DIGITAL ASSETS AND REPORTING: IS THERE ANYTHING NEW UNDER THE SUN?

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Resumen

Los efectos disruptivos de la digitalización de activos exigen no solo adaptaciones legislativas y regulatorias, sino también la revisión del marco de *reporting* aplicable a esa categoría general de activos. Pero la difusión de información relevante para la toma de decisiones en relación con activos digitales como los criptoactivos se enfrenta a retos específicos. La particular naturaleza de estos instrumentos ha retrasado no solo una clasificación regulatoria completa y coherente para estos, sino también un consenso sobre las necesidades y modalidades apropiadas de *reporting.* Este trabajo examina los retos que plantea esta cuestión sobre la base del examen conjunto de la tecnología y de los casos de uso de los criptoactivos, por un lado, y de los estándares generales de *reporting* existentes, por otro. Asimismo, se examina el estado de algunas iniciativas de adaptación a los criptoactivos de marcos de *reporting* existentes. El trabajo analiza, además, el dilema entre calidad y precisión de información que se suscita para muchos criptoactivos a consecuencia de su volatilidad, que tiene consecuencias prudenciales.

Palabras clave: criptoactivos, contabilidad, regulación, Basilea.

Abstract

The disruptive effects of the digitalisation of assets call for legislative and regulatory adaptation and for a review of the reporting framework applicable to this general category of assets. But the dissemination of relevant information for decision-making in relation to digital assets, such as crypto-assets, faces challenges. The peculiar nature of these instruments has not only delayed a complete and consistent regulatory classification for them, but also a consensus on reporting needs and appropriate reporting types. This paper examines both the challenges posed by this issue based on the joint review of crypto-asset technology and use cases, and the existing general reporting standards. The paper also describes the status of some initiatives that aim to adapt existing reporting frameworks to crypto-assets and also addresses the dilemma between information quality and precision that arises for many crypto-assets as a result of their volatility.

Keywords: Crypto-assets, accounting, regulation, Basel.

1 Introduction

Digital assets do not escape reporting needs. The interests of a diversity of stakeholders in making decisions on the basis of appropriate information gives rise to statistical (macroeconomic) and/or conventional reporting needs for different types of digital tokens. Investors, lenders, audit professionals and regulators stand out as significant potential users of reporting on crypto-assets. The presence of various sorts of data gaps has been argued to be a major limitation in the assessment of the crypto-asset ecosystem (Financial Stability Board (FSB), 2022) and its risks to financial stability. On a similar note, the G20 Data Gaps Initiative includes recommendations for the development of a data collection framework for crypto-assets and the OECD Crypto-Asset Reporting Framework (Organisation for Economic Co-operation and Development (OECD), 2022) has set the ground for the exchange of information on crypto-assets for tax purposes. The compilation of information on digital assets relevant for macroeconomic and balance of payments purposes and its full regulation, have also been highlighted by the International Monetary Fund (IMF, 2023) as a priority. For the record, the initial inroads of official screening of crypto-assets addressed anti-money laundering use cases and users' identity matters.

But the challenging categorisation and taxonomy of some digital assets, such as crypto-assets, has raised doubts on the applicability of existing basic reporting

standards. A consistent treatment for them might be challenged by the perception that they are "new things under the sun", paraphrasing the Book of Ecclesiastes.[1] Regulators are also faced with taxonomy challenges although they have so far paid scant attention to reporting issues, as argued by the European Systemic Risk Board (ESRB, 2023) in connection with MICA in the European Union (EU). Only recently has the Basel Committee of Banking Services (BCBS, 2022) redressed the problem of bank exposures to crypto-assets by putting forward prudential risk-based requirements. Among the recent prominent calls to improve disclosure in the crypto-asset space, the White House's plea in the aftermath of the bankruptcy of FTX stands out.[2]

Against this general background, this paper examines the applicability of existing basic reporting standards, elaborates on the need for new interpretations and/or rules and attempts to identify the hard-to-crack reporting challenges. The paper reviews the work of some standard setters (Financial Accounting Standards Board (FASB) and International Accounting Standards Board (IASB)) on new principles and/or interpretations regarding the disclosure of relevant information. The arguments put forward in the paper mostly deal with the classification and valuation issues raised by the polymorphic profile of unbacked crypto-assets, a particularly contentious category of digital assets. By contrast, the paper argues that asset-referenced digital assets are more straightforward in terms of the applicable existing disclosure categories. The paper makes the case that progress on the general regulatory agenda for crypto-assets requires that outstanding reporting issues be addressed.

It also attempts to shed some light on the resulting trade-offs between disclosure and financial stability when the signal-to-noise ratio of prices is disproportionately low, as happens with some crypto-assets. The analysis conducted thus contributes to the broad call made by authorities to regulate crypto-assets in a complete and consistent manner (IMF, 2023). The paper also argues that international convergence on some basic classification and reporting seems necessary to avoid arbitrage.

The paper is aware of (but does not deal with) the positive contributions of the technology behind crypto-assets to reporting. Its contribution to facilitating audit and supervisory processes thanks to embedded transparency features merits a separate discussion. In the same vein, the emergence of "suptech" techniques in "embedded supervision" raises the expectation of enabling new more effective regulatory approaches to deal with some particularly elusive segments of the crypto ecosystem (Auer, 2022). The inherent potential of the technology for facilitating monitoring is already being tested by authorities, as evidenced by the project Pyxtrial

1 Ecclesiastes 1: "…What has been will be again, what has been done will be done again; there is nothing new under the sun".

2 See White House (2023).

initiated by the BIS Innovation Hub to automatically monitor coverage with reserves of stablecoins.

The paper is structured as follows. The discussion of topics pertaining to the classification and valuation of crypto-assets for reporting purposes, undertaken in Section 3, is preceded by an analysis, in Section 2, of their technological and use-based underpinnings. Section 3 analyses the applicability of international reporting standards and describes the ongoing work by relevant standard setters to partially review some identified issues. Section 4 covers issues at the frontier between prudential regulation and basic reporting bearing in mind the low level of the signal-to-noise ratio in some crypto-assets' prices. The concluding remarks attempt to provide insights on the if, when and how of amendments to reporting standards.

2 Digital and crypto-assets: technological developments and diversity of use cases

For the purposes of this paper, digital assets encompass a broad category of tokens[3] that resort to distributed ledger technology and cryptographic techniques to represent value. The range of assets included covers a diversity of use cases. Central bank digital currencies, tokenised assets or liabilities and crypto-assets are examples of digital assets. This section discusses the technological and use-based underpinnings for their classification for reporting purposes. The basic bottom line of the analysis, set out in Sections 2.1 and 2.2, is a distinction between asset referenced tokens, unbacked crypto-assets, utility tokens and a self-referential ecosystem of tokens (DeFi). The details feed the discussion in Section 3.

2.1 Technological underpinnings: distributed ledger technology (DLT)[4] and the crypto ecosystem

The technology underpinning crypto-assets was originally shaped by a libertarian philosophy of value exchange that pursued the radical empowerment of individuals. A seminal monetary formulation of this objective by Nakamoto (2008) consisted in a peer-to-peer distributed software system capable of allowing the instruction of value transfers in a decentralised and trustless setting. The various information processing and cryptographic innovations orchestrated by Nakamoto (2008) thus led to the implementation of a type of synthetic commodity money called bitcoin that does not require a central bank, financial intermediaries or any issuer whatsoever. In a nutshell,

3 In general, token is a polysemic notion for unitary constructs that embed a unit of value, rights to vote or rights to use resources, inter alia. Here the construct is assumed to be wrapped in a digital and cryptographic solution whose embedded content has an expression in terms of economic value.

4 DLT and blockchain will be two interchangeable terms throughout the paper despite some technical differences of scope.

bitcoin was money organically produced within the corresponding so-called Bitcoin network.

But its original purpose of being the native money of a visionary "island" of exchange within the real fiat world quickly changed, becoming an intangible investment. First, exchanges between the virtual "island" and the fiat world gave rise to a cryptocurrency profile for bitcoin. Second, the original monetary logic of bitcoin quickly paved the way for a transactional and broader financial logic through new intangible tokens also following a market-based logic of exchange and aimed at lifting the intrinsic technological limitations of bitcoin and/or at expanding the use cases of crypto-assets beyond those that are just exchange-type ones.

As a driver of these developments, technology has had the collateral effect of impacting the conditions for basic reporting. The crypto program aspiration of a trustless, pseudonymous and decentralised exchange of value based on public and private cryptographic keys has altered ordinary contracting patterns and has required technological solutions to prevent tokens from being forged or spent in multiple transactions. The irreversible recording of transactions in distributed ledgers based on cryptographic processes operated by (competing) validators has jointly brought to fruition the ability to exchange value on a fully decentralised market and to account for the transfer in an open and trustworthy ledger. The technology underpinning bitcoin thus amounts to an implementation of triple-entry accounting under pseudonymity (Griggs, 2005). Reporting is thus close to the heart of the crypto-asset ecosystem.

As anticipated, the challenges of achieving trusted decentralised pseudo-accounting have influenced the innovation of and quest for new coins, as throughput and feature limitations inherent to bitcoin and succeeding tokens have led to exploring new networks and coins. A specific insight on the innovation dynamics at play and their new constructs illustrates some of the evolving reporting challenges. More specifically, the pace at which bitcoin can be supplied to support exchange in the virtual "island" is intrinsically limited by the fundamental logic that guides its network of actors. Namely, validators acting in an uncoordinated and decentralised way need to find a consensus on the acceptable (block of) transactions entered into by users and to be added to the ledger. But the so called proof-of-work protocol applied to achieve consensus is intensive on computing resources and time. In turn, this constrained pace of recognition of new acceptable transactions determines the supply of bitcoins mechanically. Its driver is the automatic remuneration with new tokens of that validator who, acting in competition with the rest, manages to notarise first the adequacy of the transactions.

The intrinsic bottlenecks in bitcoin production and payments can be said to have largely driven innovation and growth in relation to the scope of the crypto space. The quest for alternatives and the development of the crypto ecosystem can be

conceptually framed by the limits expressed through the so-called Buterin trilemma.[5] Transaction throughput, security and scalability cannot be independently optimised. The amount of computing resources in competition needed for truthful validation of transactions (i.e. the security of the arrangement) limits the scalability of the virtual "island" of transactions and/or the processing rate. The industry's attempts at optimising the trilemma have thus mushroomed. But as explained in Section 2.2, it still cannot organically provide a genuinely superior payment instrument.

The quest to expand the use cases of tokens has led to radical new constructs and new activities. This broader scope has relied heavily on so-called smart contracts, i.e. a self-executing code in a virtual machine that runs along the ordinary cycle of transaction validation and recording, with the ultimate result that the blockchain is updated as per the code's instructions. The ability of smart contracts to implement new tokens and functionalities has opened up the range of services available within the virtual "island" of trade. New unbacked crypto tokens, lending and collateralisation, and virtual funding of entrepreneurial activity through what are known as initial coin offerings are some examples of the breadth achieved by the virtual "island".

But the overall development of the crypto-asset ecosystem and the different reporting issues emerging have been led not only by technology but by the major business models driving the development of new capabilities. Namely, (i) the unbacked crypto model of virtual money along the lines of bitcoin, (ii) a self-service model to obtain access to virtual decentralised financial services (DeFi), (iii) a hybrid model that attempts to establish value links between the virtual and fiat world assets (it encompasses stablecoins and asset tokenisation) and (iv) a utility model that grants holders of tokens access to the network's resources. Although utility tokens are only intended to be used within the blockchain's network, their linkage with the network's fortune has typically also converted them into an investment-type token in terms of performance. In turn, it will be argued later on that the asset referencing nature of stablecoins and tokenised assets is less prone to raising reporting issues, unless the assets backing the stablecoins are themselves virtual. As described later in this article, the stablecoins model largely follows the logic of settlement and/or deposit of value instruments and facilitates on-ramp and off-ramp moves between the fiat and virtual worlds as well as among different islands within the former.

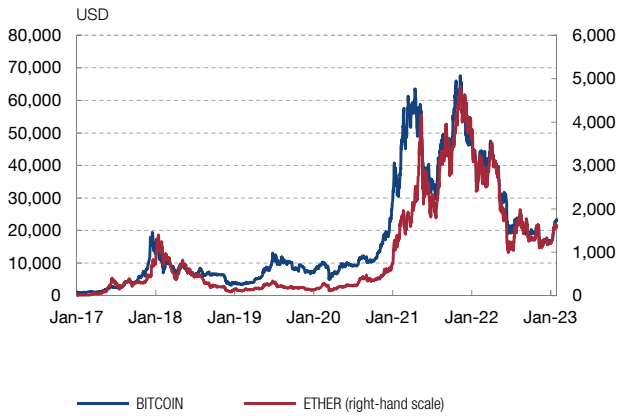
The radical DeFi protocols program entails profound innovations in the way business operations are conducted. The resulting impact on basic reporting issues is thus significant but still minor compared to the legal and mercantile issues raised. The fundamental driver of the radical developments in DeFi is the nature of the new information frictions arising as a result of the DeFi program to eliminate traditional

5 The consensus mechanism that directs the operation of the system of an open blockchain system does not allow the simultaneous optimisation of its transaction processing capacity (performance), its security or the decentralisation under which the registration takes place.

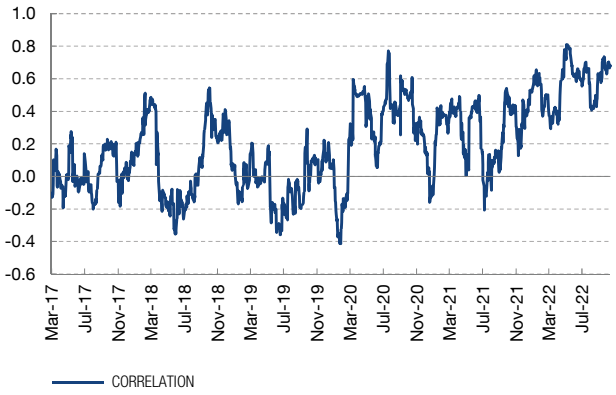
Chart 1

VOLATILITY OF CRYPTOCURRENCIES AND THEIR CORRELATION WITH TRADFI

1 BITCOIN AND ETHER PRICES



2 CORRELATION BETWEEN BITCOIN AND S&P500 RETURNS



SOURCES: CoinMarketCap, Yahoo Finance and own calculations.

financial intermediaries. Namely, DeFi attempts to: (i) provide universal access to financial services to users despite reliance on pseudonymous identity; (ii) follow transparent and deterministic rules coded in smart contracts; (iii) apply non-custodial arrangements; and (iv) cover multiple services through interoperability. DeFi poses challenges that go far beyond reporting challenges mainly because of the hard choices made in its design as regards the transactional environment. As its design does not allow for arranging contracts using identity-related information, this imposes widespread collateralisation requirements on every contract (Roukny, 2022). The limitations on commitment imposed by pseudonymity also lead to governance concerns addressed through so-called Decentralised Autonomous Organisations (DAOs). A DAO is a code-based collective governance mechanism, nominally with no single entity or centralised power in charge. The allocation of holdings to a DAO thus inherently obfuscates any sectoral breakdown of holdings. The need to expand the verifiable information used to support sound contracting in DeFi and the interest in broadening financial services also leads to complex trading patterns. In particular, the composition and inter-operation of various tokens and protocols to provide a single service raises new transparency issues.

The expansion of services with the help of smart contracts as basic infrastructure elements brings their value as intangibles that feed a longer chain of value into the assessment of different tokens. From a conceptual perspective, this argument would place bitcoin and ethereum (i.e. the currency of the Ethereum network built with the broadening of on-chain services in mind) in different camps. However, as discussed in Section 3, the inability to identify the amount of intangible value produced creates basic reporting issues. In any case, the pattern followed by their

respective prices over time (see Chart 1.1) does not evidence any key difference between them.

The crypto-asset ecosystem also contains non-fungible tokens (NFTs). Their intangible idiosyncratic value acquires a distinct character. NFTs are special cryptographic tokens that implement control rights over unique digital assets. Much like pieces of art, NFTs are tradable based on idiosyncratic valuations. NFTs are simply data memorised in smart contracts that manage intellectual property rights.

2.2 The diversity of services and use cases entails broad reporting needs

The technological versatility of blockchain technology has crystallised in multiple use cases and supporting activities. The kinds of services provided have extended beyond the strictly monetary and financial domains that motivated the original projects to also include services like the management of ownership of unique digital rights with NFTs.

The comparison and classification of multiple products and use cases is instrumental in finance, regulation and reporting since they provide precision (understood as a similar treatment for comparable items). This section attempts to briefly characterise some basic relevant features of the alleged use cases for the discussion in Section 3 of classification issues appropriate for reporting.

It is important to notice that crypto-asset features to be considered for reporting purposes may only partially overlap with others driving regulatory classifications that mainly deal with risk issues. The latter are outside the scope of this article other than through their interaction with basic reporting issues. Their interaction arises from two sources. First, through the influence exerted by these regulatory taxonomy programs for crypto-assets on the classification agenda for reporting purposes. A significant example in this regard is the long standing controversy in the US about classifying crypto-assets in the security or the commodity categories rather than as something radically new (Vereckey, 2022). Second, through the compatibility between the regulatory process and the disclosure tools. Section 4 highlights a compatibility issue between a recently approved prudential rule and existing reporting standards for crypto-assets.

The need for classifying crypto-assets into relevant categories follows from both precision and traceability considerations. The crypto-asset ecosystem is of a sufficient size to map them into a limited number of categories based on both qualitative (e.g. use) and quantitative features (e.g. liquidity, capitalisation). As a reference, it is worth noting that as at 1 February 2023 the cryptocurrency analytics firm CoinMarketCap reported a total of 8,861 fungible coins listed in the exchanges monitored by it, while the total number of tokens is currently around 20,000.

Table 1

TAXONOMY OF THE CRYPTO ECOSYSTEM

Type	Subtype	*Service*
Digital Currencies	Value Transfer	
	Specialised	*Meme*
		Privacy
		Remittance
Blockchain Infrastructure	Smart Contract Platforms	
	Blockchain Utilities	*Network Scaling*
		Cross-Chain Interoperability
		Blockchain Networks
	Application Utilities	*Oracles*
		Digital Identity
		Governance Tools
Digital Asset Applications	Decentralised Finance	*Decentralised Exchange*
		Derivatives Trading
		Decentralised Lending
		Stablecoin Issuers
		Prediction Markets
		Asset Management
		Crowdfunding
	Intermediated Finance	*Intermediated Lending*
		Payments Platforms
		Private Exchanges
Digital Asset Applications (cont'd)	Business Services	*Professional Services*
		Enterprise Solutions
	Information Technology	*Data Services*
		Compute & Storage
		Wallets & Messaging
		Internet of Things
	Metaverse	*Virtual Worlds*
		Gaming
		NFT Ecosystems
	Media Services	*Advertising*
		Content & Streaming
On-Chain Derivatives	Stablecoins	*Fiat-Backed*
		Crypto-Backed
		Algorithmic
	Tokenised Assets	*Asset-Backed Tokens*
		Synthetic Tokens
	Claim Tokens	*Liquidity Pool Tokens*
		Staked Tokens

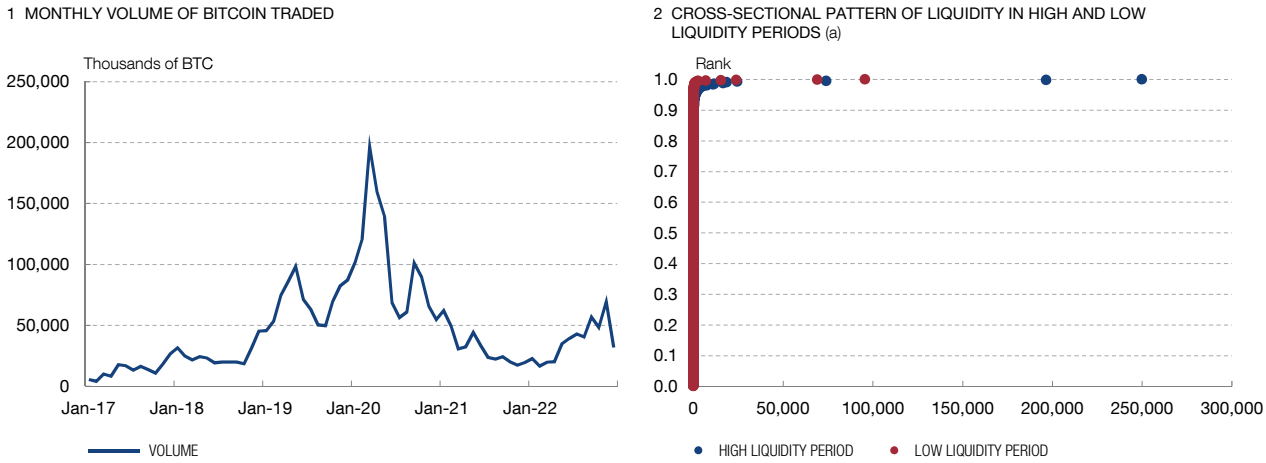
SOURCE: Datonomy.

The number of use cases of digital tokens is unsurprisingly large and growing. Table 1 displays a breakdown of the universe of tokens included in the index compiled by Datonomy (2023) into a multiplicity of qualitatively different use cases. The portfolio benchmarking purpose of the index resembles similar tools employed by traditional investment practitioners and highlights the relevance of investment-like reporting and disclosure for crypto-assets.

An outstanding feature of the crypto-asset ecosystem is its extreme volatility (see Chart 1.1). A well-known benchmark and common factor behind these dynamics is the changes in bitcoin prices. Moreover, the growing (but unstable) correlation with traditional assets reinforces the investment logic that guides the pricing of bitcoin (Chart 1.2). Because of its influence on basic reporting conditions, it is important to highlight the fact that the extreme short and medium-term volatility of crypto-assets unfolds in a context of a strongly uneven liquidity of crypto-assets on a cross-sectional basis and a strong procyclical behaviour. Chart 2.1 highlights the wide dynamic range of the (real) liquidity of bitcoin. Chart 2.2 illustrates both the concentration of liquidity in just a few tokens and the significant change over time in the overall pattern of liquidity.

Chart 2

HIGHLY VOLATILE AND UNEVEN PATTERNS OF LIQUIDITY



SOURCE: CoinMarketCap and own calculations.

a Liquidity ranking of a currently relevant basket of crypto-assets in both a high and a low liquidity period. The liquidity (x axis) is measured based on the monthly trading volume, and the high and low liquidity periods are March 2020 and November 2022, respectively. The chart highlights the concentration of liquidity in a small set of crypto-assets at any given time as well as the strong downsizing of the market during downturns.

The prevailing speculative investment profile of most of the crypto ecosystem as a whole, as documented so far, shadows the monetary or payment functionalities originally proposed for them. The throughput limitations faced by crypto-asset technology to satisfactorily serve payment purposes is shown in Chart 3.2, where the processing rates of existing retail payment rails are compared to those of the Bitcoin and Ethereum networks.[6] Moreover, the introduction of new protocols and chains to alleviate the processing bottlenecks has achieved some success but has not been convincing enough to entice widespread adoption (see Chart 3.1).

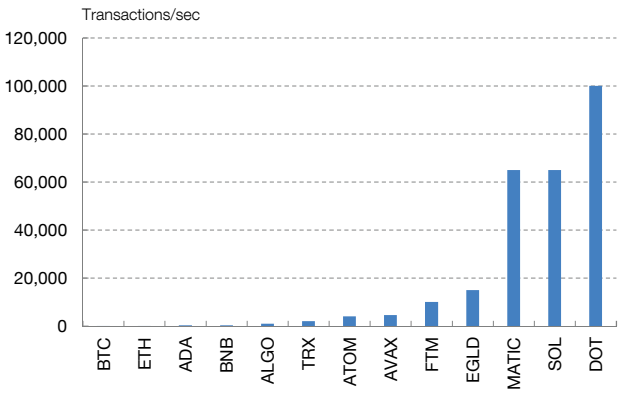
The investment profile of most crypto-assets has led to a corresponding regulatory perception and treatment in the jurisdictions that are ahead in the process of implementing FSB guidance on crypto-asset regulation (FSB, 2022). The specifics of such implementation are beyond this article. But it is informative to witness how the singular features of unbacked crypto-assets and DeFi have led to classification issues. The former category is treated under a financial instruments regulatory umbrella in the United Kingdom and under a special regime in the EU, while in the United States there is still indecision between the equity and commodity asset classes. Moreover, DeFi remains largely unexplored as regards its regulatory treatment owing to its elusive features. By contrast, the regulatory framing of stablecoins can be said to be more certain despite the remaining hurdles to considering them as ordinary financial instruments.

6 The transition from proof-of-work to proof of stake has not substantially altered the throughput of the Ethereum network.

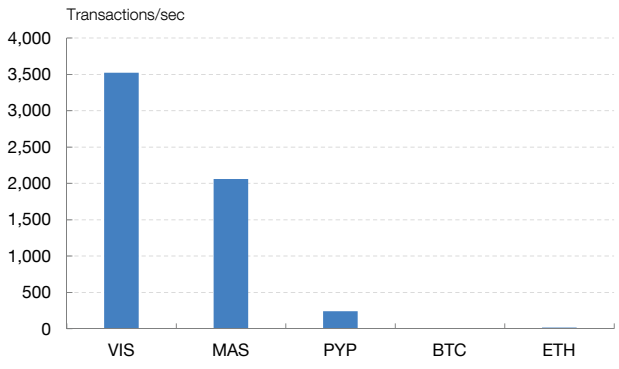
Chart 3

CURRENT CRYPTO-ASSET LIMITATIONS TO PROCESSING PAYMENTS AT SCALE

1 COMPARISON OF BLOCKCHAIN'S PROCESSING CAPACITY ACROSS CHAINS



2 PROCESSING CAPACITY. TRADIONAL PAYMENT RAILS, BTC AND ETH



SOURCE: BIS and JP Morgan Asset Management.

Investment activity, ongoing regulatory recognition, taxation and statistical requirements justify the calls for consistent reporting. Table 1 illustrates the broad range of services and reporting situations that need to be covered. Section 3 essentially makes the case that from a basic reporting standards perspective there is really not necessarily much (fundamentally) new "under the sun" for that classification. But certainly some of the developments described call for clarifications and possibly interpretations of existing standards.

3 Basic reporting standards

This section draws on the arguments set forth in the previous section to address the classification and valuation challenges to crypto-assets posed by existing standards. Section 3.1 discusses the applicability of existing International Financial Reporting Standards (IFRS) and International Accounting Standards (IAS) issued by the International Accounting Standards Board (IASB). Section 3.2 provides a snapshot of the work programme on revisions to the basic crypto-asset reporting by the main global standard setters, i.e. IASB and the Financial Accounting Standards Board (FASB).

3.1 Applicability of existing standards

The edifice of international reporting is built upon a Conceptual Framework for Financial Reporting (Conceptual Framework) and a set of specific accounting standards. The former assist standard setters in the build-up of concepts for the consistent classification and measurement of economic activity as well as to support preparers in developing consistent reporting policies when no accounting standard

is applicable to a specific transaction or event. The absence of either a full-fledged standard or guidance specifically aimed at crypto-assets could thus make the Conceptual Framework a key interpretative tool for the application of existing standards. But a fully self-interpreted reporting seems less appropriate because of its potential to lead to fragmentation.

Crypto-assets can be said to meet the Conceptual Framework's very general definition of assets as economic resources controlled by their holders from which economic benefits are expected to be obtained. Thus, the enforceability of blockchain operations is deemed to, at least, sustain the right to resell the crypto-asset purchased or any other benefits resulting from the relevant smart contracts.

The various types of use cases described in Section 2 may sustain contemplating the classification of crypto-assets into the different categories envisaged under IASB. Based on the qualitative characteristics of the useful financial information included in the Conceptual Framework, information must faithfully represent the substance of what it purports to represent. The nature of the tokens, their use and their regulatory treatment might thus support mapping them into various categories: the financial instruments category (under IAS 32 and IFRS 9), the intangibles category (under IAS 38) and the inventories category (under IAS 2). However, this endeavour is far from automatic and is prone to contradictory outcomes.

Classifying crypto-assets according to existing reporting standards is especially challenging when the only future yield for the holder stems from the enforceable right to resell them, as happens with unbacked crypto-assets such as bitcoin. Their characteristics are peculiar: they are immaterial in nature, they lack a contractual underpinning, and they fail to feed an underlying "production" process the way commodities can do. Admittedly, a technological breakthrough that would facilitate the use of bitcoins and similar cryptocurrencies in the processing of payments might alter the conclusion. But that possibility has been refuted in Section 2 on the basis of structural arguments, as has their recording as cash equivalents.

Admittedly, existing standards still cope with assets broadly similar to bitcoins in terms of being peculiar. For example, gold bullion may be highly liquid but is not considered to be a financial instrument but rather a commodity. The analogy may have inspired initial pronouncements regarding the treatment of native crypto-assets.[7] Be that as it may, in 2019 the IFRS Interpretations Committee (IFRS IC) clarified that cryptocurrencies should be classified either as intangible assets under IAS 38, or as inventory under IAS 2, depending on the purpose of the cryptocurrency holding (IFRS Foundation, 2019).

7 Other analogies sometimes used to capture the nature of unbacked crypto-assets as "a gamble disguised as an investment asset" (see Panetta, 2023) or similar to investments in numismatics fail to convey a reporting insight due to the expensed treatment of the former and the tangible nature of the latter.

The intangible asset classification implicitly links the value of cryptocurrencies to the existence of some intangible source of value as set forth in Section 2 and to an associated longer holding. Importantly, explicit sources of intangible value are not identified. In any case, the standard for recording exhibits a sense of prudence when it requires it to be at cost or at revaluation prices (both net of accumulated amortisation or impairments), the latter only being acceptable when there is an active market.[8] Additionally, the prudent recording of value under the revaluation method follows from the fact that the income statement will show all the revaluation losses but only the revaluation gains to the extent that they reverse revaluation losses of the same asset that were previously recognised in the income statement. Other revaluation gains, i.e. movements in value above cost, are recorded under Other Comprehensive Income.

The second option (IAS 2) requires a commodity-type case of use for the crypto-asset that would justify holding it as inventory to support the ordinary course of business. The measurement now would have to take place at the prudent benchmark determined by the lower of acquisition cost and net realisable value. The impact of price changes on the income statement would thus be that of the asymmetric fair value recording, i.e. immediate recognition of losses in the income statement. It is important to note that the asymmetric recording of inventories is typically predicated on the basis of the stability of the holding on the balance sheet, a feature that tends to correlate with the (poor) liquidity of the asset in question. A business model for a token based on trading would thus contradict that model. But IAS 2 also envisages a recording model aimed at actively traded inventories. Inventories could then be valued at fair value with recognition in the income statement.

The investment-type case of use prevalent for cryptocurrencies does not support their classification as a financial asset. Importantly, this reporting-related argument is currently valid irrespective of the regulatory treatment of cryptocurrencies. IAS 32 defines a financial asset as cash, an equity instrument of another entity, a contractual right to receive cash, a contractual right to exchange financial assets or financial liabilities with another entity, or a particular contract that will or may be settled in the entity's own equity instruments. But in order to be cash they should be readily used as a medium of exchange. In turn, cash equivalents, based on IAS 7, are short-term, highly liquid investments that are readily convertible to known amounts of cash and which are subject to an insignificant risk of changes in value. However, as discussed in Section 2, cryptocurrencies are strongly handicapped to be considered cash by their significant volatility and the impact of such volatility on their widespread voluntary adoption as a payment instrument.[9] Finally, cryptocurrencies do not qualify

8 IFRS 13 defines an active market 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.

9 The adoption of a crypto-asset as legal tender is strongly discouraged by the IMF and by the World Bank. Although the adoption would still be possible, as evidenced in El Salvador, the extent of circulation remains limited to official purposes and is still questioned.

as financial assets only because they do not represent some equity interest in an entity or a contract establishing a right or obligation to deliver or receive cash or other financial instruments in exchange.

By contrast, fiat-backed stablecoins satisfy the conditions of financial assets under IAS 32, as expected bearing in mind the philosophy behind their design. Accounting for stablecoins will largely depend on the underlying asset and the use case as much as with other financial assets. The terms of digital assets can vary widely and, therefore, the accounting method to be applied needs to be considered on a case-by-case basis. Stablecoins will be valued at fair value through profit or loss if they are classified as financial assets or as inventories sold in the short term as part of the holder's ordinary course of business. If they qualify as intangibles they will not be valued at fair value through profit or loss. The reason is that the IASB does not provide for a category of intangible investment assets, as it does for tangible assets in its IAS 40.

NFTs do not seem controversial as regards the general nature of their mapping for reporting purposes. In contrast to cryptocurrencies, NFTs convey intangible identifiable rights after their acquisition. The accounting treatment of NFTs thus has a clear reference consisting in the treatment granted to the underlying intangible rights channelled through them.

3.2 Issues with reporting standards

The analysis carried out in Section 3.1 has highlighted a patchy matching between the use cases of some crypto-assets and existing classification/valuation guidance from IASB. The limitations of the different reporting models examined and/or the lack of guidance may pave the way for the adoption of accounting policies adapted to each user use case based on the interpretation of existing standards in accordance with IAS 8. But this outcome could give raise to heterogeneous interpretations among preparers and, more generally, to a disclosure framework inappropriate for a globally integrated set of markets. Luo and Yu (2022) highlight the reporting inconsistencies resulting from the absence of sufficient guidance and/or standards based on an analysis conducted with a diverse sample of international companies. Section 4.2 highlights a potential inconsistency in the capital treatment of bank exposures that has an accounting background. This section describes the general reporting issues at stake and the initiatives launched by some standard setters to bring more clarity.

Admittedly, most reporting issues are caused by a discrepancy between the use cases of most crypto-assets as either financial investments or as settlement assets and the profile of the traditional instruments that fulfil these purposes and their applicable standards. The discrepancy thus gives rise to the risk of a distorted

reporting of crypto-asset holdings. The increasing regulation and institutionalisation of the market may entail the beginning of the end for this state of affairs irrespective of the current "crypto winter". The realisation that regulation should be complete is an important driving force to also systematise crypto-asset reporting treatment.

An overarching missing element that impacts on crypto-asset reporting is the fact that intangible assets are not recognised as a kind of non-financial investment (as per IAS 40). Using a proxy classification of cryptocurrencies based on the standard for intangible assets leads to several logical disparities. On the one hand, it is difficult to identify in crypto-asset prices the economic parallels with legally recognised intangibles like software, trademarks and licenses employed in value creation processes. For instance, unlike familiar intangible assets (e.g. software, intellectual property and brands), crypto-assets are meant to be actively traded and are often presented with trading or investment asset attributes (see Section 2.2). There are many potential difficulties in relation to the application of classification concepts contained in the intangibles standard. For example, the category of items "held in the ordinary course of business" used to exclude some intangible assets from the scope of the standard would need clarification as regards its meaning for crypto-assets.

A second "dissonance" results when one confronts potentially applicable standards (IAS 38 and IAS 2) with the volatility of most crypto-assets and/or their uneven liquidity profile. The economic characteristics of crypto-assets that have trading or investment asset attributes may not find an accurate representation. An asymmetric expression in terms of profits and losses of a liquid crypto-asset due to cost accounting leads to gains recognition in the income statement only upon sale while capital losses are recognised when they are incurred. The prudential contribution of the standard thus leads to a distorted disclosure. Meanwhile, revaluation accounting applied under IAS 38 (subject to the condition that markets are active) first requires a clarification of the meaning of that term. The ability to contribute to disclosure in an investment-type activity is also impaired by the fact that information on price gains and losses is dispersed between the full-fledged income statement and other comprehensive income. Admittedly, the valuation of crypto-assets at fair value through profit or loss is likewise not devoid of challenges due to liquidity and micro-structure pricing issues like the operation of multiple unregulated exchanges.

The highlighted issues tend to be apparent when applying automatic procedures for the standards. In particular, the mechanics necessary to apply the intangible solution pose specific problems in the absence of guidance. The calculation of amortisation rates is hampered by inherent difficulties in estimating the useful life, if any, of the crypto-asset intangible. For example, it is unclear how to factor into useful life or into residual value the overall limit to the size of bitcoins in circulation. In the same vein, the amount to be amortised needs to be calculated on the basis of acquisition price less residual value. But the residual value of a cryptocurrency could be extremely volatile if calculated on the basis of prices and, eventually, could result in negative

amortisation. These considerations may call into question the mandatory amortisation imposed by the standard for finite-life intangibles. On the other hand, amortisation does not seem conceptually relevant in the absence of wear-based degradation of value. Admittedly, one could argue that obsolescence is possible due to innovations (like transition from proof-of-work to proof-of-stake) that make a competing token more attractive (in the given example, a lower consumption of energy and public acceptance). But the mechanics for calculing impairment are equally tricky. Impairment of the crypto-asset classified as intangible must be calculated on the basis of its fair value, net of selling costs. It may not make much sense to consider employing the value in use for that purpose, because this would imply that a fungible cryptocurrency would follow an idiosyncratic pricing logic.

The "dissonance" between the alleged uses case of stablecoins as settlement assets and the requirements for applying a financial instrument model (IAS 32) highlight the significance in practice of non-accounting related standards and policies. In that regard, despite the advances made by CPMI-IOSCO in classifying stablecoins as payment instruments, conditional on the fulfilment of the principles more generally applicable to financial market structures, the use of stablecoins still seems to be confined to the purpose of a ramp between the virtual and fiat space or within the virtual space itself. The inroads into fiat world payments are still limited. An adaptation of IAS 7 might be needed if a complete regulation of stablecoins and elimination of risk (see Kronick and Zelner, 2023) would make them eligible for a cash or cash equivalent characterisation.

The absence of a standard and/or specific guidance on crypto-assets impairs the quality of disclosure in the notes to financial statements. Unless mandated by sectoral regulation (like BCBS for banks) holders most probably will not disclose information. The IMF's call (IMF, 2023) for building a comprehensive view of where holdings sit (and how) is thus weakened from both a quantitative and qualitative perspective. Typically, as formulated by BCBS (2022), in addition to the quantitative information, disclosure requirements for holders' exposures to crypto-assets should include at least the following: business activities and how these business activities translate into components of the risk profile of the holder, risk management policies of the holder, direct and indirect exposure amounts, and accounting classification.

Against this general backdrop, some national standard setters have started to work in the adaptation of their reporting rules for crypto-assets. In particular, the FASB is in the process of reacting to the calls made by practitioners[10] and by the issues raised by other authorities. Investors, preparers and practitioners requested urgent accounting guidance (KPMG, 2022). Moreover, the issuance of a standard on the custody of crypto-assets by Securities Exchange Commission Staff (see Section 4.1 below) has further exposed discrepancies in the application of existing standards.

10 See ISDA, 2022 for a pronouncement on accounting policy for crypto-assets.

The work carried out to adapt the standards has yielded some interim conclusions. The scope of the project is narrow but some of the conclusions are illustrative. The FASB acknowledged certain similarities between many digital assets and commodities but finally decided (in May 2022) to exclude commodities from the scope of its revision project because, unlike digital assets, physical commodities can also be used in the production of other physical products.

The scope of the FASB's work has ultimately been narrowed to accounting for crypto-assets that satisfy the US GAAP definition of intangible assets, i.e. those not providing the asset holder with enforceable rights to, or claims on, underlying goods, services or other assets. So far, both stablecoins that did not meet the definition of a financial asset and unbacked crypto-assets have been accounted for as indefinite-lived intangible assets. Such treatment has the drawbacks of asymmetry highlighted above. Nonetheless, under the FASB's sectoral rules on investment companies (ASC 946) and broker-dealers (ASC 940) it has been possible to measure holdings of crypto-assets held for investment or trading purposes at fair value through earnings. The FASB's interim decision as a result of the revision projects widens the application of this standard by requiring the measurement of all in-scope crypto-assets at fair value. They should thus be measured at fair value, with fair value changes recorded in the income statement. The decision does not permit an alternative measurement, such as historical cost less impairment, for crypto-assets not traded in an active market.

In the EU, the European Financial Reporting Advisory Group (EFRAG) (EFRAG, 2020) has also made cautious recommendations on the adaptation of existing standards. EFRAG provides advice to the European Commission on whether newly issued or revised IFRS Standards meet the criteria of the IAS Regulation for endorsement for use in the European Union. EFRAG launched a research project on the reporting challenges of crypto-assets that has culminated in a tentative recommendations document (EFRAG, 2020) that recognizes the current gaps for the reporting of crypto-assets based on the international standards and suggests considering a gradual but comprehensive amendment of the standards. The recommendations discard an entirely new standard but recognise the issues mainly faced by holders of crypto-assets. Largely in line with the also cautious approach followed by the FASB, EFRAG recommends in particular that the intangibles standard IAS 38 be amended to allow fair value through profit and loss of cryptocurrencies. Recommendations on issuance of cryptocurrencies that would affect stablecoins, utility tokens and other crypto-assets are left to a second stage in their analysis.

The ongoing revisions do not yet provide clarifications to outstanding issues related with the "issuance" of produced crypto-assets. The production process, as described in Section 3.1, entails the allocation of resources by validators to access the competition to notarise transactions and thereby expand the ledger. In proof-of-work protocols the resources allocated are mainly significant computational power

and high amounts of energy consumption. The impact of these production techniques on climate and sustainability goals has led European legislators to include crypto-asset mining in the EU taxonomy for sustainable activities that would call for consistent standards for producers. For example, the open issue of how to account for costs incurred by unsuccessful miners (all but one at each block validation) could distort the picture (Prochazka, 2018). In proof-of-stake protocols the allocated resources are of a financial nature and validation is restricted to holders of the currency native to the blockchain.

However, proof-of-stake protocols raise their own reporting clarification issues. In fact, proof-of-stake protocols and, for that matter, also collateralisation in the DeFi, raise clarification needs as to the accounting ownership of the relevant tokens involved. The matter might just amount to clarifying the control tests applied in different scenarios of accounting de-recognition. But the gains from greater clarity may be large if double-counting is eliminated on aggregate in an already complex environment. The absence of standards may be more important for the state of reporting and the quality of data than the current non-regulated nature of DeFi, as suggested by the FSB (2023).[11]

4 Reporting and prudential goals

The interface between general and sectoral reporting is traditionally a fertile ground for cross-breeding between disclosure and prudential considerations. The perceived trade-offs between the two perspectives arise ultimately because reporting matters both for financial stability[12] and for investor decisions (see Wall et al., 2014). This general issue has received significant attention in the past in the context of bank reporting of credit loss provisions. This section attempts to briefly frame a broadly similar perspective for the case of the highly volatile and risky crypto-assets. In particular, Section 4.1 links observations made in Section 2 on the risky profile of crypto-assets (as regards volatility, liquidity and market structure) with different accounting rules (existing, necessary and proposed). In particular, the section illustrates the attempt to exploit the complementarity between prudential and accounting rules to achieve regulatory goals based on an accounting rule for crypto-asset custody. Section 4.2 briefly examines two recent regulatory actions on crypto-assets that highlight the evolving conditions for the trade-off between disclosure and prudential considerations.

11 Namely, the FSB (2023) attributes the absence of reporting in the DeFi space to the non-regulated status in the following terms: "Data issues are largely due to the nature of crypto-assets and the associated blockchains as well as the incentives of market participants, in particular (…) the lack of reporting producing consistent and reliable data because parts of the crypto-asset ecosystem fall outside of, or are in non-compliance with, the regulatory perimeter at present. This means that crypto-asset market participants typically do not comply with common disclosure, recordkeeping and reporting rules covering entities in traditional finance, hampering data quality and comparability."

12 For a central bank perspective, see Schwartz et al (2014).

4.1 Accounting policies in an extended sense

Accounting policies aimed at interpreting the existing reporting framework are known to be designed to cope with the practical gaps arising. Notwithstanding the fact that they are weaker than full-fledged standards and/or interpretations, they typically enable practitioners to appropriately match stylised criteria and a complex transactional reality.

In an extended sense, it has also been argued that accounting policies also enable authorities to deal with prudential concerns. The literature is broad. But Wall et al. (2014) is illustrative in that the authors examine the issues arising in the reporting of loan loss provisions in the US market due to the trade-offs between the different mandates of the prudential authority (the Fed and the securities market regulator (SEC). In fact, this case is only a specific expression of a long-lasting and widespread debate that ultimately led to a revision of the standards for credit risk in financial instruments issued by the IASB and the FASB.

Some existing standards applied to crypto have been seen in Section 3 to contain a bias towards prudent reporting when they cap the booking price. But the prudential concerns raised by excess volatility and a low signal-to-noise ratio of crypto-asset prices could also be dealt with to some extent through prudential adjustments implemented outside the reporting standard. A "thought back-test" of the protection offered by conservative measurement criteria, as opposed to that offered by fair value with one-for-one impact on the income statement, illustrates the force (although limited) of a prudential case in the adoption of a reporting rule. The accumulation of implicit buffers as volatile prices follow an upward trend certainly protects from the impact of turnarounds. It may also deter entry in a volatile market because access to profits is restrained. A casual confirmatory observation of the merit of these arguments among practitioners is the words of appreciation in the US when the FASB hinted that it would pivot to a fair value with full impact on profit and loss from the currently capped prices rule. But Section 4.2 will argue that the development of full-fledged prudential rules addresses intrinsic limitations of proxy rules based on conservative reporting like their potential for arbitrage (across jurisdictions based on consolidated reporting), their potential to influence holding horizons and, most certainly, their asymmetric protection. The time of reckoning eventually arrives if the position is held long enough and the implicit buffers have been eliminated.

The interaction between prudential and reporting considerations also emerges when considering the liquidity and technology risks of crypto-assets. Liquidity in the crypto-asset market has been shown in Section 3.2 to be very volatile and uneven (see Charts 2.1 and 2.2). The alleged price transparency of crypto-assets may thus be hampered by their lack of depth. Liquidity issues have typically been handled in traditional mark-to-market assets through disclosure (under IFRS 13) and, for bank held assets, through prudential requirements. For example, Bischoff et al. (2022)

show the importance from a disclosure perspective of the splitting of mark-to-market assets held by banks in the euro area into the three complexity categories (Level 1, Level 2 and Level 3). A similar case for the role of supervision based valuation adjustments can be made for crypto-assets based on their poor liquidity (see Chart 2.2). But the recognition of a Level 3 category would now be more problematic owing to model based pricing difficulties.

Interestingly, some of the technology/market structure risks associated with crypto-assets have led to reporting-related decisions aimed at neutralising their impact. In turn, the decisions have revealed some of the discrepancies in the existing standards. More specifically, the custody of digital assets poses risks and features that led SEC staff to formulate its own interpretation of the conditions under which digital assets have to be treated as an ownership of the depositor for accounting purposes. Individuals frequently engage a third party to hold them in either a custodial or non-custodial wallet. The view expressed in Staff Accounting Bulletin 121 (SAB 121) elicited many opinions in the crypto ecosystem by revealing a view on the regulation of digital assets as a whole and by exposing reporting mismatches.

SAB 121 initially deals with companies that safeguard digital assets. But the increasing absence of separation from transaction facilitation services as well the technological, legal, and regulatory risks and uncertainties unique to crypto-assets led SEC staff to require the recognition of asset and liability entries in the balance sheet of these providers, even in the case of non-custodial wallet services. In this case, the safeguarding obligation liability is measured at the fair value of the digital assets held in custody and the corresponding safeguarding asset is measured in the same manner, except for actual or potential safeguarding loss events, such as those resulting from fraud or theft (including hacks). Moreover, the ruling also revealed reporting mismatches. Custodial wallets, (i.e. where control entails on balance sheet recognition under US GAAP) still entail that liabilities be measured at fair value, whereas digital assets under custody are not measured at fair value.

4.2 MiCA and BCBS rules

The brief reference in this section to the reporting regimes envisaged in two relevant packages (MiCA and BCBS) of rules for crypto-assets intends to complement the paper's basic reporting perspective which focuses on standards. Nonetheless, it is important to keep in mind the transformative boost that regulatory packages may have for disclosure standards due to the formal crystallisation of use cases and contexts that they entail. Thus a complete regulation of crypto-assets, as proclaimed by the IMF (2023), also calls for consistent reporting frameworks.

The MiCA regulation has introduced in the EU a special regulatory regime for crypto-assets with the intent of protecting investors and contributing to the preservation of

financial stability. MiCA regulates primary market activities (issuance/public offerings) and access to the secondary market (listings) as well as the provision of certain crypto-related services based on the features selection of in-scope crypto-assets. For the purposes of this section, it is important to mention that MiCA only contains reporting obligations on the issuance of the two types of stablecoins envisaged under the rule (asset-referenced tokens and e-money tokens) as well as on trading information from crypto-asset service providers (CASPs). But MiCA does not set out standardised reporting obligations (ESRB, 2023).

The BCBS standard on banks' exposures (BCBS, 2022) has pre-empted the deepening of interconnections with the traditional financial system and of the potential financial stability risks highlighted by the FSB (2022). The standard establishes a strong global minimum prudential framework for internationally active banks to mitigate risks from crypto-assets by focusing on the risk of their exposures. The framework is structured on the basis of three hierarchical criteria to classify the universe of crypto-assets. Ideally, the BCBS should serve as a blueprint for disclosure and risk control regimes applicable to other sectors of the financial industry, such as the funds sector and others.

The BCBS (2022) standards will significantly improve the visibility and control of risks due to holdings by banks and, as a result, will partially improve disclosure in the ecosystem as a whole. The standards classify crypto-assets into four categories based on a set of risk features broadly consistent with the ones highlighted in Sections 2 and 3 as relevant to classify crypto-assets from both technology and business case perspectives. Namely, the nature of the tokens at stake, their referencing and stabilisation mechanisms, their underlying technology, their liquidity and their hedging properties. The rules also envisage a disclosure regime to enhance the quantitative information on exposures and on associated capital requirements.

Interestingly, the classification of some crypto-assets in BCBS (2022) may reveal the drawbacks of the lack of a consistent set of basic reporting criteria. Typically, prudential rules for bank exposures are formulated only with an indirect regard for their basic reporting categories. The indirect (but fundamental) connection is the different risk profile of positions actively traded and held on the balance sheet. The risk-based approach thus tends to (apparently) de-link prudential and accounting rules on the surface except for the fact that the prudential rules turn out to be different for banking and trading books.

The general philosophy of splitting the duties of standard setters largely holds also for the crypto-asset classification contained in BCBS (2022). In effect, so-called qualifying group 1 assets have to be assigned to the banking book or trading book based on the application of the boundary criteria either to the non-tokenised equivalent traditional asset (tokenised assets or group 1A) or to the underlying reference asset (stablecoins or group 1B). But group 2 assets, consisting in the set of tokens not

qualifying for group 1, must be treated according to proposed market risk rules (group 2A) or conservative rules (group 2B) regardless of whether they stem from trading or banking book instruments (see paragraph 60.23 in BCBS, 2022). The reliance of the rules for group 2 crypto-assets on book values recorded which, based on the discussion held in Section 3, may derive from non-standardised measurement criteria, might lead to heterogeneous capital requirements across banks and jurisdictions. Moreover, the importance of the consistency between prudential and reporting rules is also highlighted by the potential for some group 2 crypto-asset arbitrage based on a choice of exposure measurement that suits market trends.

5 Concluding remarks

Crypto-assets have arguably turned regulators and accountants into taxonomists. The peculiar and risky features of crypto-assets are still being mapped into existing regulatory and reporting classifications. Do they really represent "something new under the sun" in terms of mappings? The question reformulates the ongoing struggle to find a mapping for crypto-assets and, more generally, for digital assets within existing reporting standards in a way that is useful from a public policy perspective.

The paper does not prejudge a general response to the mapping question to address the challenges of digital assets reporting. Instead, the paper recognises that the response regarding the most appropriate disclosure logic for digital and crypto-assets must be framed in the context of changes to the broader set of protections (beyond disclosure) and clarifications to a complex and sometimes risky category of instruments. The need for adaptations to the existing reporting standards, their timing and scope thus needs to be assessed jointly with the move towards complete regulation. But the progress made in crypto-asset regulation worldwide suggests that clarifications and/or adaptations of existing standards are already required to avoid inconsistent outcomes like those highlighted in the paper.

From a positive perspective, the paper's analysis highlights the genuine and evolving developments in the crypto-asset space, the ensuing difficulties of using the existing reporting categories and the diversity of considerations involved as regards the optimal course of action. The paper documents how some standard setters are already moving while others are waiting for the scene to be clearer. Clarity in that regard is not meant to refer only to a less complex state of the overall ecosystem but also to a consensus on the complementary role of the various relevant policies for dealing with the risks posed by crypto-assets. The paper also briefly elaborates on these complementary contributions among various policies aimed at providing quality information to make decisions, on the one hand, and to entice prudent behaviour, on the other. The poor signal-to-noise ratio of most crypto-assets gives this question a strong dichotomous profile that is highly dependent on the existing prudential protections.

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