DIGITAL ASSET VALUATION

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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.

***Key Words**:* Digital Assets, Valuation, Blockchain, Distributed Ledger Technology, Emerging Technology

***JEL Categories**:* K20, K23, K32, L43, L5, O31, O3

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I. Introduction

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

Pricing inadequacies are at the forefront of the issues that undermine the evolution of the digital asset market. The valuation infrastructure in the current legal, accounting, finance, technology, and back-office framework 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 managers' valuation efforts and methodology. While many traditional assets also cannot be fully assessed, the lack of valuation accuracy for financial reporting is exacerbated by the lack of established pricing standards for digital assets.

The definition of fair value under existing accounting terminology may not apply to digital assets.[2] As a result, the correct valuation of digital assets may not be possible for financial reporting issues. Digital assets may also not meet the definition of financial instruments under

[1] Sid Clarkmore, *Why is BTC-E Bitcoin Cheaper and Lower in Price Than Other Markets?*, HEAVY (Nov. 20, 2013), http://perma.cc/XPP5-DEJ2).

[2] Financial Accounting Standards Board, *Statement No. 157* (DATE?) ("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.

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

It is unclear how digital assets may be priced in fair valuation metrics under the existing accounting terminology. Fair value is defined as the exit price of a given asset at the time of sale in an orderly market.[3] Three classes of asset falls help categorize fair value of an asset which reflect the level of judgment in estimating fair values, in order from most to least liquid. Assets in the Level one category generally are liquid exchange-traded assets that have reliable observable inputs.[4] Bitcoin and Ethereum as 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. For traditional markets, when a security is dual-listed, we see the bid-ask spread decrease because additional liquidity is being injected into the market. This differs from the crypto market where the difference between the two exchanges can reach upwards of 5% during peak trading times.[5] As markets continue to develop, this market arbitrage should continue to reduce.

Level two encapsulates semi-liquid or illiquid assets but allows asset managers to extrapolate price based on comparable assets.[6] Typically, 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).

Level three uses unobservable inputs that are developed internally from the reporting entity's point of view. The assessment of market

[3] International Financial Reporting Standards Foundation, *IFRS 13 Fair Value Measurement* (2021); [3] PwC, *Fair value measurements* global accounting and financial reporting guide (Sep. 2019) at 8 or 1-4.
[4] FASB 157, *supra*.
[5] https://www.gemini.com/cryptopedia/crypto-arbitrage-crypto-exchange-prices
[6] FASB 157, *supra*.

participant assumptions are based on the most up to date information. These inputs are used when there are little, if any, market activity for the asset or liability at the measurement date.

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

Digital asset valuation methodologies vary significantly. Tradeoffs between such methodologies allow for some valuation discretion between digital asset managers. For instance, when quoting level 1 securities, while some managers may use the price on their favored cryptocurrency exchange, others might take an aggregate the price from multiple exchanges.[7] 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.

Digital assets valuation is critical to the establishment of digital assets as a legitimate financial asset.[8] Digital currencies are being recognized

[7] A datafeed by Coinmarketcap.com offers the average price. Because of the shortcomings of average price determination, several industry participants have started to use proprietary methods in an effort to determine best industry practices. See for instance Lukka proprietary pricing: "Called Lukka Pricing, Lukka's new service lets fund administrators to use one of three different methodologies when striking a price for a cryptoasset: an average pricing methodology, the price struck by the fund itself or the price on the primary exchange. Here is how the firm describes its five steps to coming up with a spot price for a cryptocurrency based on picking its primary exchange. The first consists of assigning for each currency traded on each exchange accessed by the fund manager a base exchange score (BES) reflecting the compliance oversight, microstructure and technology used by the exchange. The second consists of adjusting the BES on the relative monthly volume on each exchange to create the volume adjusted score (VAS). The third is to decay or adjust the VAS to take into account the time passed since the last trade to create the decayed volume adjusted score (DVAS). The fourth step is to select the exchange which has the highest DVAS as the principal market. Lastly, the price of the last transaction on the principal market is the Lukka spot price.

[8] Hayes, *supra* note 1, at 1308.

as an emerging asset class and an emergent derivatives market is slowly evolving for digital currencies.[9]

II. Digital Asset Valuation

1. Digital Asset Valuation Issues in Practice

Digital asset valuation issues are affecting business decisions for digital asset startups and have resulted in litigation. The existing litigation record involving cases on digital asset valuation provides an early indicator on digital asset valuation issues that may require further clarification.

a) Market Arbitrage Issues

The concept of arbitrage is common in traditional markets and has started to creep into the crypto markets. Traditionally, when securities are being bought and sold for different prices at the same time, individuals will look to cover the spread by arbitrage trading. This has become one of the key indicators of an inefficient market.

The reason arbitrage trading starts to happen is because of asymmetries of information across the different exchanges. These asymmetries can happen as a result of imperfect disclosures or incite on whether a company has a willingness to take on debt. As a result, market efficiency decreases, which may allow for arbitrage traders to take advantage of market conditions.

One of the most prominent examples of arbitrage happened on the South Korean exchange Bithumb. On December 15, 2017, when Bitcoin hit it's all time high, Coinbase was trading one bitcoin for roughly $18,500. On this same day, Bithumb hit $21,000 per Bitcoin. Traders able to time their trades correctly made roughly 14% just by providing additional liquidity to the Bithumb market.

[9] Adam S. Hayes, *Cryptocurrency value formation: An empirical study leading to a cost of production model for valuing bitcoin*, 34 TELEMATICS AND INFORMATICS 1308, 1308 (2017).

It is unlikely any South Korean investor was able to take advantage of this opportunity because of the hurdles they would have to go through before being able to access the US exchange Coinbase. The Korean investor would have had to take their Korean Won and transferred it into United States dollars because that is the functional currency used by Coinbase. This requires a reliance on the foreign exchange market that would increase the fees associated with 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.

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

Arguably, arbitrage traders may be providing markets with liquidity they would otherwise be lacking. 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.

b) Private Investment Fund Valuation Issues

Exchanges are not the only place that have seen issues with crypto valuation, the private investment fund space has also run into valuation issues. For example, Polychain Capital was one of the first digital asset funds that was involved in litigation over the valuation of its digital assets. In 2017, an investor in Polychain Capital, Mr. Greenhouse, who gained over 2000 percent through his investment in Polychain Capital, sued the fund over the fund's asset valuation.[10]

Several events precipitated Mr. Greenhouses's decision to sue Polychain Capital. According to Greenhouse, Polychain Capital's employees made contradictory statements regarding the valuation of digital assets.[11] Polychain Capital had assured Mr. Greenhouse the

[10] *Greenhouse*, No. CV 2018-0214-JRS,

[11] Greenhouse was a limited partner of Polychain at the time of this request and "[i]n reliance upon the assurances given by [Eagan]," on November 27, 2017, Greenhouse notified Polychain by email that he wanted to make a full redemption

fund's most liquid assets would be valued for redemption and there would be a framework to value less liquid assets.[12] Later he was told the illiquid assets would be placed in side pockets[13] and excluded from the redemption until they were deemed to be liquid by Polychain Capital.[14] Because Greenhouse requested full withdrawal before Polychain had designated any side pockets, Polychain determined his redemption would be valued without the benefit of excluding less liquid assets from the valuation process until their liquidity improved.[15] Upon request, Polychain Capital told Greenhouse the fund's asset valuation policy would not be disclosed.[16] Thereafter, Polychain Capital denied Greenhouses's requests for information and

of his capital account. Compl. ¶ 15. On November 29, 2017, Greenhouse emailed Jacquiss requesting confirmation that his redemption would be made as described by Eagan. Compl. ¶ 16. Jacquiss informed Greenhouse the redemption would not follow the process Eagan described during the November 15 call but would not explain why. Compl. ¶ 16. The Court opinion reveals that the redemption would be valued "under the old terms" and that no assets would be side-pocketed. *Greenhouse*, No. CV 2018-0214-JRS, at *2 (citing Compl. ¶¶ 7, 16).

[12] *Greenhouse*, No. CV 2018-0214-JRS, at *2 (citing Compl. ¶¶ 10, 14-15).

[13] The opinion explains that a "side pocket" is a "type of account used by hedge funds to separate illiquid, hard-to-value assets from liquid assets." *Greenhouse*, No. CV 2018-0214-JRS, at fn 8 (citing Henry Ordower, *Demystifying Hedge Funds: A Design Primer*, 7 U.C. Davis Bus. L.J. 323, 328 (2007)). Most often, some 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. *Id*. Some funds estimate the value of side pocket positions and include a payment for them in the redemption price. *Id*. 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. *Id*. Occasionally, managers 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. *Id*.

[14] *Id.* (citing Compl. ¶ 14). On December 13, 2017, counsel for Polychain Capital contacted Greenhouse via email. Compl. ¶ 17. The Court opinion reveals that this email "largely confirmed Eagan's prior assurances concerning the valuation procedures." *Greenhouse*, No. CV 2018-0214-JRS, at *2 (citing Copml. ¶ 17; Compl., Ex. D). 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. *Greenhouse*, No. CV 2018-0214-JRS, at fn 14.

[15] *Id.* at *2 (citing Compl. ¶ 17; Compl., Ex. D).

[16] *Greenhouse*, No. CV 2018-0214-JRS, at *2 (citing Compl. ¶¶ 18, 19; Compl. Ex. E), Compl. ¶ 18.

his request to suspend his redemption.[17] Mr. Greenhouses capital account with Polychain had been redeemed and he received a wire transfer for the withdrawal amount without receiving any documentation or valuation explanation.[18] The fund denied subsequent requests to review its book and records.[19]

[17] On December 22, 2017, Greenhouse's counsel sent Polychain Capital counsel a letter requesting information. Compl. ¶ 19. On December 26, 2017, having received no response, Greenhouse's counsel sent another letter to the owner and manager of Polychain Capital and Polychain 2030 directing Polychain to suspend Greenhouse's request to redeem his interest. Compl. ¶ 20. On December 30, 2017, Polychain counsel responded via letter stating that Greenhouse's request to suspend his redemption was denied. Compl. ¶ 21.

[18] On January 25, 2018, Greenhouse received an investor statement dated December 31, 2017 indicating that his capital account for Polychain had been redeemed. Compl. ¶ 22. On January 29, 2018, Greenhouse received a wire transfer for the withdrawal. Compl. ¶ 22. Greenhouse at no time received explanation for, or documentation regarding the information he requested. Compl. ¶ 23. Polychain withheld 5% of Greenhouse's capital account as an audit holdback per Polychain's limited partnership agreement. *Greenhouse*, No. CV 2018-0214-JRS, at *2 (citing Compl. ¶ 22, Compl., Ex. A (limited partnership agreement) § 8.04 "[T]he General Partner shall have the right, at its discretion, to withhold 5% of the net asset value of the withdrawn Capital Account for the Partnership's liabilities and other contingencies until no later than 30 days after the completion of the year-end audit of the Partnership's financial statements …").

[19] On February 20, 2018, Greenhouse sent a request to Polychain owner and manager seeking to examine Polychain's books and records in connection with his redemption. Compl. ¶ 24. Greenhouse stated his goal was "to evaluate the figures reported and the amount paid to [him" and the General Partner. Compl. ¶ 24. Polychain denied Greenhouse's request via letter through their counsel on February 26, 2018, stating that the Delaware Revised Uniform Limited Partnership Act did not give limited partners the right to the information Greenhouse requested. Compl. ¶ 25. On February 28, 2017, Greenhouse's counsel formalized and renewed Greenhouse's inspection demand pursuant to 6. Del. C. § 17-305 via letter to Polychain counsel, including their special power attorney required by the statute. Compl. ¶ 26. The request demanded that Polychain "produce for inspection and copying any and all books and records from the time Mr. Greenhouse invested pertaining to [redacted]." Compl. ¶ 26. Polychain failed to respond as of the date Greenhouse filed this action on March 9, 2018. Compl. ¶ 28. Greenhouse states that these efforts have complied with the requirements of section 17-305 with respect to the form and manner of his demand on Polychain for inspection and copying of Polychain's books and records in the demand letter sent by his counsel on February 28, 2017.

In 2018, Greenhouse filed an action to enforce his rights as limited partner in Polychain Capital.[20] Polychain argued that at the time Greenhouse filed his complaint, he had already withdrawn from the partnership and fully redeemed his partnership interest, he was no longer a limited partner and therefore had no standing to inspect Polychain's books and records.[21] Polychain argued Greenhouse was instead at most a creditor with no inspection rights.[22] The complaint did not allege that Greenhouse resisted Polychain'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.[23] Therefore, the Court was not persuaded by Greenhouse's oral arguments and concluded these facts "do not change the fact that he has withdrawn from the partnership and no longer has rights as a limited partner."[24] Therefore, the court concluded that Greenhouse did not retain and equity interest in the partnership and was not entitled to inspect the partnership's books and records.[25]

In summary, the Court concluded 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 would entitle them to

[20] 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." Compl. ¶ 1.
[21] *Greenhouse*, No. CV 2018-0214-JRS, at *3.
[22] *Id*.
[23] *Id.* at *3-4. In oral arguments Greenhouse argued that because Polychain redeemed him over his objection, his withdrawal was involuntary. *Greenhouse*, No. CV 2018-0214-JRS, at *3. Furthermore, Greenhouse argued in oral arguments that because Polychain withheld 5% of Greenhouse's interest as an audit holdback and later gave him a cash distribution based on assets in which he continued to have an interest after his redemption, Greenhouse's involuntary withdrawal was partial and therefore he continued to hold an equity interest in Polychain. *Id*. At oral arguments, Greenhouse introduced new documents into evidence: a distribution letter with a transmittal email from Polychain and a wire transfer from Polychain. *Greenhouse*, No. CV 2018-0214-JRS, at *6. Greenhouse argued that the cash distribution evidences an ongoing interest in a side pocket account that existed after his redemption. *Id.* (citing Oral Arg. Ex. B where the description of the wire transfer refers to "BK OBI=SIDE POCKET REDEMPTION").
[24] *Id.* at *4.
[25] *Id.*

rights as limited partners.[26] The Court found that Polychain correctly responded that the cash distribution was in satisfaction of what was owed to Greenhouse and that the distribution was Greenhouse's pro rata share of additional assets that could not be valued when Greenhouse withdrew from the fund but could be valued as of January 30, 2019.[27] The cash distribution made to Greenhouse did not indicate an equity share in Polychain Capital.[28]

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[26] *Greenhouse*, No. CV 2018-0214-JRS, at *3. This decision was supported by the plain language of 6 Del. C. § 17-305 that was to be abided by per the LPA, in addition to agreeing Delaware Limited Liability Company Act § 18-305 and Delaware General Corporation Law § 220, in addition to 6 Del. C. § 17-305's departure from 34 RULPA § 304(e)'s provision for right to former limited partners to inspect a partnership's books and records. *Id.* at *4-5. Once a partner withdraws, the partner becomes a "contract claimant holding fixed rights … and can sue in contract for failure to pay the value of tis share as of the withdrawal date." *Greenhouse*, No. CV 2018-0214-JRS, at *5 citing *Schuss v. Penfield P'rs, L.P.*, [see *Greenhouse* fn 42]. The Court points out that Greenhouse referred to himself as a redeemed partner throughout the Complaint. *Greenhouse*, No. CV 2018-0214-JRS, at *5 (citing Compl. ¶¶ 15, 22, 23, 24). Greenhouse did not challenge Polychain's denial of his request for suspension of his redemption and has acted as if he had been redeemed since. *Id.* at *5-6. (citing Compl. ¶ 22). Greenhouse challenges the valuation of his redemption but does not make any claim that the redemption itself was ineffective, for less than his full capital account, or that the valuation is based on an ongoing equity interest in the Fund. *Id*.

[27] *Id.* (citing Oral Ag. Ex. A).

[28] Equity interests of Polychain's remaining limited partners fluctuated with the value of the Fund. *Greenhouse*, No. CV 2018-0214-JRS, at *6 (citing Oral Arg. Ex. A). Greenhouse's "pro rata" share did not. *Id*. "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." *Greenhouse*, No. CV 2018-0214-JRS, at *6-7.

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

2. Impact of Digital Asset Characteristics on Valuation

Digital assets are often coded with hard caps—the set maximum number of digital assets that will be issued is absolute—to maintain a reliable positive value. 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.[29] The traditional solution is instantiated through price commitments, called redemption contracts, holding the issuer accountable through an enforceable money-back guarantee.[30] Such redemption contracts lack credibility.[31] In contrast, the pre-programmed smart contract's enabled by cryptocurrencies facilitate an enforceable and secure quantity commitment.[32] For instance, a programmed enforceable quantity commitment ensures a reliable positive value of Bitcoin.[33] Cryptocurrencies' observable source code are fully transparent on their respective blockchain and continuously verifiable.[34]

[29] White, *supra*, note 10, at 387.
[30] Lawrence H. White, *What Kinds of Monetary Institutions Would a Free Market Deliver?*, 9 CATO J. 367 (Fall 1989)).
[31] White, *supra*, note 10, at 387.
[32] On the historical perspective of quantity commitments, *see e.g.* Ronald Coase, *Durability and Monopoly*, 25 JOURNAL OF LAW AND ECONOMICS 143 (April 1972).
[33] White, *supra*, note 10, at 388.
[34] R.S. King, S. Williams, and D. Yanofsky, *By Reading This Article, You're Mining Bitcoins*, QUARTZ (Dec. 17, 2013), http://qz.com/154877/by-reading-this-page-you-are-mining-bitcoins, F.R. Velde, *Bitcoin: A Primer*, 317 CHICAGO FED LETTER (Dec. 2013), www.chicagofed.org/digital_assets/publications/chicago_fed_letter/2013/cfldecember2013_317.pdf, and K. Dowd & M. Hutchinson, *Bitcoin Will Bite the Dust*. 35 (2) CATO J. 357 (2015).

The effects of supply limitations on digital assets is the subject of an 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.[35] As cryptocurrencies deflates, users may begin hoarding. Where the supply is capped, it may not be able to be increased to counter this deflation or stop the hoarding.[36] Others argue that the quantity commitments in existing digital currencies will inevitably lead to a bubble because the market price of digital assets is still left to vary with demand and can be tied merely to tentative expectations of market valuation.[37] In the same vein, some academics argue that Bitcoin has no intrinsic value.[38] The cryptocurrency market growth in 2017 was driven by a combination of improved ease of access, media attention, speculation, network mining activity, distrust of traditional banking, global instability hedging, and a demand effect from the market. [39]

An agreed-upon reliable valuation method does not exist for cryptocurrencies in 2022. Some academic valuation models are focused on the labor side of mining cryptocurrencies and may be indicative of prices. 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.[40] Other valuation models point

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[35] Pittman, *supra* note 32, at 60-61 (citing Matthew O'Brien, *Bitcoin is No Longer a Currency*, THE ATLANTIC (Apr. 11, 2013), https://www.theatlantic.com/business/archive/2013/04/bitcoin-is-no-longer-a-currency/274859/).

[36] Pittman, *supra* note 32, at 61 (citing O'Brien, *supra* note 26).

[37] White, *supra*, note 10, at 391-93.

[38] Hayes, *supra* note 1, at 1310 (*see* David Yermack, *Is Bitcoin a Real Currency?*, *in* Handbook of Digital Currency 31-43 (2013), Brian P. Hanley, *The False Premises and Promises of Bitcoin* (Dec. 7 2013), https://arxiv.org/abs/1312.2048, Woo et al., *Bitcoin: A First Assessment*, BANK OF AMERICA MERRILL LYNCH (2013), http://web.elastic.org/~fche/mirrors/www.cryptome.org/2013/12/boa-bitcoin.pdf).

[39] Ryan Clements, *Assessing the Evolution of Cryptocurrency: Demand Factors, Latent Value, and Regulatory Developments*, 8 MICH. BUS. & ENTREPRENEURIAL L. REV. 73, 75 (2018) (*see* Eustance Huang, *Bitcoin Market Cap Falls Below $100 Billion for First Time Since October 2017*, CNBC (Nov. 15, 2018), https://www.cnbc.com/2018/11/15/bitcoin-market-cap-falls-below-100-billion-for-first-time-since-2017.html.

[40] Jamal Bouoiyour & Refk Selmi, *What Bitcoin Looks Like?* (Sept. 2014)).

out the importance of considering altcoins in Bitcoin valuation strategy[41] or develop a valuation model based on the cost of production of Bitcoin.[42]

III. Traditional Asset Valuation Metrics

Whenever a new asset class comes to the market, practitioners look to apply legacy asset valuation methodologies. 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.

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."[43] Fair value measurements provide information about what an entity might realize if it sold an asset or might pay to transfer a liability.[44] The fair value standards outlined in ASC 820 and IFRS 13 provide authoritative guidance on fair value measurement,[45] establishing a framework applicable to all fair value measurements under US GAAP and IFRS.[46] These

[41] Hayes, *supra* note 1, at 1310.
[42] The predominant factor in forming Bitcoin's value is the profitability of mining a new bitcoin given its relative cost of production by setting "a lower bound in value around which miners will decide to produce it or not". Hayes, *supra* note 1, at 1315-16. The input variables in Hayes' model were the block reward, the hashing power employed by a miner, and the difficulty. Hayes, *supra* note 1, at 1308, 1314. Hayes regression model points to three main drivers of value: level of competition in the network of products, the rate of unit production, and the difficulty of algorithm used to "mine" for the cryptocurrency → relative diffs in cost of production of one digital currency over another at the margin → diffs in relative cost of production – electricity. No-arbitrage situation established for cryptocurrencies followed by the formalization of a cost of production model to determine the fair value of a bitcoin.
[43] PwC, *Fair value measurements* global accounting and financial reporting guide (Sep. 2019) at 8 or 1-4
[44] PwC *supra* note 1 at 6 or 1-2
[45] PwC *supra* note 1 at 6 or 1-2
[46] PwC *supra* note 1 at 8 or 1-4

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.[47] Fair market value is the legal standard for valuation, but it has real-world problems.[48]

Objectivity and observability is at the core of fair market valuation.[49] Where inputs are less observable, a higher degree of disclosure is required[50] to explain the fair value of the entire asset or the significant input(s) to the fair value measurement.[51] The highest priority level of inputs ("level 1" used in valuation techniques is observable inputs reflecting unadjusted quoted prices for identical assets or liabilities in active markets.[52] An active market is defined as one in which transactions for the asset or liability being measured take place with sufficient frequency and volume to provide pricing information on an ongoing basis.[53] Level two inputs are those other than quoted prices which are observable for the asset or liability or indirectly.[54] Level three inputs are unobservable--e.g., a reporting entity's or other entity's own data.[55]

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 appropriately categorized as level two.[56]

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[47] *See* PwC *supra* note 1 at 6 or 1-2, 8-12 or 1-4 - 1-8. *See also* American Institute of Certified Public Accountants, *Statements on Standarsd for Valuation Services VS Section* 100, VALUATION SERVICES at 8-10 (paragraph 25-30) (Jun. 2007). (Herinafter, "AICPA")
[48] *See, e.g.*, Z. Christopher Mercer & Terry S. Brown, *Fair Market Value vs. The Real World*, Business Valuation Review 16-25 (Mar. 1999).
[49] *See* PwC *supra* note 1 at 51-52 (4-24 - 4-25)
[50] *See* PwC *supra* note 1 at 51-52 (4-24 - 4-25)
[51] PwC *supra* note 1 at 64 4-37
[52] PwC *supra* note 1 at 51 or 4-24, 60 4-33 - 62 4-35
[53] PwC *supra* note 1 at 55 4-28. *See* PwC *supra* note 1 at 65 for factors indicating an inactive market.
[54] PwC *supra* note 1 at 51 or 4-24; 62-63 4-35 - 4-36; *see also* PwC 59 or 4-32
[55] PwC *supra* note 1 at 4-24; 64 4-37
[56] PwC *supra* note 1 at 59 4-32

ASC 820 methodologies are applied to debt and equity investments[57], derivatives[58], financial assets/liabilities eligible for fair value option[59], financial instruments, hybrid financial instruments, and stock compensation.[60] IFRS valuation is applied to financial instruments and revenue.[61] There are exceptions to these generalities for scope and practicability.[62] Market participant assumptions, which continue to evolve, are also important to fair market valuation.[63]

Traditional asset valuation methods do not easily lend themselves to digital asset valuations. Stocks and cryptocurrencies are both traded on markets, with fluctuating prices, and seem similar enough in context to warrant similar regulation, yet they differ in their potential for abuse, their nature, acceptance, and use.[64]

Three basic concepts form the foundation for any given valuation analysis: exit price, market price, and underlying value of the asset if sold. Exit price, the price that would be received in a sale of assets and liabilities between market participants at the measured date, controls when available.[65] 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).[66] 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

[57] *See* PwC *supra* note 1 at 100-01 6-5-6 for discussion of valuation of equity investments.
[58] *See* PwC *supra* note 1 at 112-14 6-17-19 for discussion of valuation of derivative assets and liabilities.
[59] *See* PwC *supra* note 1 at Chapter 5 (page 71-95) for discussion of fair value option ("FVO").
[60] PwC *supra* note 1 at 16 or 2-2
[61] PwC *supra* note 1 at 17 or 2-3
[62] PwC *supra* note 1 at 2-4-2-7; PwC *supra* note 1 at 2-7-2-8
[63] *See* PwC *supra* note 1 at 11 1-7. For discussion of changes in market participant assumptions, *see* PwC *supra* note 1 at 119-25 6-24-30
[64] Pittman, *supra* note 32, at 53.
[65] FASB 157, *supra*.
[66] *Id.*

prepared for sale or whether the shareholders intend to sell in the near future).[67]

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 either a market approach or discounted cash flow. A review of each will provide a starting point to understand where we have been as well as what adjustments may be needed in the age of digital currencies.

1. Asset Approach

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

The liquidation approach considers the situation of the business ceasing to do business and liquidating all its assets as well as paying off all debts. The value does not consider any ongoing business and only consider a disposition of assets. 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.

The adjusted net asset approach starts at the book net asset value set out in company accounts. Book values do not necessarily reflect the fair value because of the amount of depreciation taken on the assets. The estimated useful life of a given asset can differ from its actual useful life in real life. Therefore, the adjusted net asset approach attempts to revalue the balance sheet values by aligning them more with the current fair value of the assets. One way this is done is by bringing in machinery experts to determine the depreciated

[67] *Id.*

replacement cost of the assets. However, the approach still fails to take into consider any intangible assets because they are not represented on the balance sheet.[68]

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). 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.

2. Market Approach

The market approach looks to peer companies' enterprise value, based on the understanding that similar assets will sell for similar prices. 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. 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 then finally make adjustments.

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 seasonality), capital structure and the industry and sector within which company operates (future outlook and key developments). Peer companies should have growth and risk trends similar to the valuation subject in question. 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.

[68] For an overview of discussion of intangible asset valuation, *see* http://www.appraisers.org/docs/default-source/default-document-library/bv-standards.pdf?sfvrsn=2, *supra*, at 20.

The market approach is more subjective than the asset approach because it heavily considers other similar businesses that have been sold. When using the market approach, there is typically a consideration of four factors being the price of recent investments, multiples, industry, valuation benchmarks and available market prices.

When considering recent investments, the typical consideration is whether transactions were at arm's length or not. If a company is planning on acquiring another company through a transaction, it will be important to understand the disposition of the parties prior to the transaction.

3. Discounted Cash Flow Model

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).[69] Income expected in the future is of less value to its recipient today than income that recipient expects today. Thus, in order to value future income today, expected net cash flows must be discounted. The present value of future expected net cash flows is calculated using a discount rate.[70] The discount is a rate of return that considers the relative risk of the cash flows and the time value of money. [71] Under a DCF analysis, the terminal value is present value at end of projection period of all subsequent cash flows to end of life of asset, or into perpetuity. A DCF analysis estimates future cash flows and terminal value and discounts those amounts to present value at the calculated discount rate.[72] The DCF method factors in

[69] Deloitte, *supra* note 24 at 5.
[70] American Society of Appraisers, *ASA Business Valuation Standards* at 27 (2009), http://www.appraisers.org/docs/default-source/default-document-library/bv-standards.pdf?sfvrsn=2.
[71] PwC *supra* note 1 at 48/ 4-20; Deloitte, *supra* note 24 at 5.
[72] PwC *supra* note 1 at 48/ 4-20

capitalization,[73] forecast assumptions,[74] forecast earnings or cash flows, and terminal value.[75]

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").[76] The discount rate reflects the cost of raising equity financing.[77]

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 USD 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.[78] However, no such set discount rate or currency exchange forward curve is available for digital assets, as they are not traded in exchange markets where closing prices are readily available and representative of fair value.[79]

Digital assets exchanges are most comparable to principal-to-principal markets, where transactions (originations and resales) are negotiated independently, with no intermediary.[80] There is often little information about principal-to-principal transactions publicly available, and as such the markets are generally not considered observable.[81] If reporting entities use pricing services from third parties, the entity

[73] *See* AICPA, *supra* note 5 at 11 Par. 33.a for factors
[74] *See* AICPA, *supra* note 5 at 28-30 for illustrative list of assumptions and limiting conditions for a business valuation
[75] AICPA, *supra* note 5 at 11 Par 33b
[76] Deloitte, *supra* note 24 at 5.
[77] Deloitte, *supra* note 24 at 5
[78] PwC *supra* note 1 at 51 or 4-24
[79] PwC *supra* note 1 at 56 4-29 (contrast with NYSE, London Stock Exchange)
[80] PwC *supra* note 1 at 4-30
[81] PwC *supra* note 1 at 4-30

needs to confirm the prices were developed in accordance with the fair value standard.[82]

A pre-adjustment value should be discounted for lack of marketability or liquidity.[83] Observability could have an indirect relationship with liquidity, but liquidity is not a differentiating factor between levels of inputs.[84] A quote for a non-liquid security from a dealer that is ready and able to transact is considered a level two asset.[85] Complex instruments (currency swaps and structured derivatives with longer-dated interest rates) and fixed income asset-back securities are examples of instruments that are typically level 3 asset measurements.[86]

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

$$Equity\ Value = Enterprise\ Value - (debt - cash\ \&\ Investment)$$

After determining the enterprise value, that amount is attributed between the company's relevant financial instruments taking into account any priority. By having this basic understanding of what the company is worth, further valuation methods can be used to zero in on the true valuation.

Under the discounted cash flow ("DCF") approach, the analysis is forecasting the businesses unlevered free cash flow into the future and discounting it back to todays Weighted Average Cost of Capital ("WACC"). After determining the valuation, additional adjustments

[82] PwC *supra* note 1 at 57 (citing ASC 820-10-35-54K and IFRS 13.B45)
[83] AICPA, *supra* note 5 at 13 par 40.
[84] PwC *supra* note 1 at 55 4-28
[85] PwC *supra* note 1 at 62 4-35
[86] PwC *supra* note 1 at 64 4-37

are made for lack of control, lack of marketability, liquidity, and multiple classes of the asset are made.

a) Lack of Liquidity

Traditionally, the concept of liquidity considers how easily an asset could readily be converted into a country's functional currency on demand. By converting the asset into a functional currency, the individual has 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 has the ability to change over time depending on the market size for the asset.

Within the concept of liquidity, there is another concept called market liquidity which refers to the extent an accessible market is available to an individual where assets are bought and sold at transparent prices. In order to have strong market liquidity, there must be large trade volume within the market. Historically, 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 fall. This results in investors giving up unrealized gain as a result 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 feely exit without being penalized as a result of market conditions.

In the private markets, lack of marketability for a security can detract from the 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. Typically, a minority interest will

be considered nonmarketable for investment purposes and therefore must be discounted accordingly.

Marketability, an asset's capability and ease of transfer or salability, denotes the legal ability to sell or transfer ownership.[87] Liquidity refers to an asset holder's ability to readily convert an asset into cash without significant loss of principal[88], which in traditional stocks, drops rapidly for larger trading volumes which results in increasing bid-ask spreads, large price impact, and frequent market failure.[89] It has been said "A block of unregistered stock in a privately held business suffers from impairment in value from a lack of both marketability and liquidity."[90]

In creating the appropriate model to discount the investment, several qualitative 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 distribution that are to be made; and
- Concentration of ownership

[87] Abbott, *supra* note 49 at 144.
[88] Jay E. Fishman & Bonnie O'Rourke, *Estimating Discounts for Lack of Marketability: Understanding Alternative Approaches--Put Options Versus Monetizing an Option Collar*, Business Valuation Review 81, 82 (Fall 2016) (citing American Society of Appraisers).
[89] Abbott, *supra* note 49 at 144-45.
[90] Abbott, *supra* note 49 at 145.

Over time three quantitative foundational models have been developed to determine the discount amount attributable to nonmarketable securities: The prospective put model, which focuses on loss avoidance; the Longstaff model, which focuses on unrealized gains; and the Quantitative Marketability Discount Model, which focuses on income.

(1) Prospective Put Model (PPM)

A put option is an option to sell financial assets at an agreed price on or before a particular date.[91] The premium is the price of the option and represents the present value, of the risk-free rate, of the expected benefit from owning the option at maturity.[92] Thus, an ability to exercise such a right results in a lack of marketability which must be discounted.[93]

A 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.[94] A put option covers this risk and the prospective put model, first described in 1993 by David Chaffe, includes compensation for both loss types.[95] Chaffe developed a model to measures this discount by dividing the value of the put at the time period of restriction by the current value of the stock.[96]

[91] 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 32, 33 (Winter 2017).
[92] Abbott, *supra* note 49 at 146.
[93] Stockdale, *supra* note 57 at 132.
[94] Abbott, *supra* note 49 at 146.
[95] John D. Finnerty, *Using Put Option-based DLOM Models to Estimate Discounts for Lack of Marketability*, Business Valuation Review 165, 168 (Fall 2013).
[96] Stockdale, *supra* note 57 at 132.

The prospective put model focuses on loss avoidance[97] 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.[98] This formula produces prices that vary directly with time and volatility and inversely with interest rate.[99] By calculating the purchase at the time-money put option, the buyer is guaranteed a price at minimum equal to today's stock value.

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.[100] Put option models estimate the price risk borne by an owner during the period of illiquidity.[101] 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.[102]

(2) Longstaff Model

A "look back" 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.[103] Similarly, the Longstaff model[104] focuses on restricted transferability

[97] Elmore, *supra* note 60 at 42.
[98] David B.H. Chaffe III, *Option Pricing as a Proxy for Discount for Lack of Marketability in Private Company Valuations--A Working Paper*, Business Valuation Review 182-88 (Dec. 1993).
[99] Chaffe, *supra* note 65 at 184.
[100] Abbott, *supra* note 49 at 145.
[101] Abbott, *supra* note 49 at 145.
[102] Finnerty, *supra* note __ at 168 (citing Longstaff 1995).
[103] Elmore, *supra* note 60 at 42.
[104] Francis A Longstaff, "How much Can Marketability Affect Security Values," The Journal of Finance, vol. 50, issue 5 (December 1995): 1767-74

and unrealized gains[105] using a hypothetical "look back" option to consider the upper bound in the discount for lack of marketability.[106]

Longstaff's model assumes an investor has perfect timing, but can't exercise the option in order to benefit from that perfect timing due to a restriction period.[107] 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.[108] For an actual investor with imperfect market timing ability, the value of marketability would be less.[109] Therefore, Longstaff's model creates an upper bound on the value of marketability which provides a benchmark for estimating the valuation effects of marketability restrictions[110] and represents the largest discount for lack of marketability that could be sustained in a market with rational investors.[111]

It has been suggested 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 instrument (e.g. market timing ability).[112] 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.[113]

(3) Quantitative Marketability Discount Model (QMDM)

[105] Elmore, *supra* note 60 at 42.
[106] Elmore, *supra* note 60 at 42.
[107] Stockdale, *supra* note 57 at 133.
[108] Longstaff, *supra* note 71 at 1769.
[109] Longstaff, *supra* note 71 at 1769.
[110] Longstaff, *supra* note 71 at 1768.
[111] Longstaff, *supra* note 71 at 1770.
[112] Robert Brooks, *A General Option Valuation Approach to Discount for Lack of Marketability*, Business Valuation Review 135, 135 (Winter 2016).
[113] Elmore, *supra* note 60 at 44.

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[114] to employ the basic DCF model to value illiquid interests of closely held enterprises in the context of appraisals.[115] The QMDM is a shareholder-level discounted cash flow method under the income approach to valuation[116] where value is a function of expected cash flow, risk, and growth.[117] The model points out concerns over if the security is held for a long period of time.

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

In order 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.[118] The model considers the following valuation inputs:

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[114] The model was introduced publicly at the Joint ASA/CICBV Conference in San Diego, CA in 1994. Z. Christopher Mercer, *The QMDM and Estimating Required Rates of Return for Restricted Stocks of Public Companies*, Business Valuation Review 5, 5 (Jun. 2001). *See also* Z. Christopher Mercer, *Quantifying Marketability Discounts: Developing and Supporting Marketability Discounts in the Appraisal of Closely Held Business Interests* (1997).

[115] Z. Christopher Mercer, *A Primer on the Quantitative Marketability Discount Model*, The CPA Journal (Jul. 2003), http://archives.cpajournal.com/2003/0703/dept/d076603.htm.

[116] Chris Mercer, *The Quantitative Marketability Discount Model's (QMDM) 20th Anniversary* (Oct. 24, 2017) https://chrismercer.net/the-quantitative-marketability-discount-models-qmdm-20th-anniversary/.

[117] Mercer, *supra* note __ (*QMDM 20th Anniversary*)

[118] Z. Christopher Mercer and Travis W. Harms, *Marketability Discount Analysis at a Fork in the Road*, Business Valuation Review 21, 23 (Dec. 2001)

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

One major shortcoming of the QMDM is that it has not been accepted by any court in any case, but has been mentioned explicitly in three tax cases from 2000, 2001, and 2006.[119] The QMDM has also been criticized for measuring minority discount, relying on arbitrary growth assumptions, and requiring additional assumptions.[120]

IV. Application of Traditional Valuation Methods to Digital Assets

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. Factors impacting the price of a digital asset include 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.

1. Market Pricing

When available, exit or market prices control. In the case of exit prices, data is published by Bitcoin Charts that would make it possible to

[119] *See Janda v. C.I.R.*, 2001 WL 95127 (U.S. Tax Court 2001); *Weinberg v. C.I.R.*, 2000 WL 157919 (U.S. Tax Court 2000); *Temple v. U.S.*, 423 F.Supp.2d 605, 613-14 (E.D. Tex. 2006). For full discussion of QMDM and tax court, *see* Z. Christopher Mercer, *The QMDM & The Tax Court*, https://www.mercercapital.com/assets/DLOM_QMDM-and-the-Courts.pdf.

[120] Mercer and Harms, supra note 88 at 32-34.

calculate average Bitcoin prices, but such a resource is often not available for other cryptocurrencies.[121]

In the market 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. However, trade execution on digital assets exchanges is different from traditional exchanges. The main issue may be that the number of token holders have not continued to expand exponentially year over year. Having a greater number of stake holders may result in the deeper liquidity in the market, which would in turn allow for seamless movement in and out of the market. Liquidity is one of the key elements considered in determining how healthy a market is at any given time.

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 (e.g., Coinbase, Binance, Kraken) where custody and intermediary issues remain. In 2020, decentralized finance appeared, and along with it, decentralized exchanges. Decentralized exchanges (DEXes) are smart contracts that allow users to directly (peer-to-peer) buy, sell, or trade digital assets.[122]

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, they have to ensure they do not flood the market with token, causing price to drop on the exchange. Remedies or solutions include monitoring and buy-in.

To increase the trading volume, one solution may be 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. The uncertainty surrounding

[121] Pittman, *supra* note 32, at 57 (citing Bitcoin Charts, http://www.bitcoincharts.com).
[122] William Peaster, *What is DeFi? Understanding Decentralized Finance*, DeFi Pulse (Aug. 31, 2021) https://www.defipulse.com/blog/what-is-defi

these legal issues has a chilling effect 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.

Another way to increase liquidity may be to have buy in from the business community. Having buy in from the business community may involve using crypto as a means of transacting. Increasing liquidity does not mean only being able to exchange crypto for fiat currency, but also the ability to exchange for any good or service. By allowing for transactions to use crypto as a means of transaction may increase market liquidity.

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). Blockchain transactions are required to be stored eternally and redundantly on as many machines as possible in order to aid decentralization.[123] 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.[124]

As a result of these uncertainties, some exchanges have refused to accept any trading account with individuals in the United States. One issue with U.S.-based customers is the potential application of long-arm statutes to the claim jurisdiction over them. 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 may be one

[123] Craig Calcaterra and Wulf A. Kaal, Decentralization: Technology's Impact on Organizational and Societal Structure, Chapter 8 (2021).
[124] *See* Wulf A. Kaal and Hayley A. Howe, *Custody of Digital Assets* (2021) for in-depth discussion. Non-custodial trading options are also becoming available.

of the reasons why trading arbitrage has become a common practice in the crypto market.

2. Private Market Transactions

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.

a) Market Approach

The market approach values a subject company by examining peer companies' enterprise value based on cash flow and earnings, constant growth profile, and company continuing indefinitely.

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 (inflationary or deflationary), user experience, ecosystem breadth, consensus protocol, and governance.[125]

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).[126] A benefit of stablecoins has shown to be affordable, low-friction international transfers.[127] In fact, stablecoins are used to increase digital asset market liquidity by supplying stablecoins to DEX liquidity pools.[128]

[125] Wulf A. Kaal, *Crypto Economics – The Top 100 Token Models Compared* (2018).
[126] William Peaster, *What are stablecoins? A guide to stable crypto money*, DeFi Pulse (Jan. 10, 2022) https://www.defipulse.com/blog/stablecoins
[127] *Id.*
[128] *Id.*

Digital assets are comparable to high-growth companies, where scenario planning is critical because markets may not yet exist.[129] In such a case, business leaders must start from the future rather than the present.

When applying the market approach to digital assets, the valuer can look to secondary trade pricing or comparable token price.[130] Secondary trade pricing (as seen in exchanges) are relevant when liquidity is high enough to rely on these prices.[131] 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.

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.[132] The minimum network value can be calculated by using supply, demand, and velocity.[133] Second, the price to earnings ratio is similar to network value to transactions multiple.[134]

[129] Liz Erickson and Tim Koller, *Why 'digital' is no different when it comes to valuation*, McKinzey & Company (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.
[130] *The valuation of crypto-assets*, Ernst & Young 1, 7 (2019) *https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/emeia-financial-services/ey-the-valuation-of-crypto-assets.pdf*
[131] Ernst & Young, *supra*, at 7.
[132] Aenigma Capital, *How do you value cryptocurrency?*, Medium (May 5, 2018) https://medium.com/@aenigmacapital/how-do-you-value-cryptocurrency-3d296f68ec40
[133] Id.
[134] 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/

b) DCF

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.

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

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.[135] This model is used in some distributed autonomous corporations (DACs).[136] PoW networks (Dash Master Nodes, Ethereum Validators after PoS) make service fee payments to workers, paid tokens by other users, for the services they perform.[137] Ripple, Stellar, Factcom, and Binance offer token burns or buybacks, comparable to product sales paid for using company stock, or treasury stock (share repurchases).[138] In this case, tokens are purchased and destroyed for use of the platform or to distribute profits.[139] 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.[140] These are dividend payments, where token holders receive an ongoing stream of value distributions.[141]

Cash flow is impacted by whether a token's model is inflationary or deflationary. A deflationary model of token issuance caps the number

[135] John Tadaro, *Valuing Crypto Assets using a DCF Model*, Medium (Jun. 21, 2018) https://medium.com/@john_19547/valuing-crypto-assets-using-a-dcf-model-bc6297b0bd25. S*ee also* Blocktown Capital's REN report applying DCF
[136] Aenigma Capital, *Fundamental Valuation Approaches: DCF* (May 6, 2018) https://medium.com/@aenigmacapital/fundamental-valuation-approaches-dcf-3dcdbf873c3b
[137] Aenigma Capital, *Fundamental Valuation Approaches: DCF*, *supra*.
[138] Aenigma Capital, *Fundamental Valuation Approaches: DCF*, *supra*.
[139] Aenigma Capital, *Fundamental Valuation Approaches: DCF*, *supra*.
[140] Aenigma Capital, *Fundamental Valuation Approaches: DCF*, *supra*.
[141] Aenigma Capital, *Fundamental Valuation Approaches: DCF*, *supra*.

of tokens that will ever be issued by the respective token issuer.[142] This method is utilized by tokens such as Bitcoin. With a deflationary method, prices are expected to increase due to fundamental scarcity of token supply.

Tokens that utilize an inflationary model often attempt to operate similar to a fiat currency. This means typically 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. Several indicia seem to suggest that as the cryptocurrency market matures, inflationary token models may continue to become more popular. Inflationary token models allow the use of stability mechanisms, which may allow more experimentation with volatility mitigation.

In the case of Bitcoin, the reward per mined transaction has decreased over time from its initial 50 BTC in 2009.[143] In November 2021 the reward per mined transaction was 6.25 bitcoins.[144] One valuation method that focuses on cash inflow is a trailing twelve-month revenue to miners, stakers and liquidity providers.[145] Another is a stock-to-flow model, which shows that historically, the price of BTC has correlated inversely to mining reward amount.[146] However, BTC's issuance schedule and relative scarcity are not necessarily the only reasons for its rise in value.[147] "There are thousands of bitcoin

[142] All of this comes from Wulf A. Kaal, *Crypto Economics – The Top 100 Token Models Compared*, Banking & Fin. Ser. Pol. Rep. 1, 22-23 (2018).
[143] Black, *supra*.
[144] Black, *supra*.
[145] Keith Black, *What's the correct valuation model for digital assets?*, CAIA Association (Nov. 21, 2021) https://caia.org/blog/2021/11/21/whats-correct-valuation-model-digital-assets
[146] Black, *supra* (citing Steven Ehrlic, Demystifying Bitcoin's Remarkably Accurate Price Prediction Model, Stock-To-Flow, Forbes (Apr. 29, 2021) https://www.forbes.com/sites/stevenehrlich/2021/04/29/demystifying-bitcoins-remarkably-accurate-price-prediction-model-stock-to-flow/?sh=48f4e46e476a).
[147] Ehrlic, *supra*.

copycats with the same issuance schedules, but none can match its demand, and thus its value."[148]

V. Conclusion

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. 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 what are slowly evolving.

[148] Ehrlic, *supra* (quoting PlanB, who in 2019 released *Modeling Bitcoin Value with Scarcity* https://medium.com/@100trillionUSD/modeling-bitcoins-value-with-scarcity-91fa0fc03e25).