g.*, Catherine Rowsey et.al, *SEC to Keep Watchful Eye on Digital Asset Trading Platforms*, HOLLAND & KNIGHT (Feb. 16, 2022), https://www.hklaw.com/en/insights/publications/2022/02/sec-to-keep-watchful-eye-on-digital-asset-trading-platforms [https://perma.cc/FA89-X4RW].

on the market. Once the market gains greater clarity on the legal issues surrounding this new asset class, increased liquidity in the market may follow.

[74] Another way to increase liquidity is to have buy-in from the business community. This might involve using crypto for the business's transactions. Increasing liquidity does not mean only being able to exchange crypto for fiat currency, but also the ability to exchange crypto itself for any good or service. The use crypto in transactions may increase market liquidity.

[75] Custody introduces additional uncertainties that are unique to exchanges for digital assets. Traditional exchanges stay away from the broker dealer role and never touch the custody of the asset. In contrast, digital asset transactions take place on the blockchain and therefore require exchanges to store funds in an offline digital wallet (traditionally referred to as cold storage).[174] Blockchain transactions are required to be stored eternally and redundantly on as many machines as possible in order to aid decentralization.[175] By having the crypto exchange perform the services of a traditional broker/dealer and custody holder, digital asset exchanges face uncertainties and increased liability that do not impact traditional exchanges.[176]

[174] *See* Ryan Haar, *How to Decide on a Hot Wallet or Cold Wallet for Your Crypto, and Whether You Need One at All*, NEXTADVISOR (Sept. 23, 2021), https://time.com/nextadvisor/investing/cryptocurrency/hot-wallet-vs-cold-wallet/ [https://perma.cc/KMW9-GVPS].

[175] CRAIG CALCATERRA & WULF A. KAAL, DECENTRALIZATION: TECHNOLOGY'S IMPACT ON ORGANIZATIONAL AND SOCIETAL STRUCTURE 177 (2021).

[176] *See* Wulf A. Kaal & Hayley A. Howe, *Custody of Digital Assets*, MEDIUM (Oct. 21, 2021), https://wulfkaal.medium.com/custody-of-digital-assets-9fed9b207abe [https://perma.cc/9VZL-FXK9] (discussing the role digital custody plays in the evolution of the digital asset industry).

[76] As a result of these uncertainties, some exchanges have refused to accept any trading account with individuals in the United States.[177] One issue with U.S.-based customers is the potential application of long-arm jurisdiction statutes. When U.S.-based individuals are precluded from trading on digital asset exchanges, or when exchanges exclude certain individuals from access based on residence or any other status, this reduces the number of participants allowed in the market. When different exchanges apply different standards as to who can trade on their platform, the market sees different prices for the same asset across exchanges. This issue contributes to trading arbitrage in the crypto market.

B. Private Market Transactions

[77] Valuation in the context of private market transactions is much less transparent than for publicly owned companies whose shares are purchased on an exchange with a published market price. As discussed above, a business is valued via either a market approach or discounted cash flow in a traditional private market transaction.

1. Market Approach

[78] The market approach values a subject company by examining peer companies' enterprise value based on cash flow and earnings, constant growth profile, and assumed indefinite life of the company.

[79] Factors impacting the adoption, success, and price of digital assets that are unique from traditional assets include technical core (blockchain native, ERC-20, Dapp, etc.), token model (currency, stablecoin, utility, asset-backed, etc.), underlying value (inherent, permission to use, permission to work, physical asset, share in enterprise), valuation trajectory

[177] *See id.* (discussing the OCC guidelines on digital custody in response to banks being apprehensive to provide custody services for digital assets).

(inflationary or deflationary), user experience, ecosystem breadth, consensus protocol, and governance.[178]

[80] To reduce price volatility in digital assets, the stablecoin was born. A stablecoin is pegged to the value of an external asset (frequently fiat currency).[179] Stablecoins are affordable, low-friction options in international transfers.[180] In fact, stablecoins are used to increase digital asset market liquidity by supplying stablecoins to DEX liquidity pools.[181]

[81] Digital assets are comparable to high-growth companies, where scenario planning is critical because markets may not yet exist.[182] In such a case, business leaders must start from the future rather than from the present.

[82] When applying the market approach to digital assets, the valuer can look to secondary trade pricing or comparable token price.[183] Secondary trade pricing (as seen in exchanges) are relevant when liquidity is high

[178] *See generally* Wulf A. Kaal, *Crypto Economics – The Top 100 Token Models Compared*, 1, 11–29 (Sept. 18, 2018), https://wulfkaal.com/2018/09/18/crypto-economics-the-top-100-token-models-compared/ [https://perma.cc/9PVL-ZY44].

[179] William Peaster, *What are stablecoins? A guide to stable crypto money*, DEFI PULSE (Jan. 10, 2022), https://www.defipulse.com/blog/stablecoins [https://perma.cc/LBZ6-YFSC].

[180] *Id.*

[181] *Id.*

[182] Liz Ericson & Tim Koller, *Why 'digital' is no different when it comes to valuation*, MCKINSEY & CO. (Oct. 20, 2020), https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/why-digital-is-no-different-when-it-comes-to-valuation [https://perma.cc/BVF2-TSWX].

[183] ERNST & YOUNG, THE VALUATION OF CRYPTO-ASSETS, 1, 7 (Feb. 26, 2019), https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/emeia-financial-services/ey-the-valuation-of-crypto-assets.pdf [https://perma.cc/8ECY-J4J7].

enough to rely on these prices.[184] The analysis for liquidity and depth of trades can be significantly different between token-to-token trades versus token-to-fiat trades. When liquidity is lacking or unreliable, a valuer can discount for lack of liquidity as described above. Tokens can also be valued according to comparable token prices, where factors indicating comparability are those unique characteristics of digital assets described above.

[83] A couple of other valuation models developed in 2017 and 2018 can help inform the evolution of digital asset valuation. First, for utility tokens used as a pure medium of exchange for network access, the network utility usage valuation can capture a low amount of the token's value.[185] The minimum network value can be calculated by using supply, demand, and velocity.[186] Second, the price to earnings ratio is similar to network value to transactions ratio.[187]

2. Discounted Cash Flow Approach

[84] The Discounted Cash Flow model seeks to value enterprise cash flows. The discount rate considers the relative risk of future cash flow and time value of money.

[85] Until this point, we have thought of digital asset valuation as valuing a given token at a given time, so DCF would appear at first glance not to be a good fit for digital asset valuation. However, some digital asset networks

[184] *Id.*

[185] Aenigma Capital, *How do you value cryptocurrency?*, MEDIUM (May 5, 2018), https://medium.com/@aenigmacapital/how-do-you-value-cryptocurrency-3d296f68ec40 [https://perma.cc/4EB2-WHK7].

[186] *Id.*

[187] Willy Woo, *Introducing NVT Ratio (Bitcoin's PE Ratio), Use It to Detect Bubbles*, WOOBULL (Oct. 5, 2017), https://woobull.com/introducing-nvt-ratio-bitcoins-pe-ratio-use-it-to-detect-bubbles/ [https://perma.cc/Q3UF-JDKR].

do return cash flows to token holders or those who contribute work to the network.[188] In such a case, DCF can shed light on the role of these structures in digital asset valuation.

[86] DCF is applicable in fee incentivized networks where platforms record transaction fees that are paid out to token holders who perform work on the network.[189] This model is used in some distributed autonomous corporations (DACs).[190] Proof of Work ("PoW") networks (Dash Master Nodes, Ethereum Validators after Proof of Stake ("PoS")) make service fee payments to workers who are paid tokens by other users for the services they perform.[191] Ripple, Stellar, Factcom, and Binance offer token burns or buybacks, comparable to product sales paid for using company stock, known as treasury stock (share repurchases).[192] In this case, tokens are purchased and destroyed for use by the platform or to distribute profits.[193] Next is inflationary or dilutive value redistribution (Stellar, Factcom Federated Servers, Dash, Pivx), where networks pay newly-minted block rewards to workers as an expense that redistributes value.[194] These are dividend payments, where token holders receive an ongoing stream of value distributions.[195]

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[188] Todaro, *supra* note 63.

[189] *Id.*; James Todaro et al., *Republic Protocol: Analysis and Valuation*, MEDIUM (June 2, 2018), https://medium.com/greymatter/republic-protocol-analysis-and-valuation-e73fab4c32fc [https://perma.cc/U9V7-6J8V].

[190] Aenigma Capital, *Fundamental Valuation Approaches: DCF*, MEDIUM (May 6, 2018), https://medium.com/@aenigmacapital/fundamental-valuation-approaches-dcf-3dcdbf873c3b [https://perma.cc/DV4D-74N3].

[191] *Id.*

[192] *Id.*

[193] *Id.*

[194] *Id.*

[195] Aenigma Capital, *supra* note 190.

[87] Cash flow is impacted by whether a token's model is inflationary or deflationary. A deflationary model of token issuance caps the number of tokens that will ever be issued by the respective token issuer.[196] This method is utilized by tokens such as Bitcoin.[197] With a deflationary method, prices are expected to increase due to the fundamental scarcity of token supply.

[88] Tokens that utilize an inflationary model often attempt to operate like a fiat currency. This typically means that no maximum number of token issuance is contemplated. Rather, inflationary token models consider a continuing token minting process that allows the issuer more flexibility depending on the current state of the token and the general market environment.[198] Several indicia seem to suggest that as the cryptocurrency market matures, inflationary token models may continue to become more popular.[199] Inflationary token models allow the use of stability mechanisms, which may allow more experimentation with volatility mitigation.

[89] In the case of Bitcoin, the reward per mined transaction has decreased over time from its initial 50 Bitcoins in 2009.[200] In November, 2021, the reward per mined transaction was 6.25 Bitcoins.[201] One valuation method that focuses on cash inflow is a trailing twelve-month revenue to

[196] *Id.*

[197] Kaal, *supra* note 178.

[198] Vildana Hajric, *Need an Inflation Hedge? Bitcoin Has Delivered 99.996% Deflation*, BLOOMBERG, (Nov. 11, 2021, 1:21 PM), https://www.bloomberg.com/news/articles/2021-11-11/need-an-inflation-hedge-bitcoin-has-delivered-99-996-deflation [https://perma.cc/ZX22-WV6A].

[199] *Id.*

[200] Keith Black, *What's the Correct Valuation Model for Digital Assets?*, CAIA ASS'N (Nov. 21, 2021), https://caia.org/blog/2021/11/21/whats-correct-valuation-model-digital-assets [https://perma.cc/V8W4-R9WR].

[201] *Id.*

miners, stakers, and liquidity providers.[202] Another is a stock-to-flow model, which shows that historically the price of Bitcoin has correlated inversely to mining reward amount.[203] However, Bitcoin's issuance schedule and relative scarcity are not necessarily the only reasons for its rise in value.[204] "There are thousands of bitcoin copycats with the same issuance schedules, but none can match its demand, and thus its value."[205]

V. CONCLUSION

[90] Traditional valuation methods are only loosely applicable to digital assets. While there are large commonalities, the digital assets space requires a disparate analysis of digital asset pricing. Digital asset valuation methodologies vary significantly. Tradeoffs between such methodologies allow for some valuation discretion between digital asset managers. The lack of standards for digital asset valuation leads to uncertainty and confusion among investors and managers. The industry would benefit from uniform standards for digital asset valuation. Such standards can evolve over time as the market evolves. Standard setting requires common core practices that evolve with the technology.

[202] *Id.*; *Staking*, ALEXANDRIA, https://coinmarketcap.com/alexandria/glossary/staking [https://perma.cc/WY5Y-YXYM] (Staking is defined as "[p]articipation in a proof-of-stake (PoS) system to put your tokens in to serve as a validator to the blockchain and receive rewards.")

[203] Steven Ehrlich, *Demystifying Bitcoin's Remarkably Accurate Price Prediction Model, Stock-To-Flow*, FORBES (Apr. 29, 2021, 8:14 AM), https://www.forbes.com/sites/stevenehrlich/2021/04/29/demystifying-bitcoins-remarkably-accurate-price-prediction-model-stock-to-flow/?sh=48f4e46e476a [https://perma.cc/7EGB-R99J].

[204] *Id.*

[205] *Id.*