HSLU Lucerne University of Applied Sciences and Arts

Crypto Assets Study 2024

An overview of the Swiss and Liechtenstein crypto assets ecosystem

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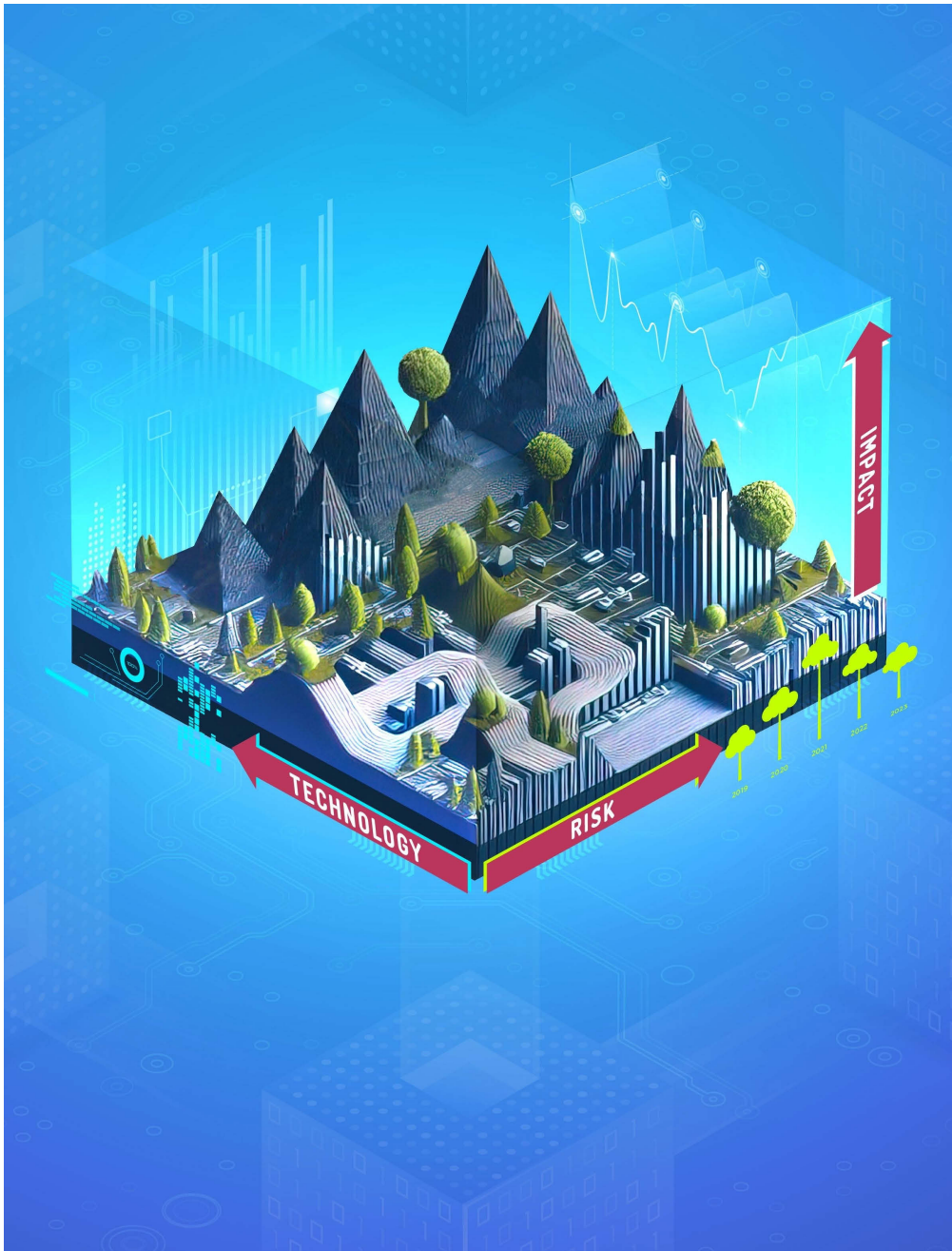

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1. Introduction

The fourth edition of the "Crypto Assets Study" proceeds to trace the status and developments of the crypto assets investment ecosystem in Switzerland and Liechtenstein. The study aims to provide information not only for the industry itself but also for other stakeholders such as investors and regulators.

A first general overview of the developments in the global crypto assets ecosystem can be gained from the total market capitalisation of publicly traded crypto assets in Figure 1.1. Since 2017, the total market capitalisation has experienced significant growth and fluctuations, influenced by various economic, political, and technological factors. In particular, there have been three significant growth phases, one in 2017, one in 2020 and 2021, and one at the end of the observation period, each characterised by relatively strong price increases for the leading crypto assets.

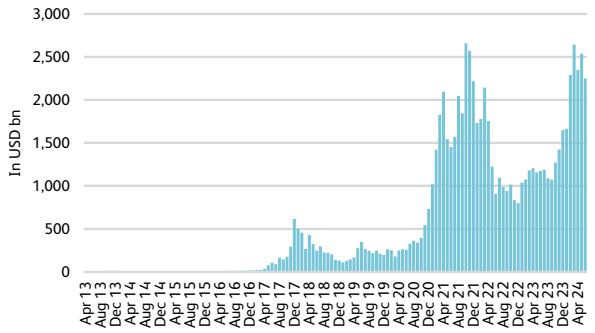

Figure 1.1: Total market capitalisation of crypto assets, by end of period (source: CoinMarketCap (2024))

The figure shows that the total market capitalisation was at a local bottom in September 2022 and started to recover steadily up until April 2023. In October 2023, the price levels began rising rapidly, reaching a peak in March 2024. Since then, the value of the total market has stabilised, with a total value of USD 2,250 billion as of the end of June 2024. In comparison to the end of 2023, this market capitalisation relates to an increase of 36 percent, whereas in comparison to the overall highest market value in October 2021, a decrease of 15 percent is recorded.

The strong development of the overall market capitalisation in recent months could be at least partly fuelled by fund flows into spot Bitcoin exchange traded funds (ETFs) that were approved in the US in January 2024 (U.S. Securities and Exchange Commission, 2024). The global Bitcoin ETF market capitalisation increased rapidly at the beginning of the year, analogous to the described value development of the total market. As of the end of June this sub-market recorded a capitalisation of USD 54 billion, accounting for more than two percent of the total crypto assets market (CoinGlass, online).

Also, the number of crypto asset-related investment products and service providers in Switzerland continued to grow. According to the Swiss Financial Market Supervisory Authority (FINMA), the number of banks and securities firms involved in this sector increased by four over the past year, reaching a total of 34 institutions by the end of 2023. Most of these institutions rely on third party custodians to be able to provide custody solutions, which results in high asset concentrations at just a few companies in Switzerland (FINMA, 2024a).

The increased number of investment products and service providers might reflect a broader adoption of crypto assets within the financial sector, possibly mirroring the interest and participation seen among individual consumers. The adoption of crypto assets among the Swiss population was estimated at slightly less than ten percent already in 2022, according to a survey by the Swiss National Bank (2023). Furthermore, the Swiss adoption rate ranks among the top ten globally, in comparison to 55 other countries and territories (Statista, 2024).

In summary, both globally and nationally, the investment ecosystem for crypto assets has seen various developments in recent months. This dynamic environment necessitates a closer look at regional trends and initiatives. This study aims to provide an in-depth examination of relevant products and services in the so-called "Crypto Valley", which encompasses Switzerland and the Principality of Liechtenstein, and to discuss the corresponding market activities. We thereby seek to offer insights into how these countries are adapting to and influencing the broader developments in the crypto assets investment landscape.

1.1. Definition of Crypto Assets

The definition of the subject matter of the study is crucial as it provides clarity and focus and ensures that the scope and context of the study is clearly outlined. For consistency with previous editions of the "Crypto Assets Study", crypto assets are defined in this study as follows:

Crypto assets are digital representations, like claims, values, or rights, issued on a distributed ledger, such as a blockchain protocol, in the form of tokens.

Therefore, any tokenised information stored on a distributed ledger is considered a crypto asset. This category includes cryptocurrencies (designed as alternative payment methods), non-fungible tokens (NFTs), and representations of real-world assets.[1] The degree of decentralisation of the underlying distributed ledger technology (DLT) is irrelevant, meaning that crypto assets, according to this definition, can exist on both public and private DLTs.

1.2. Methodological Approach

In contrast to past editions of the "Crypto Assets Study", this year's edition measures market activities primarily based on collected data and refrains from conducting a survey among market participants of the Swiss and Liechtenstein crypto assets investment ecosystem. This allows to increase the number of considered providers in Chapter 3 and therefore provide a more comprehensive picture of the relevant players in the ecosystem. Specifically, the corporate websites of the following types of companies were reviewed in order to gather information on their business activities:

1. **FinTech companies**: Swiss and Liechtenstein FinTech companies were identified from a continuously maintained and updated proprietary database on the FinTech sector, based on publicly available information.

2. **Banks**: Swiss and Liechtenstein banks were identified using publicly available lists provided by the financial market supervisors FINMA (2024b) and FMA (2024).

3. **Others**: Other companies in Switzerland and Liechtenstein were identified through ongoing monitoring of the crypto assets ecosystem. This included following newsletters and consulting commercial registers. The companies identified include asset managers and IT providers with a crypto asset-related investment product or service offering.

Two analyses were carried out in order to identify the companies in the sample that actually offer crypto asset-related investment products and services. First, company specific top ten Google search results and the general knowledge of OpenAI's GPT-4o model were used to identify companies with related activities in the ecosystem. Second, the corporate websites of entities with clear business activities related to crypto assets were evaluated by the GPT-4o model in order to record a company's involvement according to the structure of the investment ecosystem presented in Chapter 2. Furthermore, plausibility checks were performed to increase the accuracy of the results. However, it is important to note that the information derived is based on the mentioned desk research and has not been verified with the identified market participants.

In addition, public and paid data from different sources were gathered and put into context to further evaluate current market activities in the Swiss and Liechtenstein ecosystem for investments in crypto assets. The data providers include:

1. Bloomberg
2. BX Swiss
3. CoinGecko
4. Morningstar Direct
5. Semrush
6. SIX

Please note that the previously mentioned providers who report data on crypto assets primarily focus on publicly traded assets. Consequently, market activities on private DLT networks are not monitored. Therefore, the analysis of market activity in this study relates exclusively to crypto assets on public DLTs.

[1] For a detailed discussion of the various designs of crypto assets, see Chapter 6.

2. Structure of the Investment Ecosystem for Crypto Assets

The value chain of crypto asset investments aligns fundamentally with that of traditional financial assets. As represented in the verticals of Figure 2.1, this includes the issuance of crypto assets (or related indirect products), corresponding investment solutions, trading, and post-trading processes, with the investor as the end client. However, a key distinction is the integration of the blockchain technology, the extent of which varies depending on the product and service. This technological aspect is illustrated by the horizontal layers in Figure 2.1. Specifically, the investment ecosystem for crypto assets encompasses indirect investment opportunities such as funds, derivatives, and structured products that follow an "off-chain" value chain, thus avoiding operational exposure to crypto assets or the underlying DLT for the investor. Conversely, direct investment in crypto assets involves using DLT, with the "on-chain" value chain varying based on the degree of decentralisation. These can be offered by centralised providers or intermediaries ("Centralised On-Chain") or set up in a fully decentralised manner using smart contracts or self-management tools ("Decentralised On-Chain").

The following sections briefly describe the ecosystem elements in the various processes of the value chain presented in Figure 2.1.

Issuance

Issuers are pivotal to the primary market by introducing new crypto assets or indirect financial products based on crypto assets. These products, such as funds, derivatives, and structured products (e.g., tracker certificates) are often offered by providers who also offer traditional investment solutions. These products benefit investors by eliminating the need for DLT-based activities, such as maintaining a personal wallet, and can be seamlessly integrated into traditional securities accounts, though they do entail counterparty risks. In contrast, tokenisers create tokens that represent various assets, such as claims, values, or rights (e.g., fiat-backed stablecoins or tokenised shares) on a DLT network and are typically centralised providers. In a DLT network, miners and validators also function as issuers, receiving newly created crypto assets as rewards for validating and proposing blocks, thereby maintaining and securing the system.

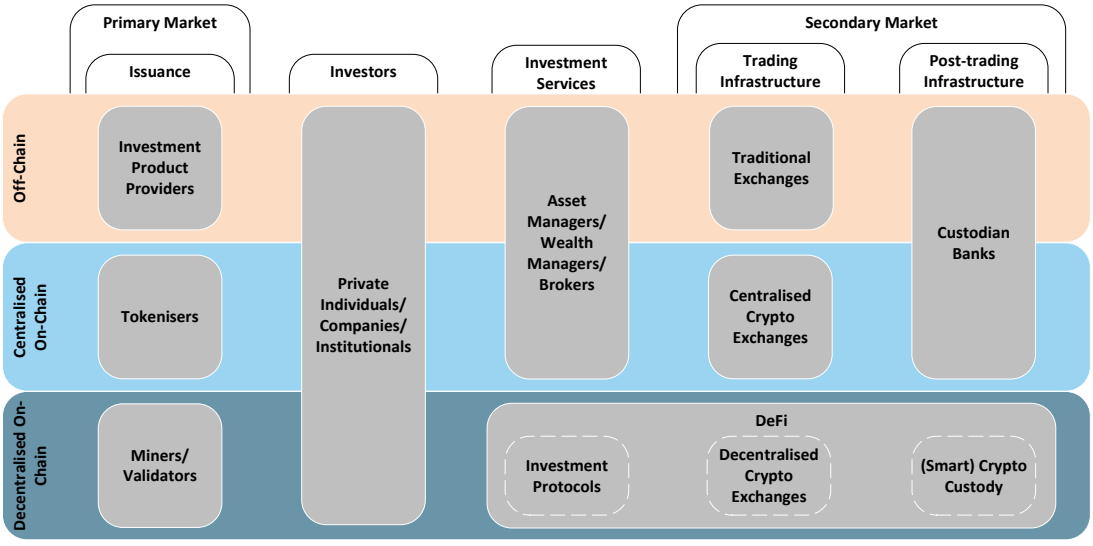

Figure 2.1: Structure of the investment ecosystem for crypto assets

Investors

Investors are crucial as the end customers in the value chain of crypto asset investments. This study distinguishes between retail and private clients, corporate clients, family offices, banks, and other institutional clients. However, due to the anonymity of DLT networks, identifying and categorising investors in direct investments remains a challenge and is therefore not undertaken in the evaluation of the business volumes in Chapter 4 of this study.

Investment Services

Investment services for crypto assets can be provided by asset managers, wealth managers, or brokers, who may include indirect investments in their offerings, akin to traditional assets, or extend their services to cover direct investments in crypto assets. These providers act as intermediaries, facilitating investment services for their clients. The rise of decentralised finance (DeFi) has also led to the development of smart contract-based decentralised solutions, offering functionalities such as managing investments or credit and loan positions independently. These DeFi solutions provide alternatives to traditional intermediaries, offering decentralised options for managing, interacting with, and investing in crypto assets.

Trading Infrastructure

Marketplaces are essential for facilitating the trading of crypto assets and related financial products. For indirect investment vehicles, traditional exchanges can be used since these products do not involve DLT-based transactions in trading. For the direct trading of crypto assets, both centralised and decentralised exchanges are available. Centralised crypto exchanges operate similarly to traditional exchanges, using an order book and matchmaking engine through an intermediary. In contrast, decentralised crypto exchanges are built on DLT networks and typically use liquidity pools, operating without intermediaries and relying on smart contracts to facilitate trading.

Post-trading Infrastructure

Custody represents the final stage in the investment value chain. For indirect financial products, the custody can be seamlessly integrated into traditional security accounts held by custodian banks. In contrast, the direct custody of crypto assets, i.e., tokens on a DLT network, requires maintaining a dedicated crypto wallet, which involves independently managing the wallet and private keys to authorise transactions.

3. Overview of Providers of Crypto Asset-related Products and Services

This chapter shows the results of an evaluation of the Swiss and Liechtenstein crypto assets investment ecosystem[1], using OpenAI's GPT-4o model and public web data for a comprehensive analysis and insights. Note that the quality of the results was reviewed and occasional adjustments were made to capture the state of the ecosystem as of the end of June 2024 as accurately as possible. In detail, a total sample of 964 companies were considered, though a Google web search revealed only 674 entities (70 %) are active in potentially crypto-related business. After the classification of these companies according to the structure of the crypto assets investment ecosystem presented in Chapter 2 by the GPT-4o model, as well as manual plausibility checks and adjustments, 359 companies (37 %) with tangible business activities and projects remained. For this core sample, the regional distribution, targeted customer segments, as well as product and service offerings are further described in the following.

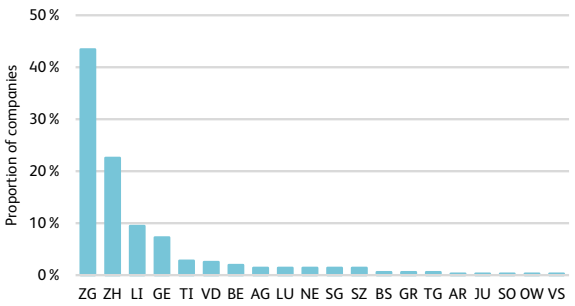

Figure 3.1: Headquarters of examined companies (n=359)

Figure 3.1 illustrates the regional distribution of the companies in the Swiss and Liechtenstein crypto assets investment ecosystem. It reveals that the cantons of Zug (ZG) and Zurich (ZH) are the most strongly represented, with 43 and 23 percent of all companies, respectively. The Principality of Liechtenstein (LI) and Geneva (GE) follow with nine and seven percent, respectively. Other notable clusters of companies involved in crypto asset-related investment products and services are located in Ticino (TI) and Vaud (VD) with three percent each, and Bern (BE) with two percent. This distribution highlights the concentration of crypto asset investment companies in the cantons of Zurich and Zug.

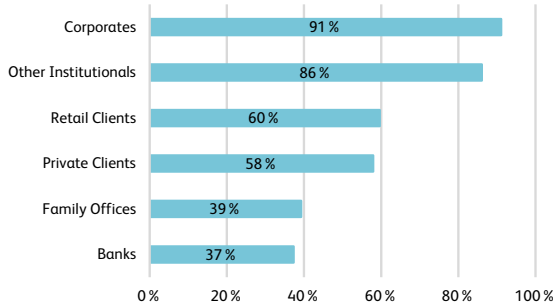

Figure 3.2: Customer segments of examined companies (n=359, multiple answers possible)

Figure 3.2 shows the various customer segments targeted by the companies in the Swiss and Liechtenstein crypto assets investment ecosystem. It is evident that a majority of companies pursue a B2B strategy, with 91 percent targeting corporates and 86 percent focusing on other institutional clients. Other institutional clients exclude family offices and banks but include pension funds, insurance companies, foundations and other institutions with significant capital, sophisticated investment strategists, and professional management teams. In addition, 60 percent of companies serve retail clients, while 58 percent focus on private clients. Family offices are targeted by 39 percent of the surveyed companies, and banks are a focus for 37 percent. While a substantial portion of companies service both private and retail clients, the predominant focus remains on corporate and institutional clients. Fur-

[1] Note that in certain statements and analyses that follow, the Principality of Liechtenstein is referenced alongside Swiss cantons, or the two countries are considered collectively. This is done to increase the significance, although it is clear that Switzerland and Liechtenstein are distinct markets.

thermore, it is noteworthy that nearly 90 percent of the companies operate with an international business model that includes both Switzerland and Liechtenstein. In contrast, around five percent are only active in Switzerland and Liechtenstein, and just under six percent are aimed exclusively at international customer groups. Nevertheless, it has to be mentioned that some corporate websites of market participants do not allow for a clear delimitation of the targeted customer segments.

Figure 3.3 provides an overview of the product and service offerings of companies in the Swiss and Liechtenstein crypto assets investment ecosystem, categorised into *Off-Chain Indirect Investments*, *On-Chain Centralised Investments*, and *On-Chain Decentralised Investments*. The percentages represent the proportion of companies offering products or services within these categories. It is important to mention that these shares primarily reflect the product and service offerings as disclosed on the corporate websites of the entities in the core sample. It is possible that in reality, certain business areas are serviced by more market participants than indicated.

For *Off-Chain Indirect Investments*, six percent of companies offer issuance services, while 35 percent provide investment services, making it the most prevalent service in this category. Direct exchange services are offered by only three percent of companies. Meanwhile, custody services, which involve the secure storage and safeguarding of off-chain assets, are provided by 29 percent of companies.

In the category of *On-Chain Centralised Investments*, issuance services are offered by 32 percent of companies, while 55 percent provide investment services. Direct exchange services, however, are much less common, with only four percent of companies offering them. Custody services are available from 20 percent of the companies in the Swiss and Liechtenstein investment ecosystem for crypto assets.

For *On-Chain Decentralised Investments*, issuance services, including staking services, are offered by 14 percent of the companies in the sample. Furthermore, only six percent provide decentralised investment services or an investment protocol. Similar to *Off-Chain Indirect Investments*, direct exchange services are offered by three percent of companies. Self-custody services are provided by 23 percent of companies.

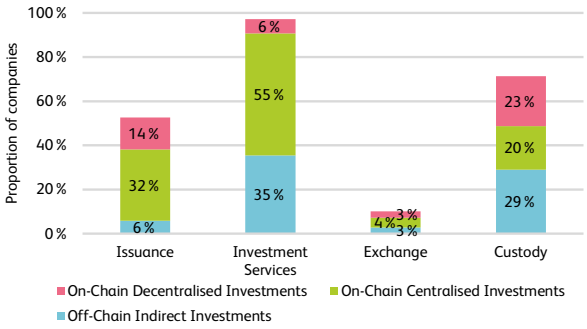

Figure 3.3: Overview of offerings in the Swiss and Liechtenstein ecosystem for crypto asset-related investments (n=359, multiple answers possible)

In summary, it becomes clear that the companies associated with the crypto assets investments ecosystem are concentrated strongly within the cantons of Zurich and Zug. Furthermore, corporate and institutional clients seem to be the primary focus of most companies, indicating the importance of B2B business models. In addition, Figure 3.3 highlights the diversity of services offered by companies in the crypto assets investment ecosystem, with a notable focus on investment services, especially for centralised providers of direct and indirect products.

4. Overview of Market Activities

In this chapter, facts and figures about different investment activities in the Swiss and Liechtenstein crypto assets investment ecosystem are described. Section 4.1 covers indirect investments in crypto assets, while Section 4.2 focuses on direct investment activities.

4.1. Indirect Investments

This section examines indirect investments within the crypto assets investment ecosystem of Switzerland and Liechtenstein. Unlike direct investments, which involve the direct ownership of DLT-based tokens, indirect investments are made through traditional financial vehicles that do not provide direct operational exposure to the DLT for the investor, as they can be booked into traditional securities accounts at financial services providers. Among the most important of these vehicles in the Swiss and Liechtenstein investment ecosystem for crypto assets are exchange-traded products (ETPs) and open-end funds.

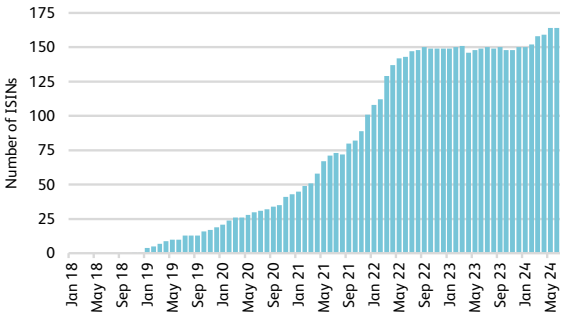

Figure 4.1: Number of individual ISINs of crypto asset-related ETPs and open-end funds (source: Morningstar Direct)

Figure 4.1 shows the number of individual "International Securities Identification Numbers (ISINs)" of crypto asset-related products that are either registered for sale, domiciled, and/or traded in Switzerland and/or Liechtenstein.[1]

The figure illustrates that since their initial launch in 2018, the number of ISINs for crypto asset-related ETPs and open-end funds increased to around 150 by mid-2022. This number remained relatively stable until the end of 2023, with a slight increase observed in 2024. By the end of June 2024, the total number of individual ISINs for ETPs and open-end funds reached 164, which represents an all-time high. In a year-on-year comparison between mid-2023 and mid-2024, this represents an increase of ten percent. Note that there were a total of 22 product liquidations during the observation period, caused by events such as the collapse of underlying assets (e.g., Terra).

The monthly total assets managed by the ETPs and open-end funds in Figure 4.1 are shown in Figure 4.2 (lightblue line and area, left-hand scale).

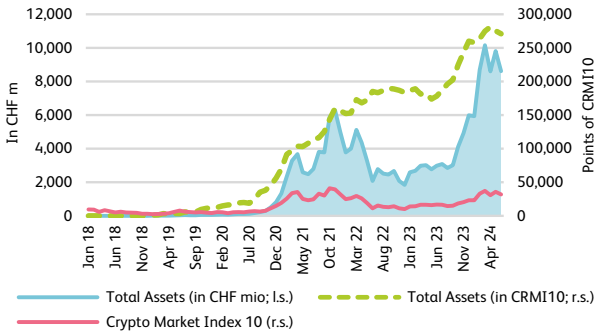

Figure 4.2: Total assets of crypto asset-related ETPs and open-end funds (sources: Morningstar Direct, Bloomberg)

It reveals that the assets managed by ETPs and open-end funds experienced significant fluctuations over time. Notably, there was a substantial increase from 2020 to November 2021, with assets under management (AuM)

[1] Note that some of the funds do not fully invest directly in crypto assets but also partially through investments in crypto-related companies. In the case of actively managed funds, temporary cash holdings may also be included. In addition, funds of funds were excluded from the analysis to prevent the double counting of the assets managed.

rising to over CHF 6.2 billion. This was followed by a decline to CHF 1.8 billion by the end of 2022. Another strong growth phase ensued, peaking in March 2024 with AuM exceeding CHF 10 billion. At the end of the first half of 2024, the 164 products managed a volume of CHF 8.6 billion, 188 percent more than at the same point in time in the previous year.

This increase is due on the one hand to the introduction of new products and on the other, to a price effect. Figure 4.2 therefore also shows the development of AuM corrected for the price effect. More precisely, it illustrates the development of the "SIX Crypto Market Index 10 (CMI10)" (magenta line, right-hand scale), which measures the performance of the largest and most liquid crypto assets (SIX, online-a), serving as a proxy for the general price trend in the crypto assets market. This index serves as the basis for calculating the volume of assets managed in ETPs and open-end funds denominated in the CMI10 (dashed green line, right-hand scale). This view is hence intended to correct for the price effect that could affect the total of managed assets denominated in CHF.

The total assets denominated in the CMI10 exhibit a less volatile pattern compared to those denominated in CHF. Instead, they show a relatively continuous increase from the beginning to the end of the observation period. This indicates that the rise in managed assets is driven not only by price changes in the underlying assets but also by new capital inflows. Specifically, AuM adjusted for the price effect increased by 52 percent year-on-year from mid-2023 to mid-2024. This indicates increased investment activity in the area of ETPs and open-end funds in the past year.

The 164 individual ISINs for crypto-related ETPs and open-end funds, with a total AuM of CHF 8.6 billion as of the end of June 2024, can be categorised by their availability to investors, domicile[2], and trading location. A corresponding breakdown is provided in Figure 4.3. The following observations can be made:

- 17 ETPs and open-end funds are available but not domiciled or listed in Switzerland and/or Liechtenstein, with a total AuM of roughly CHF 1,337 million.
- 76 ETPs and funds are available and domiciled but not listed in Switzerland and/or Liechtenstein, with a total AuM of CHF 698 million.

[2] Domicile refers to the jurisdiction in which an ETP or open-end fund is registered, as opposed to where it is managed.

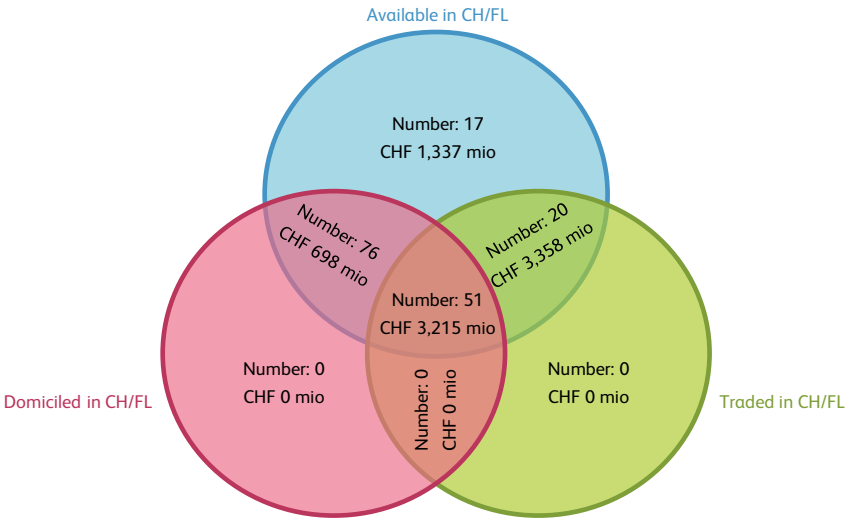

Figure 4.3: ETPs and open-end funds available, domiciled, and/or traded in Switzerland or Liechtenstein (source: Morningstar Direct, Bloomberg)

- 20 ETPs and funds are available and listed but not domiciled in Switzerland and/or Liechtenstein, with a total AuM of CHF 3,358 million.

- 51 ETPs and funds are domiciled, listed, and available in Switzerland and/or Liechtenstein, with a total AuM of CHF 3,215 million.

No products fall into the categories of being domiciled but not listed or available in Switzerland and/or Liechtenstein, listed but not domiciled and not available in Switzerland and/or Liechtenstein, or listed and domiciled but not available in Switzerland and/or Liechtenstein.

The breakdown in Figure 4.3 demonstrates that Swiss exchanges play an important role in the activities related to ETPs and open-end funds.[3] Therefore, and due to the availability of relevant data, the analysis in the following paragraphs delves deeper into the exchange activity for indirect crypto-based products in Switzerland.

While Figure 4.1 and Figure 4.2 show that ETPs and open-end funds play a relevant role in the Swiss and Liechtenstein investment ecosystem for crypto assets, these are not the only indirect investment vehicles available. Over the years, an increasingly differentiated range of structured products has emerged. Figure 4.4 presents a corresponding breakdown of the number of indirect investment products by type on the BX Swiss and SIX exchanges over time (left-hand graph).[4]

Between August 2020 and June 2024, the number of indirect investment products related to crypto assets on the BX Swiss and SIX exchanges expanded significantly, reaching a total of 434 products by the end of the period. This growth occurred in two primary phases. The first phase, from March 2021 to mid-2022, saw a rapid increase in product offerings, with the number of products more than quadrupling, largely due to the introduction of new ETPs, as illustrated in the left-hand graph of Figure 4.4. The second phase, which can be recognised at the end of the observed period, was primarily driven by the rollout of new mini futures, which totalled 130 products as of June 2024. At this point, ETPs were the most prevalent, with 174 products. A further 126 products were tracker certificates, and both barrier reverse convertibles and discount certificates accounted for two products each. Note that other types of indirect products, such as warrants, were observed intermittently throughout the period.

[3] Note that Liechtenstein does not have a traditional stock exchange.

[4] The discrepancies between the number of ETPs in Figure 4.1 and Figure 4.4 arise from different methods of product counting. More precisely, SIX counts at the financial product level, not the individual ISIN level, meaning a single ETP ISIN in Figure 4.1 can represent multiple products in Figure 4.4 if offered in different currencies.

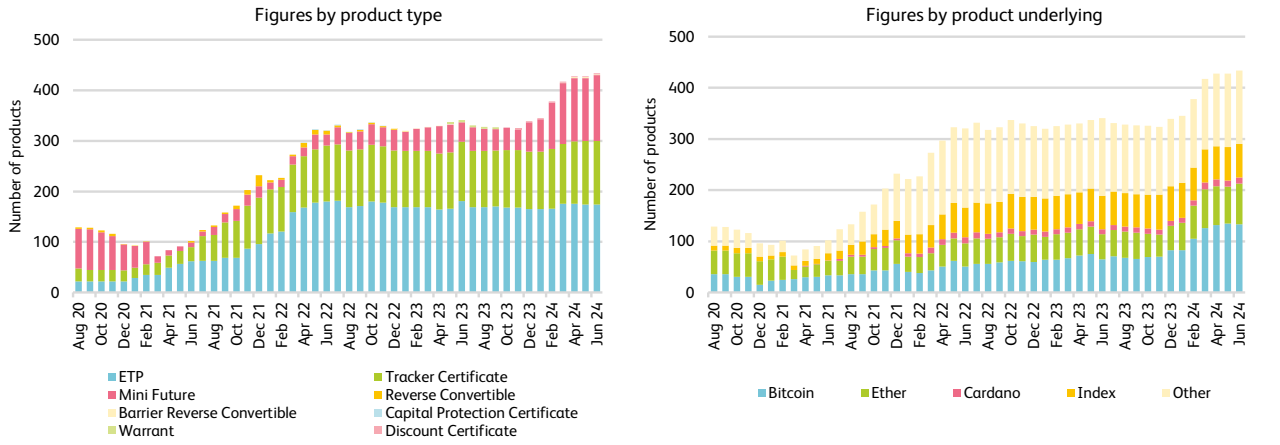

Figure 4.4: Number of crypto asset-related financial products traded in Switzerland per month by product type (left-hand graph) and underlying asset (right-hand graph) (sources: BX Swiss, SIX)

The right-hand graph in Figure 4.4 shows the breakdown of the crypto assets underlying the individual indirect products. In the first half of 2024, Ether and Bitcoin saw the highest growth in the number of indirect products, increasing by 70 percent and 60 percent, respectively. In absolute terms, however, the "Others" category accounted for the largest number of products at the end of June 2024 with 144 products, followed by Bitcoin with 133, Ether with 80, index products, i.e., baskets consisting of more than one crypto asset, with 65, and Cardano with twelve. The increasing number of products in the "Other" category over the entire observation period emphasises the growing diversity of indirect products on the two Swiss stock exchanges.

Alongside the rise in the number of indirect products on the BX Swiss and SIX stock exchanges in the first half of 2024, the corresponding trading volumes also saw an increase, as shown in the left-hand graph of Figure 4.5. This follows a significant decline in trading volumes during 2022 and 2023. The trading volume only started recovering in October 2023, leading to a peak in March 2024 at CHF 697 million. However, as the market activity declined in recent months, the trading volume dropped to CHF 142 million in June 2024. ETPs accounted for CHF 122 million of this volume and structured products for CHF 20 million.

The right-hand graph in Figure 4.5 illustrates the trading volume's proportional distribution between the two main products types over time in detail. It shows that the dominance of ETPs seems relatively consistent since their share increased gradually in 2020 and 2021. ETPs accounted for 86 percent of the market turnover as of the end of June 2024, whereas structured products contributed 14 percent. Structured products held a larger share of 39 percent in March 2024, which is consistent with the observation that structured products become more important to market participants when overall market turnover is relatively high.

Fluctuations similar to those in trading volumes can be observed in the number of transactions involving indirect investments in crypto assets on the BX Swiss and SIX exchanges. As presented in the left-hand graph of Figure 4.6, monthly trading activity increased in the second half of 2023 and the beginning of 2024, although it remains significantly lower than the levels seen in 2021. However, the 239 percent increase in the number of transactions in the first half of 2024 compared to the first half of the previous year indicates a renewed rise in investor interest in both ETPs and structured products for crypto assets. A total of 117,939 such transactions were carried out in the first half of 2024. ETPs accounted for 87 percent of the trades in this period, while structured products made up the remaining 13 percent, a distribution that has remained relatively stable since 2021.

The right-hand graph in Figure 4.6 illustrates the development of average trade sizes for ETP and structured product transactions over each half-year period since the be-

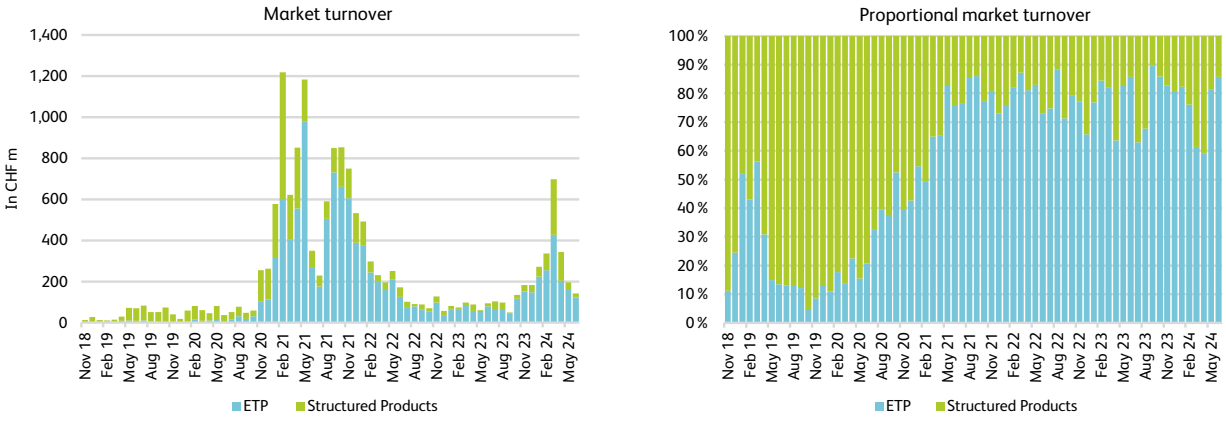

Figure 4.5: Market turnover by month (sources: Bloomberg, BX Swiss, SIX)

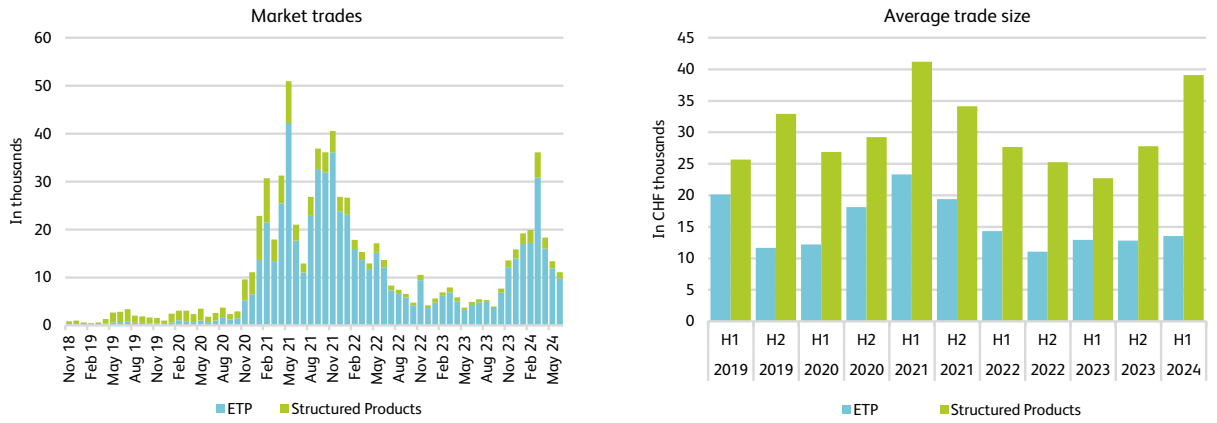

Figure 4.6: Market trades by month (sources: Bloomberg, BX Swiss, SIX)

ginning of 2019. Generally speaking, structured products reveal a larger average trade size than ETPs, however their average trade sizes fluctuate too. In the first half of 2024, the average transaction size for ETPs was CHF 13,543 and CHF 39,050 for structured products.

Across all transactions in the first six months of 2024, the US dollar was the most dominant trading currency, as can be seen in Figure 4.7. During the specified period, it accounted for 76.7 percent of the trading volume, followed by the Swiss franc at 16.6 percent, the Euro at 5.1 percent, the British Pound at 1.6 percent, and the Japanese Yen at close to 0.02 percent.

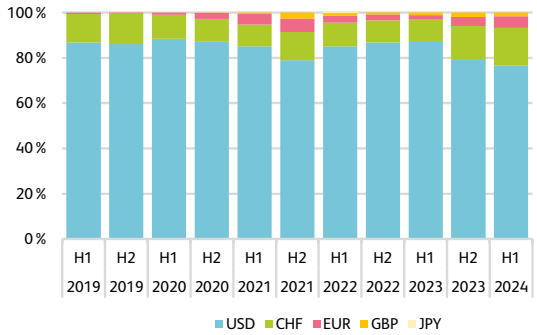

Figure 4.7: Proportion of turnover by currency by half year (sources: Bloomberg, BX Swiss, SIX)

4.2. Direct Investments

In contrast to indirect investments, direct investments involve purchasing and holding crypto assets directly, allowing investors full ownership and control over their tokens. However, such direct investments generally require interacting with the blockchain technology for activities like trading and custody. With self-custody, investors gain direct ownership and control, enabling the use and transfer of crypto assets without intermediaries. Despite these advantages, direct investments come with risks and challenges, including the need to understand private keys, public addresses, and wallet security, as well as the potential for loss through hacking, theft, or user errors.

Due to the more direct involvement of the blockchain technology compared to indirect investments, determining the regional distribution of global direct investment volumes is challenging because of the technology's inherent anonymity. In the subsequent analysis, trading activities for direct investments are estimated and compared. The following methodology was employed to derive the corresponding volumes:

1. Monthly trading volumes for all crypto exchanges were obtained from CoinGecko (online-a).

2. Starting in January 2020, the top 20 exchanges by total trading volume were identified each month. Note that only exchanges with a CoinGecko trust score above five out of ten were included to ensure reliability and liquidity (CoinGecko, online-b).
3. For these exchanges, the monthly proportion of their total website traffic from Switzerland was sourced from Semrush (online).
4. The monthly trading volume from Switzerland for each exchange was estimated by multiplying the exchange's global trading volume by the Swiss traffic share.
5. These monthly trading volumes from Switzerland were then aggregated over the sample period to determine the total monthly global trading volume of Swiss clients.

The final figures presented are hence derived from global trade volumes and website traffic originating from Switzerland, rendering them indicative rather than directly observable quantities. The procedure described was conducted separately for three distinct categories of crypto exchanges: centralised (Section 4.2.1), decentralised (Section 4.2.2), and derivatives crypto exchanges (Section 4.2.3), specifically treating derivatives exchanges as a distinct type of crypto exchange.

4.2.1 Centralised Crypto Exchanges

Centralised crypto exchanges (CEXes) are digital platforms that facilitate the trading and optional custody of crypto assets. Acting as intermediaries, these exchanges connect buyers and sellers and provide a venue for executing spot transactions. Typically, designed after traditional exchanges, CEXes offer order books and matchmaking engines. Many also provide custodial services, eliminating the need for users to manage private wallets and reducing the exposure to the blockchain technology. However, this reliance on custodial services introduces a counterparty risk, as users relinquish the direct control of their private keys. In addition, certain CEXes offer fiat on- and off-ramps, enabling the conversion of fiat currency to crypto assets and vice versa.

Figure 4.8 depicts monthly estimates of the trading volume on CEXes originating from Switzerland. The trading volume shows a rapid increase from November 2020 to May 2021, reaching close to CHF 21 billion. Following this peak, a general downward trend lasted until September 2023, at which point the trading volumes only accumulated to roughly CHF 1.6 billion. Hence, in comparison to the all-time high in May 2021, a decrease of 93 percent was reported. Since this low point, the trading volumes have recovered temporarily, reaching a peak at around CHF 10 billion in March 2024. However, at the end of June 2024 the volumes dropped to CHF 4.4 billion.

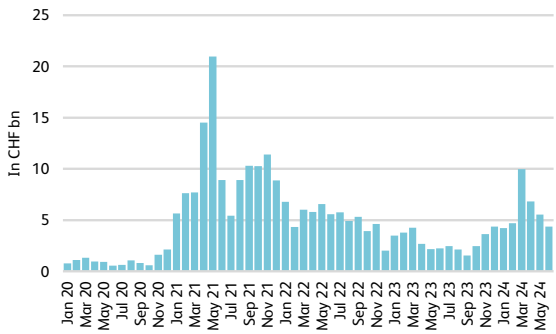

Figure 4.8: Monthly spot trading volume on centralised crypto exchanges from Switzerland (sources: CoinGecko (online-a), Semrush (online))

Among Swiss customers, based on analysis of the aggregated Swiss trading volume between January 2024 and June 2024, Binance, Bybit, and Coinbase appear to be the most popular CEXes.

In comparison to the Swiss CEX volumes reported in last year's edition of the "Crypto Assets Study", some slight differences in the aggregated monthly values are apparent. This is mainly due to the removal of four exchanges from the Coingecko API, three exchanges appear to have hindered withdrawals by customers whereas one exchange was hacked and rebranded. For the volume analysis in Figure 4.8, nine additional centralised exchanges with sufficient trust scores were identified, each listing among the largest 20 exchanges for at least one month within the analysed period in accordance with the methodology introduced in Section 4.2.

4.2.2 Decentralised Crypto Exchanges

Decentralised crypto exchanges (DEXes) are digital platforms that facilitate the peer-to-peer trading of crypto assets without the reliance on centralised intermediaries.

Unlike CEXes, which operate under central authority for trading and custody, DEXes are constructed directly on blockchain protocols and use smart contracts to enable direct trading between users. Consequently, DEX users are responsible for managing their own crypto assets, specifically their corresponding private keys, through wallets.

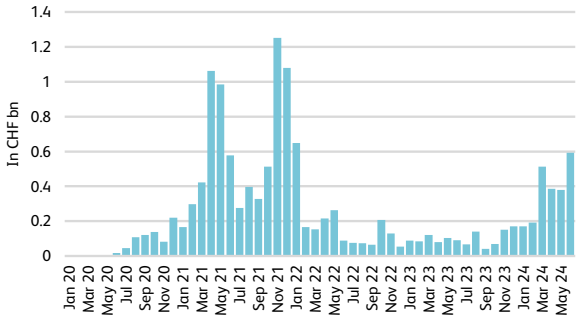

Figure 4.9: Monthly spot trading volume on decentralised crypto exchanges from Switzerland (sources: CoinGecko (online-a), Semrush (online))

In comparison to the trading volumes on CEXes, volumes on DEXes reported an all-time high in November 2021 as illustrated in Figure 4.9. With a trading volume of CHF 1.3 billion at that time, trading activity was, however, significantly smaller than that on CEXes. Following a prolonged period of inactivity throughout most of 2022 and 2023, trading volumes on DEXes began to recover in October 2023, reaching CHF 0.6 billion by June 2024.

According to their aggregated Swiss trading volumes in the first half of 2024, Pancakeswap, Raydium, and Balancer were the most relevant DEXes for Swiss investors.

4.2.3 Derivatives Crypto Exchanges

Derivatives crypto exchanges are digital platforms offering clients financial instruments extending beyond spot trading. Common derivatives provided include futures contracts and perpetual swaps.

The trading volume shown in Figure 4.10 displays a similar temporal development as the spot trading on CEXes. In June 2024, investors from Switzerland traded approximately CHF 20 billion on derivatives crypto exchanges, a figure that significantly surpasses the volumes observed

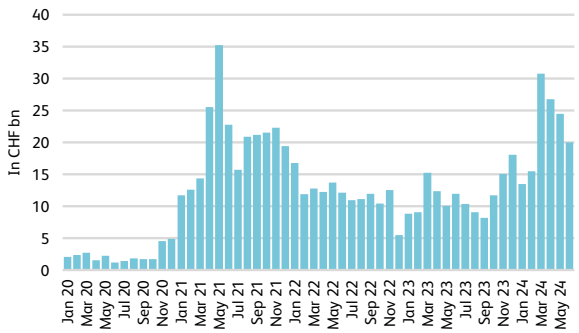

Figure 4.10: Monthly derivatives trading volume on centralised crypto exchanges from Switzerland (sources: CoinGecko (online-a), Semrush (online))

for trading in indirect products on traditional exchanges as well as spot trading on CEXes and DEXes.

In the first half of 2024, Binance, XT Futures, and Bybit emerged as the most popular exchanges for Swiss investors, based on the accumulated derivative trading volumes originating from Switzerland.

4.2.4 Exchange Type Comparison

With some slight differences, the trading volumes at centralised, decentralised, and derivatives exchanges from Switzerland have developed similarly in recent years, although there are significant differences in regard to the corresponding magnitudes. Therefore, Table 4.1 displays the global volume, the Swiss web traffic share, the estimated Swiss volume, and the derived Swiss volume per capita, for the first half of 2024.

Regarding the global trading volume, derivatives crypto exchanges report the largest total with CHF 48,968 billion. Centralised exchanges follow with CHF 11,199 billion and decentralised exchanges record CHF 883 billion. The typically higher trading volumes on derivatives crypto exchanges, compared to CEXes and DEXes, can be attributed to factors such as the ability to leverage and short-sell, as well as the diverse payoff structures offered by derivatives. Furthermore, the lower volumes on DEXes compared to CEXes are often due to lower liquidity, higher technological complexity, potential smart contract risks, and the involvement of the blockchain in every trade, which may

Table 4.1: Volume comparison of different crypto exchange types, H1 2024

	Centralised exchanges	Decentralised exchanges	Derivatives exchanges
Global volume	CHF 11,199 bn	CHF 883 bn	CHF 48,968 bn
Swiss traffic share	0.32 %	0.25 %	0.27 %
Swiss volume	CHF 35.63 bn	CHF 2.23 bn	CHF 130.95 bn
Swiss volume per capita[5]	CHF 3'976	CHF 249	CHF 14,613

result in higher transaction fees and longer settlement times.

When examining the website traffic from Switzerland in the first half of 2024, CEXes reveal the largest share (0.32 %), derivatives crypto exchanges rank second (0.27 %), and DEXes third (0.25 %).

The Swiss trading volumes are estimated by multiplying the global trading volume of each exchange with its web traffic share from Switzerland. In the first half of 2024, derivatives crypto exchanges traded CHF 130.95 billion, CEXes CHF 35.63 billion, and DEXes CHF 2.23 billion from Switzerland. These differences are also evident on a per capita basis, with the average Swiss investor trading CHF 14,613 on derivatives crypto exchanges, CHF 3,976 on CEXes, and CHF 249 on DEXes. Note that while these figures use the Swiss population as a reference, institutional investors from Switzerland likely contribute significantly to the trading volumes as well.

4.2.5 Regulated Centralised Crypto Exchanges

Despite the fact that most crypto asset exchanges remain predominantly unregulated, the world's first fully regulated exchange and central securities' depository was launched in Q4 2021 under the name SIX Digital Exchange (SDX) by SIX (SDX, online-a). In May 2024, the exchange announced that the issuance of crypto assets provided by its platform have extended over CHF 1 billion, with tokenised bonds generating a large share (SDX, online-b).

[5] Swiss population data was obtained from the Swiss Federal Statistical Office (online) and refers to the end of the year 2023.

5. Crypto Assets as an Investment

The rising prices of leading crypto assets in the first half of 2024 have attracted increased investor interest, also evidenced by the surge in trading activity in Switzerland and Liechtenstein (see Chapter 4). This in turn raises the question as to whether crypto assets can actually be understood as a value-adding investment instrument in a portfolio context. This chapter addresses this question by discussing the suitability of crypto asset investments for a traditional Swiss investor from the perspective of portfolio theory.

The following analysis is to be understood as a simplified model and is based on general assumptions about the market for crypto assets, the typical investment universe of traditional Swiss investors, their investment allocation, and the observation period. More precisely, the following basic assumptions are made:

1. The market for crypto assets is accurately proxied by Bitcoin (denominated in CHF). This is justified by the fluctuating but consistently significant market share of Bitcoin in the overall market (CoinGecko, online-c). Bitcoin price data was retrieved from finanzen.net (online).
2. The portfolio allocation of a traditional investor is accurately proxied by the overall investment strategy of Swiss pension funds according to the "Occupational Pension Supervisory Commission (OPSC)" and serves as a benchmark.[1]
3. The three asset classes held in the traditional investment portfolio, i.e., stocks, bonds, and real estate, can be accurately proxied by the Swiss Performance Index® (SPI), the Swiss Bond Index® TR (SBI), and the CH Real Estate® Shares TR (SXI), respectively. Corresponding data was retrieved from SIX (online-b).
4. The observation period is defined from the beginning of 2018 to the end of June 2024. The starting point is based on the initial availability of corresponding indirect investment products for crypto assets, which also made the asset class easily accessible to traditional investors (see Chapter 4). The dataset includes business days to account for the limited trading windows of traditional asset classes.

[1] In this analysis, traditional alternative investments are excluded from the investment universe.

The price development of the assets, indexed at 100 at the beginning of 2018, on which the following analysis is based, is shown in Figure 5.1. It clearly shows that over the observation period, Bitcoin has experienced the greatest fluctuations compared to the three traditional asset classes. The unadjusted performance for risk was highest for Bitcoin (+264 %), followed by stocks (SPI; +47 %), real estate (SXI; +27 %), and bonds (SBI; -2 %). This order is consistent with the cumulative returns in the first half of 2024, with Bitcoin achieving a 53 percent increase, followed by stocks at nine percent, real estate at five percent, and bonds at two percent. A corresponding investment in Bitcoin during the total observation period was, however, associated with significantly higher risk compared to the three traditional asset classes. This is evidenced by the annualised standard deviation of returns, which stands at 69 percent for Bitcoin, which is markedly higher than that for stocks (14 %), real estate (12 %), and bonds (4 %).

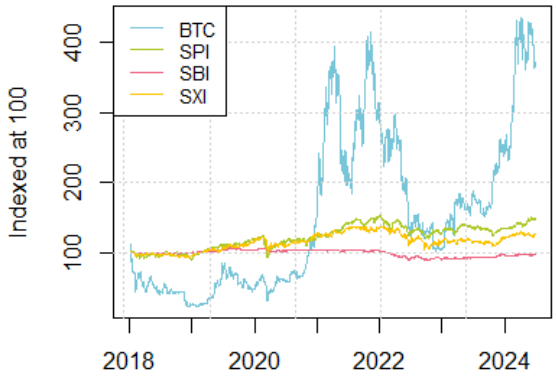

Figure 5.1: Development of individual assets and indexes, indexed at 100 in 2018

In addition to the risk-return profile, the return correlation of investment opportunities also plays a decisive role in portfolio theory in order to achieve diversification in the investment portfolio. Figure 5.2 plots the 30-day rolling return correlations between Bitcoin and the three traditional asset classes.

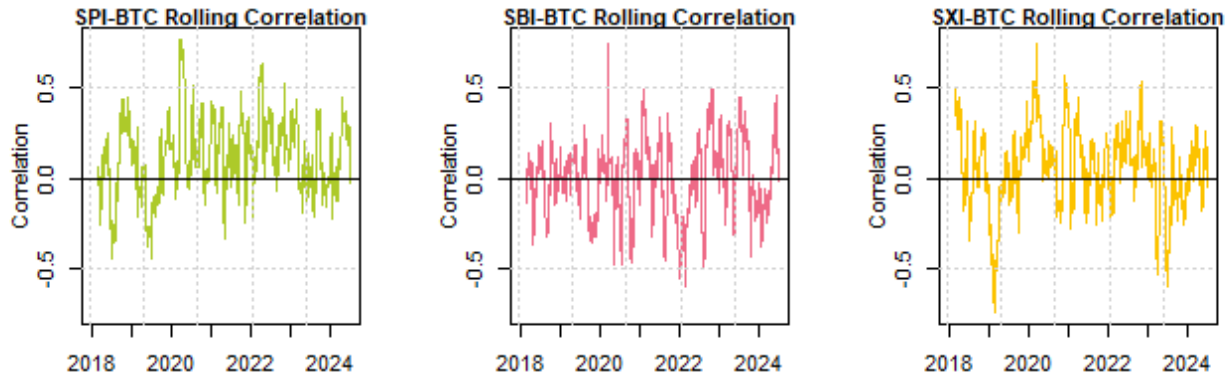

Figure 5.2: Return correlation between Bitcoin and traditional asset classes

It shows that the diversification potential of Bitcoin is subject to certain fluctuations. There are periods when Bitcoin's returns are positively correlated with those of stocks, bonds, and real estate, as well as periods when this correlation is negative. However, the corresponding coefficients typically range between -0.5 and 0.5, suggesting potential diversification benefits from the inclusion of Bitcoin in a traditional portfolio, though the degree of diversification potential varies over time.

To explore the potential of Bitcoin for traditional Swiss investors, two different portfolio allocations, presented in Table 5.1, are compared. Specifically, a traditional portfolio, aligned with the OPSC allocation (OPSC, 2024) and consisting of a 40 percent investment in bonds, 35 percent in stocks, and 25 percent in real estate, is defined as the benchmark. The performance of this benchmark portfolio is compared to a portfolio including Bitcoin. More precisely, a portfolio allocation is constructed by subtracting one percentage point from each of the three traditional asset classes and investing the resulting three percent in Bitcoin.

The performance of the two portfolios is visualised in Figure 5.3, showing the cumulative returns and maximum drawdowns for the portfolios, which are both rebalanced annually in order to restore the defined asset allocations.

The cumulative returns reveal that the portfolio with the three percent Bitcoin exposure achieved a superior return of 37.0 percent over the entire observation period, compared to 22.4 percent for the traditional investment allocation. The outperformance arose mainly at the beginning of the second half of the observation period as well as at the end. Both of these phases are characterised by a significant increase in the Bitcoin price (see Figure 5.1).

The temporal pattern of maximum drawdowns for both portfolio allocations is relatively similar. Maximum drawdown measures the largest single drop from a peak to a trough in the value of an investment portfolio before a new peak is reached. This metric indicates the maximum potential loss, providing insight into the risk involved for investors. The largest drawdown for the portfolio including Bitcoin was -19.8 percent, occurring in October 2022. In the same month, the traditional portfolio allocation without Bitcoin experienced a slightly less severe drawdown of -18.2 percent. Neither of the portfolios have yet recovered from this loss since their previous highs around the turn of the year 2021 to 2022. However, by the end of June 2024,

Table 5.1: Asset allocations considered

Portfolios	Bonds	Stocks	Real Estate	Bitcoin
Portfolio excluding BTC	40 %	35 %	25 %	0 %
Portfolio including BTC	39 %	34 %	24 %	3 %

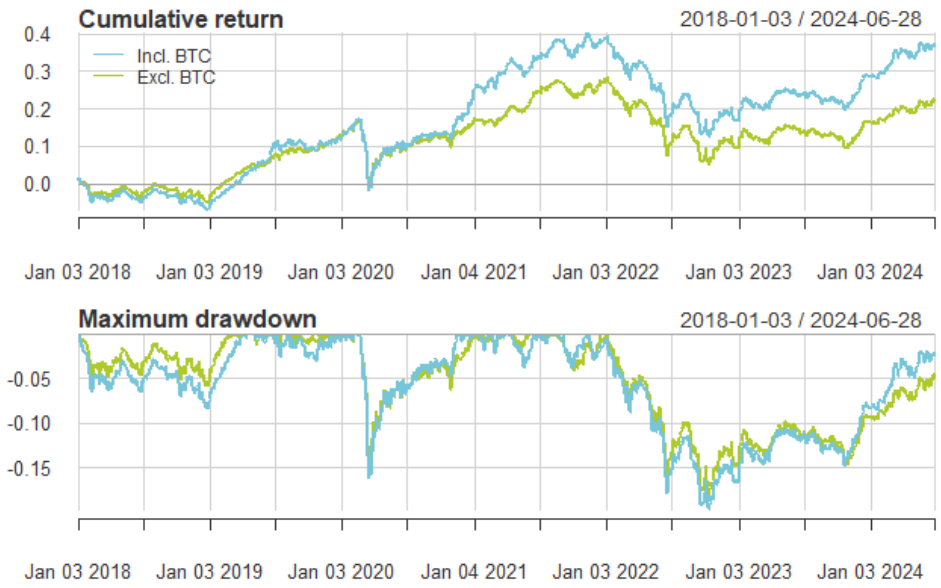

Figure 5.3: Portfolio performances in- and excluding Bitcoin

the portfolio holding Bitcoin had a remaining drawdown of roughly -2.3 percent, which is closer to a recovery compared to the traditional portfolio's -4.7 percent drawdown. Another notable feature of the maximum drawdown is its sharp increase in the spring of 2020, with the outbreak of the Covid-19 crisis exhibiting a strong negative impact on the prices of both crypto assets and traditional assets.

Table 5.2 provides a comprehensive comparison of the annualised performance metrics for the two portfolio allocations over the period from 2018 to the first half of 2024. The metrics analysed include annualised returns, the annualised standard deviation as a measure of risk, and the annualised Sharpe ratio as a measure of the risk-adjusted performance.[2]

The comparison reveals distinct differences between the portfolio with Bitcoin and the one without. Over the total period, the portfolio including Bitcoin demonstrated a higher annualised return of 5.0 percent compared to 3.2 percent for the portfolio excluding Bitcoin. However,

[2] The Sharpe ratio is calculated by subtracting the risk-free rate from the portfolio's return and then dividing the result by the portfolio's standard deviation. In the present analysis, the spot rate of the 10-year Swiss Confederation bond is used as a proxy for the risk-free interest rate.

Table 5.2: Comparison of the annualised performance of the two asset allocations

Portfolios	Metric	2018	2019	2020	2021	2022	2023	H1 2024	Total
Portfolio excl. BTC	*Return*	-4.4 %	18.1 %	4.4 %	9.2 %	-14.3 %	6.4 %	10.9 %	**3.2%**
	Standard dev.	5.4 %	4.4 %	10.3 %	5.1 %	8.6 %	5.3 %	4.6 %	**6.8%**
	Sharpe ratio	-0.81	4.16	0.46	1.86	-1.71	1.05	2.22	**0.45**
Portfolio incl. BTC	*Return*	-6.4 %	20.2 %	12.2 %	11.0 %	-15.8 %	10.1 %	14.0 %	**5.0%**
	Standard dev.	5.7 %	5.8 %	11.6 %	6.3 %	8.9 %	5.6 %	5.3 %	**7.5%**
	Sharpe ratio	-1.13	3.56	1.09	1.78	-1.83	1.68	2.52	**0.65**

the former portfolio also exhibited higher volatility with a standard deviation of 7.5 percent, against the 6.8 percent for the portfolio only holding traditional assets. The Sharpe ratio was higher for the portfolio holding Bitcoin, at 0.65, versus 0.45 for the one excluding Bitcoin, indicating a more favourable risk-adjusted return resulting from the consideration of Bitcoin in the asset universe. In the first half of 2024, the portfolio including Bitcoin significantly outperformed the traditional one, with returns of 14.0 percent compared to 10.9 percent, a higher Sharpe ratio of 2.52 against 2.22, but also a higher standard deviation of 5.3 percent versus 4.6 percent. When reviewing the performance over earlier years, the portfolio including Bitcoin typically showed higher returns and greater volatility. However, during years with negative returns, this portfolio experienced steeper losses. In 2019, both portfolios achieved their best annualised performance, with the traditional portfolio delivering a better risk-adjusted return than the portfolio including Bitcoin. However, the overall analysis indicates that incorporating Bitcoin into a portfolio could have enhanced performance for traditional investors, offering better risk-adjusted returns despite the associated higher volatility. A small Bitcoin exposure of three percent of the total portfolio value was enough to achieve this positive effect, although not in each individual year.

In addition, the portfolio weighting of Bitcoin has consistently remained significantly lower than that of traditional assets throughout the entire observation period, as illustrated in Figure 5.4. This figure displays the portfolio weights at the end of each month for all four asset classes considered, i.e., bonds, stocks, real estate, and Bitcoin. The figure reveals that the largest Bitcoin share in the portfolio was at the end of 2020, accounting for 9.7 percent of the total portfolio value. By the end of the observation period, specifically at the end of June 2024, Bitcoin's portfolio weight amounted to 4.3 percent. The small portfolio weights of Bitcoin compared to traditional investments indicate that such a portfolio could also be suitable for more risk-averse investors, as a relatively small proportion of the portfolio is constantly invested in the crypto market.

At this point, it is important to recognise that the analysis provided insights based on historical data and should not be considered as a basis for making investment decisions. The framework conditions in the market for crypto assets and the corresponding investment ecosystem are constantly changing. In addition to the financial aspects, an appropriate investment strategy should therefore take other factors like regulatory changes and technological advancements into account.

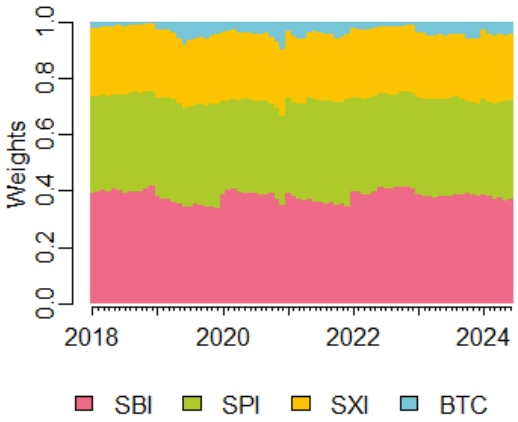

Figure 5.4: End-of-month portfolio weights

6. Crypto Asset Taxonomy

Since the launch of the Bitcoin network in 2009 (Bradbury, 2013), the crypto asset landscape has undergone constant change, propelled by advancements in the distributed ledger technology (DLT). These technological improvements have facilitated new innovations, such as the creation of smart contracts, which have become pivotal for launching various types of crypto assets without the need for their own DLT, and the development of layer two solutions to scale DLTs. In line with the technological progress, the number and diversity of crypto assets has increased, with various types of crypto assets differing greatly, for example in terms of their technical design, intended use, and regulatory aspects.

In this evolving ecosystem, creating a taxonomy that categorises crypto assets based on their design can help a broad spectrum of stakeholders, from financial service providers to investors and regulators, in comprehending the intricacies of each crypto asset. Such a structured framework not only facilitates comparisons but also serves as an essential tool for evaluating potential risks and impacts associated with each crypto asset. Moreover, this understanding is vital for devising strategies for their integration into broader financial systems, ensuring a smoother transition and alignment with existing financial practices. The taxonomy proposed in the following section aims to enhance clarity and promote informed decision-making within a complex and dynamic market.

6.1. Taxonomy

Structured frameworks for crypto assets have already been proposed in various publications (see, e.g., FINMA (2018), Plazibat (2019), Ankenbrand, Bieri, Cortivo, Hoehener, and Hardjono (2020), and Ballandies, Dapp, and Pournaras (2022)). Some of them complement each other or cover selected key topics when assessing the characteristics of (crypto) assets. The possible multidimensionality of the designs of crypto assets, their underlying DLT protocols, and the dynamic developments of the related ecosystem are often not directly taken into account. The crypto asset taxonomy presented in this section attempts to address this.

More specifically, a framework to evaluate crypto assets using morphological boxes in three different dimensions is introduced. The different dimensions are illustrated in a simplified form in Figure 6.1. The first dimension is the token dimension (see Section 6.1.1), which focuses on the token design based on static attributes. As tokens are issued on blockchain networks which operate according to the rules and standards set by specific blockchain protocols, each token has one or more connections to the underlying second dimension. This second dimension is the protocol dimension (see Section 6.1.2). It breaks down various attributes of the DLT protocol underlying a token. The reason for keeping the first and the second dimension apart is that in addition to protocol-native crypto as-

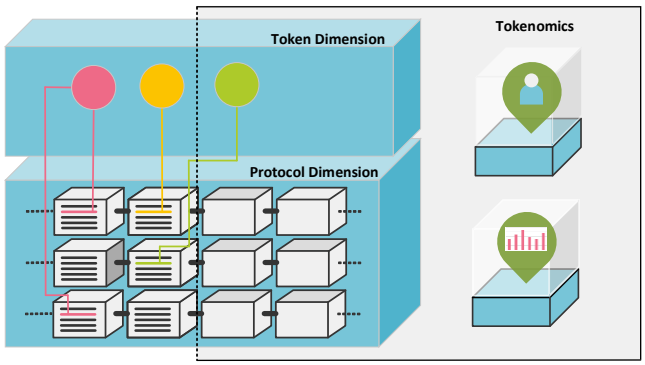

Figure 6.1: Simplified dimensions of the proposed crypto assets taxonomy

sets, i.e., tokens that are intrinsic to a specific blockchain, there is also a large number of crypto assets that are issued on existing DLT protocols, for example using a corresponding token standard (e.g., ERC-20 for Ethereum). In certain cases, crypto assets are also issued using tokens on more than one blockchain (e.g., USDC). The differentiation of the two dimensions enables a classification of the general token design and an individual classification of the corresponding DLT protocol(s). The third dimension is the tokenomics dimension (see Section 6.1.3), providing an ecosystem-driven evaluation of current dynamics related to a token. Therefore, it does not encompass static design characteristics, but rather the dynamic aspects such as the degree of decentralisation and development activity, which can fluctuate due to various factors like market demand and technological advancements.

The dimensions and attributes of the taxonomy presented in the following are based on the mentioned literature and an iterative development and case study process. The selection of the attributes was ensued according to their publicly acknowledged importance and by attempting to minimise overlaps. Due to the complexity of crypto assets and their related ecosystems, not all potentially relevant attributes were considered, also to assure the taxonomy's applicability. In addition, note that neither the dimensions nor the attributes are weighted, as their significance and dependencies can hardly be quantified and compared, and no aggregation of the individual attribute evaluations is attempted. In addition, the proposed taxonomy recommends examining the current status of attributes across the taxonomy's three dimensions. However, modifications to some of the attributes of a token or protocol can generally be made, for example through hard forks.

6.1.1 Token Dimension

The taxonomy for classifying the static properties of crypto assets and their associated DLT-based tokens is detailed in Table 6.1. This taxonomy includes 14 attributes that capture the fundamental properties of DLT-based tokens, each of which can exhibit various characteristics. In the following sections, these attributes and their respective characteristics are explained in detail, highlighting the specific questions each attribute aims to address:

Going-Live: How long has the token of the crypto asset been in existence?

- < 4 *years*: The token has been operational for less than four years.
- 4–8 *years*: The token has been operational for four to eight years.
- > 8 *years*: The token has been operational for more than eight years.

Evaluating the date a token went live can provide information about its maturity. This data can be retrieved on-chain by investigating the token's first transaction timestamp or the deployment date of its smart contract.

Primary Purpose: What is the primary purpose of the crypto token?[1]

- *Payment*: The primary purpose is to serve as a medium of exchange for goods and services.
- *Asset*: The primary purpose is to represent ownership of an asset (e.g., financial or physical).
- *Community*: The primary purpose is to enable participation in decision-making processes and/or activities within a decentralised organisation or network.
- *Smart Contract (SC) Infrastructure*: The primary purpose is to support the creation and execution of smart contracts on a DLT.
- *Interoperability*: The primary purpose is to facilitate interactions and transactions between different DLT networks.
- *Other Utility*: The primary purpose is to provide other specialised functions within a specific ecosystem, such as access to services or additional features.

Evaluating the primary purpose of a token can provide insights into its role and utility within the ecosystem. This data can be retrieved on- or off-chain from the token's white paper, official documentation, or by analysing its usage and functionality within the network.

Underlying: What underlying, collateral, or reserve asset is the token's value based on?

- *None*: The token is not linked to an underlying asset.
- *Fiat Currency*: The token is linked to a fiat currency.
- *Financial Asset*: The token is linked to a traditional financial asset with an ISIN (e.g., bond or stock).

[1] This evaluation relates only to the purpose of the token itself and not to applications that may be associated with it.

Table 6.1: Token dimension

Attribute	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
Going-Live	<4 Years	4 – 8 Years	>8 Years					
Primary Purpose	Payment	Asset	Community	SC Infrastr.	Interoperab.	Other Utility		
Underlying	None	Fiat Currency	Financial A.	Crypto A.	Other			
Issuer Type	Community	Consortium	Foundation	Corporation	Government	Other		
Functional Controls	Yes	No						
Governance Actions	On-Chain	Off-Chain	Mixed					
Initial Distrib. Insiders	0 %	0 % -25 %	26 % -50 %	51 % -75 %	76 % -100 %	N/A		
Information Access	Code	Audit	Roadmap	Finances	Governance	Team	White Paper	Tech Docs
Total Supply	Fixed	Flexible						
Token Type	Native	Non-Native						
Issuance	Once	Time-Dep.	Block-Dep.	Other				
Redemption	Yes	No						
Transferability	Transferable	Non-Transf.						
Fungibility	Fungible	Non-Fungible						

- *Crypto Asset*: The token is linked to another crypto asset (e.g., wrapped token).
- *Other*: The token is linked to a different type of asset not listed above.

Evaluating the underlying asset of a token helps understand its value stability and collateralisation. This data can be retrieved on- or off-chain from the token's white paper, official documentation, or by examining the backing reserves and assets associated with the token.

Issuer Type: Who is the issuer of the crypto token?

- *Community*: The token is issued by a decentralised group of individuals.
- *Consortium*: The token is issued by a consortium of corporations or organisations.
- *Foundation*: The token is issued by a foundation.
- *Corporation*: The token is issued by a corporation.
- *Government*: The token is issued by a governmental body.
- *Other*: The token is issued by an entity that does not fit into the above categories.

Evaluating the issuer type of a token provides insight into the operational structure behind the token and potential counterparty risk. This data can be retrieved off-chain from the token's white paper or official documentation.

Functional Controls: Does the token's (smart contract) code include functions that may provide privileges or constraints for individual stakeholders?[2]

- *Yes*: The token's code includes at least one function that may provide privileges or constraints for certain stakeholders.
- *No*: The token's code does not include any functions that may provide any privileges or constraints for stakeholders.

Evaluating the functional controls of a token helps understand the level of control and flexibility the issuer has over the token. This data can be retrieved on- or off-chain by examining the token's (smart contract) code.

Governance Actions: How are governance decisions made for the crypto token?

- *On-Chain*: Governance actions are decided directly on the blockchain.
- *Off-Chain*: Governance actions are decided outside of the blockchain.
- *Mixed*: A combination of on-chain and off-chain governance actions.

Evaluating the governance actions for a token provides insight into how decisions affecting the token are made.

[2] The exemplary evaluations in Section 6.2 assess the presence of functions such as the ability to pause transfers, blacklist addresses, modify balances, and whether the token contract's ownership has been renounced by the owner.

This data can be retrieved on- or off-chain from the token's white paper, governance documentation, or by analysing the token's governance mechanisms and processes in practice.

Initial Distribution Insiders: What is the proportion of tokens distributed to the team, founders, and advisors initially?

- $0\,\%$: 0 % of the tokens were distributed to insiders initially.
- $0\,\% - 25\,\%$: Between 0 % and 25 % of all tokens were distributed to insiders initially.
- $26\,\% - 50\,\%$: Between 26 % and 50 % of all tokens were distributed to insiders initially.
- $51\,\% - 75\,\%$: Between 51 % and 75 % of all tokens were distributed to insiders initially.
- $76\,\% - 100\,\%$: Between 76 % and 100 % of all tokens were distributed to insiders initially.
- *Not Applicable*: There was no initial token distribution to insiders.

Evaluating the initial distribution of tokens to insiders provides insight into the potential concentration of power and incentives among the core team and advisors. This data can be retrieved off-chain from the token's white paper or official documentation.

Information Access: What kind of information about the crypto token is publicly available (multiple options possible)?

- *Code*: Availability of the source code or repository links.
- *Audit*: Availability of results of security audits and assessments.
- *Roadmap*: Availability of future plans and milestones.
- *Finances*: Availability of financial reports and/or funding details.
- *Governance*: Availability of information on decision-making processes and structures.
- *Team*: Availability of details about the management team.
- *White Paper*: Availability of comprehensive project description and objectives.
- *Tech Docs*: Availability of detailed technical specifications explaining the implementation details of the token.

Evaluating the publicly available information on a token provides insights into its transparency and credibility. This data can be retrieved off-chain from the project's main website or from other publicly accessible sources (e.g., GitHub or token auditors).

Total Supply: What is the maximum number of tokens that can ever be in circulation?

- *Fixed*: The total supply is fixed at a certain number.
- *Flexible*: The total supply can change over time.

Evaluating the total supply of a token helps understand its scarcity and potential inflationary or deflationary properties. This data can be retrieved on- or off-chain from the token's white paper, official documentation, or by examining the token's (smart contract) code.

Token Type: Where was the token created and issued?

- *Native*: Created and issued on its own DLT protocol.
- *Non-Native*: Created and issued on an existing DLT protocol.

Evaluating the token type provides insight into the underlying infrastructure and independence of the token. This data can be retrieved on-chain by identifying and examining the blockchain protocol on which the token operates.

Issuance: How is the token generated?

- *Once*: After an initial issuance, no additional units of the token are issued.
- *Time-Dependent*: Additional units of the token are issued periodically over a set time frame.
- *Block-Dependent*: Additional units of the token are issued based on the generation of blocks.
- *Other*: Additional units of the token are issued according to other conditions or rules.

Evaluating the issuance mechanism of a token provides insight into its supply dynamics. This data can be retrieved on- or off-chain from the token's white paper, official documentation, or by analysing the token's issuance policy and mechanisms within the token's (smart contract) code.

Redemption: Can the number of outstanding and accessible tokens be reduced?

- *Yes*: The number of outstanding tokens can be reduced through specific mechanisms, such as burning or buyback programmes.

- *No*: There are no mechanisms in place to reduce the number of outstanding tokens.

Evaluating the redemption mechanisms of a token helps understand if the supply can be managed and potentially reduced to affect scarcity and value. This data can be retrieved on- or off-chain from the token's white paper, official documentation, or by examining the token's operational policies and (smart contract) code.

Transferability: Can the token's ownership be transferred to another party?

- *Transferable*: The token's ownership can be transferred to another party.
- *Non-Transferable*: The token's ownership cannot be transferred to another party (e.g., soulbound tokens).

Evaluating the transferability of a token provides insight into its utility and potential use cases within an ecosystem. This data can be retrieved on- or off-chain from the token's white paper, official documentation, or by examining the token's (smart contract) code.

Fungibility: Can the token be interchanged with another unit of the same token?

- *Fungible*: The token is substitutable with another unit of the same token.
- *Non-Fungible*: The token is not substitutable.

Evaluating the fungibility of a token provides insight into the level of its uniqueness. This data can be retrieved on- or off-chain from the token's white paper, official documentation, or by examining the token's (smart contract) code.

Note that other relevant token attributes such as a token's classification from the perspective of the Swiss financial markets regulator (FINMA) is excluded as no public directories are available for reference. For example, Bitcoin and Ether are not assigned an official classification by FINMA, despite some indications of the regulator's stance on the two crypto assets (see, e.g., FINMA (2018)).

6.1.2 Protocol Dimension

In addition to the token design, the functionality of the underlying DLT protocol also plays a role in a holistic view of how a crypto asset functions. This is particularly important because many crypto assets do not have their own protocol and are instead issued on an existing DLT network. Therefore, for a detailed understanding of non-native tokens, an evaluation of their underlying DLT protocols and the corresponding native tokens is necessary. The protocol dimension is broken down in the taxonomy in Table 6.2 using eight different attributes and corresponding characteristics. Note that for the classification of native tokens, certain attribute values (e.g., *Going-Live*) for the DLT protocol are inherited from the corresponding token design, as the token is inherently used to power the underlying protocol. A detailed description of the attributes and their corresponding characteristics can be found in the following:

Going-Live: How long has the protocol been in existence?

- $<$ 4 *years*: The protocol has been operational for less than four years.
- 4–8 *years*: The protocol has been operational for four to eight years.
- $>$ 8 *years*: The protocol has been operational for more than eight years.

Evaluating the date the protocol on which a token is based went live can provide information about its maturity. This data can be retrieved on-chain by investigating the timestamp of the first block created by the blockchain protocol.

DLT Type: What type of distributed ledger technology is used?

- *Public*: A blockchain that anyone can join and participate in.
- *Private*: A blockchain that is restricted to specific participants.
- *Consortium*: A blockchain that is restricted to a group of organisations.

Evaluating the type of DLT used provides insight into the accessibility of the blockchain network on which a token is based. This data can be retrieved off-chain from the protocol's white paper, official documentation, or by directly analysing the access requirements for new users of the blockchain protocol.

Consensus Mechanism: How is consensus on the finality of the system reached?

- *Proof of Work (PoW)*: Consensus is achieved through computational work by miners.

Table 6.2: Protocol dimension

Attribute	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
Going-Live	<4 Years	4 – 8 Years	>8 Years					
DLT Type	Public	Private	Consortium					
Consensus Mechanism	P o Work	P o Stake	Del. P o Stake	P o Authority	Other			
Layer	Layer 1	Layer 2	Layer 3					
Maximum TPS	<100	101–1k	1,001-5k	5,001-10k	10,001-25k	25,001-50k	50,001-100k	>100k
Governance Actions	On-Chain	Off-Chain	Mixed					
Information Access	Code	Audit	Roadmap	Finances	Governance	Team	White Paper	Tech Docs
Tx Confirmation	Near-Instant	< Minute	< Hour	< Day	> Day			

- *Proof of Stake (PoS)*: Consensus is achieved by validators who stake their tokens to validate transactions and create blocks.
- *Delegated Proof of Stake (dPoS)*: Consensus is achieved by elected delegates who stake tokens to validate transactions and create blocks.
- *Proof of Authority (PoA)*: Consensus is achieved by a limited number of authorised accounts.
- *Other*: Consensus is achieved through another approach.

Evaluating the consensus mechanism provides insight into the security, scalability, and energy efficiency of the blockchain network on which a token is based. This data can be retrieved off-chain from the protocol's white paper, official documentation, or by analysing the blockchain protocol's code.

Layer: Which layer of the blockchain architecture does the protocol represent?

- *Layer 1*: The base layer of the blockchain, where the primary network operates.
- *Layer 2*: An additional layer built on top of Layer 1 to improve the functionality (e.g., scalability, speed).
- *Layer 3*: A higher abstraction layer that focuses on application-level interactions.

Evaluating the layer of the blockchain architecture provides insight into the protocol's role and functionality within the broader ecosystem. This data can be retrieved off-chain from the protocol's white paper, official documentation, or by analysing the blockchain protocol's code.

Maximum Transactions per Second (TPS): What is the maximum theoretical TPS rate of the protocol?

- < 100: The protocol can process a maximum of less than 100 transactions per second.
- 101–$1k$: The protocol can process a maximum of between 101 and 1,000 transactions per second.
- $1,001$–$5k$: The protocol can process a maximum of between 1,001 and 5,000 transactions per second.
- $5,001$–$10k$: The protocol can process a maximum of between 5,001 and 10,000 transactions per second.
- $10,001$–$25k$: The protocol can process a maximum of between 10,001 and 25,000 transactions per second.
- $25,001$–$50k$: The protocol can process a maximum of between 25,001 and 50,000 transactions per second.
- $50,001$–$100k$: The protocol can process a maximum of between 50,001 and 100,000 transactions per second.
- $> 100k$: The protocol can process a maximum of more than 100,000 transactions per second.

Evaluating the maximum theoretical TPS provides insight into the scalability and performance capabilities of the blockchain protocol on which a token is based. This data can be retrieved off-chain from the protocol's white paper, technical documentation, or performance benchmarks conducted by third parties.

Governance Actions: How are governance decisions made for the protocol?

- *On-Chain*: Governance actions are decided directly on the blockchain.
- *Off-Chain*: Governance actions are decided outside of the blockchain.
- *Mixed*: A combination of on-chain and off-chain governance actions.

Evaluating the governance actions for the protocol a token is based on provides insight into how decisions affecting the protocol are made. This data can be retrieved on- or off-chain from the protocol's white paper, governance documentation, or by analysing the protocol's governance mechanisms and processes in practice.

Information Access: What kind of information about the protocol is publicly available (multiple options possible)?

- *Code*: Availability of the source code or repository links.
- *Audit*: Availability of results of security audits and assessments.
- *Roadmap*: Availability of future plans and milestones.
- *Finances*: Availability of financial reports and/or funding details.
- *Governance*: Availability of information on decision-making processes and structures.
- *Team*: Availability of details about the management team.
- *White Paper*: Availability of comprehensive project description and objectives.
- *Tech Docs*: Availability of detailed technical specifications explaining the implementation details of the protocol.

Evaluating the publicly available information about the protocol a token is based on provides insights into its transparency and credibility. This data can be retrieved off-chain from the protocol's main website or from other publicly accessible sources (e.g., GitHub or protocol auditors).

Transaction (Tx) Confirmation: How long does the secure confirmation of a transaction take?

- *Near-Instant*: Secure transaction confirmation occurs almost instantly.
- *< Minute*: Secure transaction confirmation occurs within a minute.
- *< Hour*: Secure transaction confirmation occurs within an hour.
- *< Day*: Secure transaction confirmation occurs within a day.
- *> Day*: Secure transaction confirmation takes longer than a day.

Evaluating the confirmation time for secure transactions provides insight into the speed and efficiency of the blockchain protocol a token is based on. This data can be retrieved off-chain from the protocol's white paper, technical documentation, or benchmarks provided by crypto exchanges or other third-party providers. Note that the confirmation time as well as the finality of a transaction depends on various factors such as the consensus mechanism or the subjective security requirements of the sender or receiver, and hence is not a completely objective measure.

6.1.3 Tokenomics Dimension

The third dimension of the proposed classification framework for crypto assets is the tokenomics dimension. It includes time-dependent factors that can vary depending on the prevailing conditions, such as market dynamics or changes in the ecosystem, which may have a significant impact on key properties of a token, such as its decentralisation. Therefore, assessing these attributes at various points in time can yield more comprehensive insights than evaluating them in one single moment. Here, 14 relevant ecosystem-driven attributes are presented in Table 6.3, which can be described in more detail as follows:

Market Capitalisation (USD): What is the token's current market capitalisation in USD?

- $0 - 100mn$: The market capitalisation is quoted between USD 0 and USD 100 million.
- $100mn - 1bn$: The market capitalisation is quoted between USD 100 million and USD 1 billion.
- $1bn - 10bn$: The market capitalisation is quoted between USD 1 billion and USD 10 billion.
- $10bn - 100bn$: The market capitalisation is quoted between USD 10 billion and USD 100 billion.
- $100bn - 1,000bn$: The market capitalisation is quoted between USD 100 billion and USD 1,000 billion.
- $> 1,000bn$: The market capitalisation is higher than USD 1,000 billion.

Evaluating the market capitalisation of a token provides insight into its size, adoption, and perceived value in the market. This data can be retrieved off-chain from crypto asset tracking websites.

Table 6.3: Tokenomics dimension

Attribute		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Market Capitalisation (USD)		0-100mn	100mn-1bn	1bn-10bn	10bn-100bn	100bn-1,000bn	>1,000bn
Supply Ratio		0 %-25 %	26 %-50 %	51 %-75 %	76 %-99 %	100 %	N/A
Average TPS		0-100	101-250	251-500	501-1,000	1,001-2,000	>2,000
Developer Activity		0-100	101-250	251-500	501-1,000	1,001-2,000	>2,000
Staking Ratio		0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %	N/A	
TVL Ratio Token		0 %-10 %	11 %-20 %	21 %-30 %	31 %-40 %	41 %-50 %	> 50 %
Locked for…	**a) Lending**	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
	b) Liquidity Mining/DEXes	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
	c) Liquid Staking	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
	d) Restaking	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
	e) Bridges	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
	f) Others	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
TVL Application/Protocol (USD)		0-100mn	100mn-1bn	1bn-10bn	10bn-100bn	>100bn	N/A
Consensus Decentralisation		1-10	11-50	51-250	251-1,000	>1,000	N/A
Client Decentralisation		1-5	6-10	11-20	21-50	>50	N/A
Developer Decentralisation		1-10	11-50	51-250	251-1,000	>1,000	N/A
Exchange Decentralisation		1-5	6-10	11-20	21-50	>50	N/A
Node Decentralisation		1-5	6-10	11-20	21-50	>50	N/A
Owner Decentralisation		1-10	11-50	51-250	251-1,000	>1,000	N/A

Supply Ratio: What percentage of the total token supply is circulating?[3]

- $0\,\% - 25\,\%$: Up to 25 % of the total token supply is circulating.
- $26\,\% - 50\,\%$: Between 26 % and 50 % of the total token supply is circulating.
- $51\,\% - 75\,\%$: Between 51 % and 75 % of the total token supply is circulating.
- $76\,\% - 99\,\%$: Between 76 % and 99 % of the total token supply is circulating.
- $100\,\%$: The maximum possible number of tokens is circulating.
- *Not Applicable*: The token has no fixed maximum supply.

Evaluating the supply ratio provides insight into the liquidity and distribution of the token within the market. This data can be retrieved off-chain from crypto asset tracking websites.

Average Transactions per Second (TPS): What is the average TPS rate for the token's underlying protocol over the past month?

- $0 - 100$: The protocol processed an average of between 0 and 100 transactions per second in the past month.
- $101 - 250$: The protocol processed an average of between 101 and 250 transactions per second in the past month.
- 251–500: The protocol processed an average of between 251 and 500 transactions per second in the past month.
- 501–$1,000$: The protocol processed an average of between 501 and 1,000 transactions per second in the past month.
- $1,001$–$2,000$: The protocol processed an average of between 1,001 and 2,000 transactions per second in the past month.
- $> 2,000$: The protocol processed an average of more than 2,000 transactions per second in the past month.

Evaluating the average TPS provides insight into the actual performance and capacity utilisation of the blockchain protocol a token is based on. This data can be retrieved directly on-chain or indirectly from blockchain explorers.

[3] Note that the supply ratio in the tokenomics dimension is particularly dependent on the "Total Supply" attribute in the token dimension.

Developer Activity: How many commits have been made to the token's main GitHub repository in the past month?

- $0 - 100$: Between 0 and 100 commits have been made to the main GitHub repository in the past month.
- $101 - 250$: Between 101 and 250 commits have been made to the main GitHub repository in the past month.
- $251 - 500$: Between 251 and 500 commits have been made to the main GitHub repository in the past month.
- $501 - 1,000$: Between 501 and 1,000 commits have been made to the main GitHub repository in the past month.
- $1,001 - 2,000$: Between 1,001 and 2,000 commits have been made to the main GitHub repository in the past month.
- $> 2,000$: More than 2,000 commits have been made to the main GitHub repository in the past month.

Evaluating developer activity provides insight into the ongoing development, maintenance, and community engagement with the token. This data can be retrieved off-chain from the token's GitHub repository or other version control platforms where code related to the token is hosted.

Staking Ratio: What percentage of the token's circulating supply is staked?[4]

- $0\,\% - 25\,\%$: Between 0 % and 25 % of the circulating token supply is staked.
- $26\,\% - 50\,\%$: Between 26 % and 50 % of the circulating token supply is staked.
- $51\,\% - 75\,\%$: Between 51 % and 75 % of the circulating token supply is staked.
- $76\,\% - 100\,\%$: Between 76 % and 100 % of the circulating token supply is staked.
- *Not Applicable*: The token cannot be staked (e.g., is a non-native token).

Evaluating the staking ratio provides insight into the level of participation in the network's security and governance. This data can be retrieved directly on-chain or indirectly from blockchain explorers or staking analytics platforms.

Total Value Locked (TVL) Ratio Token: What proportion of the token's circulating supply is locked in decentralised applications?

- $0\,\% - 10\,\%$: Between 0 % and 10 % of the token's circulating supply is locked.
- $11\,\% - 20\,\%$: Between 11 % and 20 % of the token's circulating supply is locked.
- $21\,\% - 30\,\%$: Between 21 % and 30 % of the token's circulating supply is locked.
- $31\,\% - 40\,\%$: Between 31 % and 40 % of the token's circulating supply is locked.
- $41\,\% - 50\,\%$: Between 41 % and 50 % of the token's circulating supply is locked.
- $> 50\,\%$: More than 50 % of the token's circulating supply is locked.

Evaluating the TVL ratio provides insight into the level of engagement and utility of the token within decentralised applications. This data can be retrieved directly on-chain or indirectly from blockchain explorers or crypto asset TVL tracking websites.

Locked for…: How much of the token's total TVL is represented by each of the following DeFi services: *a) Lending*, *b) Liquidity Mining/DEXes*, *c) Liquid Staking*, *d) Restaking*, *e) Bridges*, and *f) Others*?

- $0\,\% - 25\,\%$: Between 0 % and 25 % of the token's total TVL.
- $26\,\% - 50\,\%$: Between 26 % and 50 % of the token's total TVL.
- $51\,\% - 75\,\%$: Between 51 % and 75 % of the token's total TVL.
- $76\,\% - 100\,\%$: Between 76 % and 100 % of the token's total TVL.

Evaluating the distribution of the token's TVL across different DeFi services provides insight into how the token is utilised within the DeFi ecosystem. This data can be retrieved directly on-chain or indirectly from blockchain explorers or DeFi analytics platforms.

TVL Application/Protocol (USD): What is the TVL of all crypto assets locked in the token's directly related decentralised application or protocol?[5]

[4] Note that this figure encompasses all tokens utilised for network validation, regardless of the staking method employed (e.g., native staking, liquid staking).

[5] An example of a directly related application is a DeFi platform governed by a governance token. In addition, directly related protocols include DLT networks powered by their own native token.

- $0 - 100mn$: Between USD 0 and USD 100 million of crypto assets are locked.
- $100mn - 1bn$: Between USD 100 million and USD 1 billion of crypto assets are locked.
- $1bn - 10bn$: Between USD 1 billion and USD 10 billion of crypto assets are locked.
- $10bn - 100bn$: Between USD 10 billion and USD 100 billion of crypto assets are locked.
- $> 100bn$: More than USD 100 billion of crypto assets are locked.
- *Not Applicable*: The token is not directly related to a decentralised application or protocol.

Evaluating the TVL of all crypto assets for the directly related application or protocol of a token provides insight into the level of corresponding adoption and usage of that specific application or protocol. This data can be retrieved directly on-chain or indirectly from blockchain explorers or analytics platforms for decentralised applications and protocols.

Consensus Decentralisation: How many entities are required to account for over 50 percent of the total mining hash rate or (staking) validator share?

- $1-10$: Between one and ten entities are required to accumulate over 50 % of the hash rate or (staking) validator share.
- $11 - 50$: Between eleven and 50 entities are required to accumulate over 50 % of the hash rate or (staking) validator share.
- $51-250$: Between 51 and 250 entities are required to accumulate over 50 % of the hash rate or (staking) validator share.
- $251 - 1,000$: Between 251 and 1,000 entities are required to accumulate over 50 % of the hash rate or (staking) validator share.
- $> 1,000$: More than 1,000 entities are required to accumulate over 50 % of the hash rate or (staking) validator share.
- *Not Applicable*: The assessment cannot be carried out (e.g., for non-native tokens).

Evaluating the decentralisation of consensus provides insight into the distribution of power and control within the network. This data can be retrieved directly on-chain or indirectly from blockchain explorers or consensus analytics platforms.

Client Decentralisation: How many distinct software clients are required to account for over 50 percent of the current usage?

- $1-5$: Between one and five distinct software clients are required to accumulate over 50 % of the current usage.
- $6-10$: Between six and ten distinct software clients are required to accumulate over 50 % of the current usage.
- $11 - 20$: Between eleven and 20 distinct software clients are required to accumulate over 50 % of the current usage.
- $21-50$: Between 21 and 50 distinct software clients are required to accumulate over 50 % of the current usage.
- > 50: More than 50 distinct software clients are required to accumulate over 50 % of the current usage.
- *Not Applicable*: The assessment cannot be carried out (e.g., for non-native tokens).

Evaluating the decentralisation of clients provides insight into the diversity and robustness of the network's software ecosystem. This data can be retrieved off-chain from network analysis tools or client usage statistics.

Developer Decentralisation: How many contributors are required to account for over 50 percent of the code commits?

- $1 - 10$: Between one and ten contributors are required to accumulate over 50 % of the code commits.
- $11 - 50$: Between eleven and 50 contributors are required to accumulate over 50 % of the code commits.
- $51 - 250$: Between 51 and 250 contributors are required to accumulate over 50 % of the code commits.
- $251 - 1,000$: Between 251 and 1,000 contributors are required to accumulate over 50 % of the code commits.
- $> 1,000$: More than 1,000 contributors are required to accumulate over 50 % of the code commits.
- *Not Applicable*: The assessment cannot be carried out (e.g., for tokens whose code base is not public).

Evaluating developer decentralisation provides insight into the distribution of development efforts and potential technical centralisation risks. This data can be retrieved off-chain from the token's GitHub repository or other version control platforms where the token's code is hosted.

Exchange Decentralisation: How many crypto exchanges are required to account for over 50 percent of the token's past 24-hour trading volume?

- $1-5$: Between one and five crypto exchanges are required to accumulate over 50 % of the past 24-hour trading volume.
- $6-10$: Between six and ten crypto exchanges are required to accumulate over 50 % of the past 24-hour trading volume.
- $11-20$: Between eleven and 20 crypto exchanges are required to accumulate over 50 % of the past 24-hour trading volume.
- $21-50$: Between 21 and 50 crypto exchanges are required to accumulate over 50 % of the past 24-hour trading volume.
- >50: More than 50 crypto exchanges are required to accumulate over 50 % of the past 24-hour trading volume.
- *Not Applicable*: The assessment cannot be carried out (e.g., for non-publicly traded tokens).

Evaluating exchange decentralisation provides insight into the distribution of trading activity and potential risks associated with exchange concentration. This data can be retrieved off-chain from crypto asset financial data aggregators.

Node Decentralisation: How many countries are required to account for over 50 percent of the total mining hash rate or (staking) validator share)?

- $1-5$: Between one and five countries are required to accumulate over 50 % of the total mining hash rate or (staking) validator share.
- $6-10$: Between six and ten countries are required to accumulate over 50 % of the total mining hash rate or (staking) validator share.
- $11-20$: Between eleven and 20 countries are required to accumulate over 50 % of the total mining hash rate or (staking) validator share.
- $21-50$: Between 21 and 50 countries are required to accumulate over 50 % of the total mining hash rate or (staking) validator share.
- >50: More than 50 countries are required to accumulate over 50 % of the total mining hash rate or (staking) validator share.
- *Not Applicable*: The assessment cannot be carried out (e.g., for non-native tokens).

Evaluating node decentralisation provides insight into the geographic distribution and resilience of the network. This data can be retrieved off-chain from network analysis tools that track node locations.

Owner Decentralisation: How many addresses are required to account for over 50 % of the tokens in circulation?

- $1-10$: Between one and ten addresses are required to accumulate over 50 % of the tokens in circulation.
- $11-50$: Between eleven and 50 addresses are required to accumulate over 50 % of the tokens in circulation.
- $51-250$: Between 51 and 250 addresses are required to accumulate over 50 % of the tokens in circulation.
- $251-1,000$: Between 251 and 1,000 addresses are required to accumulate over 50 % of the tokens in circulation.
- $>1,000$: More than 1,000 addresses are required to accumulate over 50 % of the tokens in circulation.
- *Not Applicable*: The assessment cannot be carried out (e.g., for tokens on a private DLT protocol).

Evaluating owner decentralisation provides insight into the distribution of token ownership and potential centralisation risks. This data can be retrieved directly on-chain or indirectly from blockchain explorers.

6.2. Exemplary Classification

This section presents two exemplary classifications of crypto assets using the taxonomy presented in order to demonstrate its practicability. In Section 6.2.1, the taxonomy is applied to Bitcoin, and in Section 6.2.2, it is applied to Ether.

6.2.1 Classification of Bitcoin

Bitcoin, the pioneering crypto asset, exhibits several distinctive attributes according to the token dimension classification, shown in Table 6.4. Since the first block was

Table 6.4: Classification of Bitcoin from the token dimension

Attribute	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
Going-Live	<4 Years	4 – 8 Years	>8 Years					
Primary Purpose	Payment	Asset	Community	SC Infrastr.	Interoperab.	Other Utility		
Underlying	None	Fiat Currency	Financial A.	Crypto A.	Other			
Issuer Type	Community	Consortium	Foundation	Corporation	Government	Other		
Functional Controls	Yes	No						
Governance Actions	On-Chain	Off-Chain	Mixed					
Initial Distrib. Insiders	0 %	0 % -25 %	26 % -50 %	51 % -75 %	76 % -100 %	N/A		
Information Access	Code	Audit	Roadmap	Finances	Governance	Team	White Paper	Tech Docs
Total Supply	Fixed	Flexible						
Token Type	Native	Non-Native						
Issuance	Once	Time-Dep.	Block-Dep.	Other				
Redemption	Yes	No						
Transferability	Transferable	Non-Transf.						
Fungibility	Fungible	Non-Fungible						

mined in January 2009, tokens of the crypto asset have been in circulation for more than eight years (*Going-Live*). Its initially intended purpose was to serve as a medium of exchange for goods and services (Nakamoto, 2008), making it a payment token (*Primary Purpose*). Unlike some other payment tokens, Bitcoin is not linked to any underlying asset (Nakamoto, 2008) such as fiat currency or traditional financial instruments. Also, its value is not based on any collateral or reserve assets (*Underlying*). Bitcoin is issued by a decentralised community, reflecting its grassroots origins and the absence of a central authority (*Issuer Type*). The code governing Bitcoin does not include any functions that provide privileges or constraints for individual stakeholders, ensuring a uniform playing field for all users (*Functional Controls*). Governance actions related to Bitcoin are decided off-chain, rather than through blockchain-based mechanisms (*Governance Actions*). As units of Bitcoins are created through a mining process, it did not have a conventional initial token distribution to insiders like team members or advisors (*Initial Distribution Insiders*). In terms of information access on the project's main website[6], Bitcoin is notable for its transparency with regard to the source code, and the comprehensive project descriptions and objectives can be found in its white paper and technical documentation (*Information Access*). The total supply of Bitcoin is fixed, capped at 21 million units (Satoshi Nakamoto, online), thereby ensuring scarcity (*Token Supply*). As a native token, Bitcoin was created and issued on its own blockchain protocol (*Token Type*). New units of Bitcoin are generated through a block-dependent issuance process, with miners receiving rewards for adding new blocks to the blockchain (*Issuance*). Bitcoin's design does not include a distinct mechanisms for reducing the number of outstanding tokens, such as burning (*Redemption*). Its ownership is transferable, allowing users to send and receive Bitcoins freely (*Transferability*). Lastly, Bitcoin is fungible, meaning each Bitcoin is interchangeable with any other, maintaining uniformity across all units (*Fungibility*).[7]

Since Bitcoin is a native token, some of the attributes of the underlying protocol are identical to those of the token itself. Specifically, this holds true for the attributes *Going-Live*, *Governance Actions*, and *Information Access*. The full classification of Bitcoin from the protocol dimension is given in Table 6.5. In addition to the three attributes already mentioned, the Bitcoin protocol is characterised by being publicly accessible to everyone (*DLT Type*) and a Proof-of-Work mechanism to reach consensus across the network participants (*Consensus Mechanism*). Bitcoin's protocol functions as a Layer 1 blockchain, forming the base layer where the primary network operations occur (*Layer*). Despite its foundational role in the blockchain ecosystem, Bitcoin can process a theoretical maximum of fewer than 100 transactions per second (*Maximum*

[6] See https://bitcoin.org/.

[7] Note that the concept of so-called "Coloured Coins" introduces the idea of attaching metadata to units of the crypto assets, effectively creating unique, non-fungible tokens for specific purposes.

Table 6.5: Classification of Bitcoin from the protocol dimension

Attribute	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
Going-Live	<4 Years	4 – 8 Years	>8 Years					
DLT Type	Public	Private	Consortium					
Consensus Mechanism	P o Work	P o Stake	Del. P o Stake	P o Authority	Other			
Layer	Layer 1	Layer 2	Layer 3					
Maximum TPS	<100	101–1k	1,001-5k	5,001-10k	10,001-25k	25,001-50k	50,001-100k	>100k
Governance Actions	On-Chain	Off-Chain	Mixed					
Information Access	Code	Audit	Roadmap	Finances	Governance	Team	White Paper	Tech Docs
Tx Confirmation	Near-Instant	< Minute	< Hour	< Day	> Day			

TPS), which is relatively low compared to other protocols (Chainspect, online) and traditional settlement systems, such as the Swiss Interbank Clearing (SIC) system operated by the Swiss exchange SIX, which can handle several thousand transactions per second (SIX, online-c). In terms of transaction confirmation, Bitcoin generally achieves secure confirmations within an hour (*TX Confirmation*), or, according to the Kraken crypto exchange, after four block confirmations (Kraken, online), balancing the trade-off between security and speed in processing transactions.

The classification of Bitcoin from a tokenomics perspective is given in Table 6.6, highlighting the relevant dynamic ecosystem figures as of July 2024. As of the first of July, the aggregated value of all Bitcoin tokens was quoted at roughly USD 1,250 billion (*Market Capitalisation*). Furthermore, around 19.7 million (CoinGecko, online-d) of the total 21 million units of Bitcoin, or 94 percent in relative terms, were in circulation (*Supply Ratio*). The underlying protocol processes an average of approximately seven transactions per second (Chainspect, online), highlighting its limitations in terms of scalability (*Average TPS*). With 317 commits, Bitcoin's total repository on GitHub[8] experienced lower activity in June 2024 (*Developer Activity*)

[8] See https://github.com/bitcoin/.

Table 6.6: Classification of Bitcoin from the tokenomics dimension

Attribute		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Market Capitalisation (USD)		0-100mn	>100mn-1bn	>1bn-10bn	>10bn-100bn	>100bn-1,000bn	>1,000bn
Supply Ratio		0 % -25 %	26 % -50 %	51 % -75 %	76 % -99 %	100 %	N/A
Average TPS		0-100	101-250	251-500	501-1,000	1,001-2,000	>2,000
Developer Activity		0-100	101-250	251-500	501-1,000	1,001-2,000	>2,000
Staking Ratio		0 % -25 %	26 % -50 %	51 % -75 %	76 % -100 %	N/A	
TVL Ratio Token		0 % -10 %	11 % -20 %	21 % -30 %	31 % -40 %	41 % -50 %	> 50 %
Locked for…	a) Lending	0 % -25 %	26 % -50 %	51 % -75 %	76 % -100 %		
	b) Liquidity Mining/DEXes	0 % -25 %	26 % -50 %	51 % -75 %	76 % -100 %		
	c) Liquid Staking	0 % -25 %	26 % -50 %	51 % -75 %	76 % -100 %		
	d) Restaking	0 % -25 %	26 % -50 %	51 % -75 %	76 % -100 %		
	e) Bridges	0 % -25 %	26 % -50 %	51 % -75 %	76 % -100 %		
	f) Others	0 % -25 %	26 % -50 %	51 % -75 %	76 % -100 %		
TVL Application/Protocol (USD)		0-100mn	100mn-1bn	1bn-10bn	10bn-100bn	>100bn	N/A
Consensus Decentralisation		1-10	11-50	51-250	251-1,000	>1,000	N/A
Client Decentralisation		1-5	6-10	11-20	21-50	>50	N/A
Developer Decentralisation		1-10	11-50	51-250	251-1,000	>1,000	N/A
Exchange Decentralisation		1-5	6-10	11-20	21-50	>50	N/A
Node Decentralisation		1-5	6-10	11-20	21-50	>50	N/A
Owner Decentralisation		1-10	11-50	51-250	251-1,000	>1,000	N/A

compared to other protocols (Cryptometheus, online-a). The staking ratio is not applicable to Bitcoin, as it does not utilise a Proof-of-Stake mechanism to secure its network (*Staking Ratio*), and approximately two percent of Bitcoin's circulating supply, or roughly USD 28 billion in absolute terms (DeFiLlama, online-a), is utilised in decentralised applications (*TVL Ratio Token*). This also includes wrapped Bitcoin tokens locked on other blockchains besides the Bitcoin network. The largest share of token TVL is attributable to bridges, which account for 49 percent, followed by lending protocols with a share of 39 percent (*Locked for ...*). In contrast to the TVL of Bitcoin tokens across all blockchains, the TVL on the Bitcoin protocol (*TVL Application/Protocol*) is significantly lower at USD 430 million (CoinMarketCap, online). Decentralisation metrics reveal that consensus is relatively centralised (*Consensus Decentralisation*), with two mining pools, Foundry USA and AntPool, accounting for over 50 percent of the total hash rate (Luxor Technology, online). A similar high degree of centralisation is evident in the software clients used to execute the protocol (*Client Decentralisation*) and the distribution of nodes across countries (*Node Decentralisation*). Bitcoin Core accounts for approximately 98 percent of all Bitcoin implementations (Dance, online). In addition, the United States, Germany, China, and Canada collectively host over 50 percent of all nodes (Bitnodes, online). With regard to the development of the core implementation of Bitcoin (*Developer Decentralisation*), eleven contributors account for more than 50 percent of the commits (GitHub, online-a). Finally, the 40 largest crypto exchanges account for more than 50 percent of the 24-hour spot trading volume as of the beginning of July 2024 (*Exchange Decentralisation*) and it takes more than the thousand largest addresses to accumulate a total number of more than 50 percent of the circulating Bitcoin (*Owner Decentralisation*), which shows a comparatively higher degree of decentralisation compared to the other four centralisation measures (CoinGecko, online-e; BitInfoCharts, online).

6.2.2 Classification of Ether

Ether, the native crypto asset of the Ethereum blockchain, exhibits a range of unique characteristics according to the classification of the token dimension in Table 6.7. Originally launched as Ethereum 1.0 in July 2015 (*Going-Live*), the Ether token has been in existence for more than eight years (Etherscan, online-a) and hence is one of the most established crypto assets in the space. Its intended purpose is to serve as the underlying infrastructure for smart contracts (*Primary Purpose*), which are self-executing contracts with the terms of the agreement written directly into code (Buterin, 2014). In addition to Ether's primary purpose, Ethereum's protocol with its arbitrary state transition function creates a uniquely versatile platform. Unlike closed-ended, single-purpose protocols for specific applications like data storage, gambling, or finance, Ethereum is designed as a foundational layer for numerous financial and non-financial protocols (Buterin, 2014). Ether is not linked to any underlying asset (*Underlying*) but serves as the fundamental token of the Ethereum network (Buterin, 2014). The Ethereum foundation can be seen as the issuer of the token (*Issuer Type*), overseeing its development and promoting its adoption (Ethereum Foundation, online). Ether does not include any functions that provide privileges or constraints for individual stakeholders, ensuring equal power for all stakeholders in the Ethereum ecosystem with regard to the token's functionality (*Functional Control*). Governance actions related to Ether are decided off-chain (*Governance Actions*), rather than through blockchain-based mechanisms, highlighting the community's role in decision-making processes (Ethereum.org, online-a). In terms of initial distribution, roughly 17 percent of the funds raised were allocated to the team and early contributors (*Initial Distribution Insiders*), while the remaining 83 percent were sold publicly to investors (CoinGecko, online-f). The project's main website[9] (*Information Access*) provides public access to information about the source code, roadmap, governance details, white paper, and technical documentation. The total supply of Ether is flexible (*Token Supply*), meaning there is no predefined maximum limit on the number of Ether tokens that can exist (CoinGecko, online-g). As a native token (*Token Type*), Ether was created and issued on its own Ethereum blockchain protocol. New Ether tokens are generated through a block-dependent issuance process (*Issuance*), with validators receiving rewards for proposing and attesting to new blocks. However, Ether also has deflationary mechanisms (*Redemption*), such as the burning of transaction fees introduced by EIP-1559, which can reduce the overall supply over time (Ethereum.org, online-b). Its ownership is transferable (*Transferability*), allowing users to send and receive Ether freely and it is fungible (*Fungibility*), meaning each unit is interchangeable with any other, maintaining uniformity across all units.

[9] See https://ethereum.org/.

Table 6.7: Classification of Ether from the token dimension

Attribute	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
Going-Live	<4 Years	4 – 8 Years	>8 Years					
Primary Purpose	Payment	Asset	Community	SC Infrastr.	Interoperab.	Other Utility		
Underlying	None	Fiat Currency	Financial A.	Crypto A.	Other			
Issuer Type	Community	Consortium	Foundation	Corporation	Government	Other		
Functional Controls	Yes	No						
Governance Actions	On-Chain	Off-Chain	Mixed					
Initial Distrib. Insiders	0 %	0 % -25 %	26 % -50 %	51 % -75 %	76 % -100 %	N/A		
Information Access	Code	Audit	Roadmap	Finances	Governance	Team	White Paper	Tech Docs
Total Supply	Fixed	Flexible						
Token Type	Native	Non-Native						
Issuance	Once	Time-Dep.	Block-Dep.	Other				
Redemption	Yes	No						
Transferability	Transferable	Non-Transf.						
Fungibility	Fungible	Non-Fungible						

Analogous to the Bitcoin classification in Section 6.2.1, Ether is also a native token, implying that the characteristics of the protocol attributes *Going-Live*, *Governance Actions*, and *Information Access* are identical to Ether's token dimension classification. This is also shown in Table 6.8. Furthermore, the protocol underlying Ether is characterised by its public access (*DLT Type*). After the transition from a Proof-of-Work to a Proof-of-Stake consensus model (*Consensus Mechanism*) in September 2022 (Ethereum.org, online-c), the protocol relies on validators rather than miners to secure the network and validate transactions. The Ethereum protocol functions as a Layer 1 blockchain (*Layer*), serving as the foundational layer for decentralised applications and smart contracts. With a theoretical maximum of 119 transactions per seconds (Chainspect, online), Ethereum's scalability is limited (*Maximum TPS*). It is greater than that of Bitcoin (see Table 6.5), but significantly lower than that of traditional systems such as, for example, the SIC system operated by the SIX exchange (SIX, online-c). However, solutions like Layer 2 scaling are being developed to enhance this capacity. Finally, transaction settlement (*Tx Confirmation*) for Ether on the Ethereum mainnet typically takes around 14 minutes, equivalent to 70 confirmations, according to the Kraken crypto exchange (Kraken, online).

The classification of Ether from the perspective of the tokenomics dimension is shown in Table 6.9. As of the first of July, the aggregated value of all Ether tokens was quoted at roughly USD 413 billion (*Market Capitalisation*). Since there is no fixed total supply for Ether, it is not possible to calculate a share of the circulating supply in the total supply (*Supply Ratio*). The average transactions per second for Ethereum is 14 (*Average TPS*), reflecting its current processing capabilities at the base layer, which are significantly lower than the theoretical maximum. This limita-

Table 6.8: Classification of Ether from the protocol dimension

Attribute	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
Going-Live	<4 Years	4 – 8 Years	>8 Years					
DLT Type	Public	Private	Consortium					
Consensus Mechanism	P o Work	P o Stake	Del. P o Stake	P o Authority	Other			
Layer	Layer 1	Layer 2	Layer 3					
Maximum TPS	<100	101–1k	1,001-5k	5,001-10k	10,001-25k	25,001-50k	50,001-100k	>100k
Governance Actions	On-Chain	Off-Chain	Mixed					
Information Access	Code	Audit	Roadmap	Finances	Governance	Team	White Paper	Tech Docs
Tx Confirmation	Near-Instant	< Minute	< Hour	< Day	> Day			

Table 6.9: Classification of Ether from the tokenomics dimension

Attribute		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Market Capitalisation (USD)		0-100mn	>100mn-1bn	>1bn-10bn	>10bn-100bn	>100bn-1,000bn	>1,000bn
Supply Ratio		0 %-25 %	26 %-50 %	51 %-75 %	76 %-99 %	100 %	N/A
Average TPS		0-100	101-250	251-500	501-1,000	1,001-2,000	>2,000
Developer Activity		0-100	101-250	251-500	501-1,000	1,001-2,000	>2,000
Staking Ratio		0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %	N/A	
TVL Ratio Token		0 %-10 %	11 %-20 %	21 %-30 %	31 %-40 %	41 %-50 %	> 50 %
Locked for…	a) Lending	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
	b) Liquidity Mining/DEXes	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
	c) Liquid Staking	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
	d) Restaking	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
	e) Bridges	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
	f) Others	0 %-25 %	26 %-50 %	51 %-75 %	76 %-100 %		
TVL Application/Protocol (USD)		0-100mn	100mn-1bn	1bn-10bn	10bn-100bn	>100bn	N/A
Consensus Decentralisation		1-10	11-50	51-250	251-1,000	>1,000	N/A
Client Decentralisation		1-5	6-10	11-20	21-50	>50	N/A
Developer Decentralisation		1-10	11-50	51-250	251-1,000	>1,000	N/A
Exchange Decentralisation		1-5	6-10	11-20	21-50	>50	N/A
Node Decentralisation		1-5	6-10	11-20	21-50	>50	N/A
Owner Decentralisation		1-10	11-50	51-250	251-1,000	>1,000	N/A

tion is not necessarily due to a lack of transaction demand but can be attributed to factors such as the gas limit for each block on the Ethereum network. Development on the Ethereum project, including its website and smart contract language, is active (*Developer Activity*), with 1,923 commits pushed to the project's GitHub repository[10] in June 2024 (Cryptometheus, online-b). The total amount of Ether tokens used for staking constitutes 27 percent of the total supply (*Staking Ratio*), indicating a substantial portion of the token supply is dedicated to securing the network through staking (bitfly, online). The TVL ratio of Ether tokens across all blockchains stands at 31 percent of its market capitalisation, or roughly USD 115 billion in absolute terms (DeFiLlama, online-b), signifying a substantial portion of value locked in decentralised applications (*TVL Ratio Token*). A breakdown of locked Ether tokens shows that 35 percent are locked in liquid staking protocols, followed by (liquid) restaking solutions, bridges, and lending, with 24 percent, 14 percent, and 11 percent, respectively (*Locked for …*). The TVL on the Ethereum protocol across all tokens (*TVL Application/Protocol*) stands at USD 121 billion (CoinMarketCap, online), making it comparable in size to the TVL for Ether tokens across all blockchains. Regarding decentralisation, the five largest validators (*Consensus Decentralisation*), including staking pools, control more than 50 percent of the cumulative validator share (Dune, online). Furthermore, two software clients (*Client Decentralisation*), Geth and Nethermind, are needed to achieve a majority of the current execution client usage (Etherscan, online-b). The majority of commits for the Go implementation of the Ethereum protocol (*Developer Decentralisation*), excluding commits not directly related to the protocol's implementation, such as the project's website, are accounted for by three contributors (GitHub, online-b). In addition, as of the beginning of July 2024, the 19 largest crypto exchanges (*Exchange Decentralisation*) accounted for over 50 percent of the 24-hour spot trading volume for Ether (CoinGecko, online-h), and from a country perspective (*Node Decentralisation*), over 50 percent of the Ethereum network's validators are located in two countries, either the United States or Germany (Etherscan, online-b). Finally, it takes over a thousand of the largest addresses (*Owner Decentralisation*) to collectively hold more than 50 percent of the circulating Ethereum tokens (Etherscan, online-c). This excludes the Beacon Deposit Contract, which is a major holder with 39 percent of all Ether tokens in circulation due to the staking mechanism.

[10] See https://github.com/ethereum.

6.3. Summary

The aim of this taxonomy is to evaluate crypto assets (tokens) not only on the basis of their static design features but also on the basis of the underlying protocol and ecosystem dynamics. This should provide a multidimensional overview of a crypto asset, which can be helpful for a variety of stakeholders, like, for example, banks for the selection of tokens for their offering. In principle, this taxonomy is also intended to enable a structured comparison of different tokens.

The taxonomy is a preliminary proposal aimed at stimulating discussion on establishing a structured framework for evaluating crypto assets. In addition to the structural challenges in creating such a taxonomy, there are also various operational challenges in evaluating/classifying the various options for the individual attributes, due to the many different token and protocol designs, which can make an exact comparison difficult.

The taxonomy has completed an initial practical test by classifying Bitcoin and Ether as examples. It is noticeable that in both cases the degree of centralisation is higher than one might have intuitively assumed. However, this is a snapshot in time and therefore, a repeated classification of the blockchain protocol(s) a token is based on can generally make sense, especially in the tokenomics dimension. The two classifications have also shown that obtaining the information required for the practical application of the taxonomy is challenging, as not all attributes can be assessed using on-chain data alone. Instead, specialised analysis tools are required, which may not be available for every token or protocol and for which the quality or accuracy cannot be fully verified.

In principle, other attributes can also be relevant, such as energy efficiency or reputational risk, which were not included in this version for reasons of operationalisation. In the area of risk management in particular, further attributes would be desirable, such as the evaluation of open lawsuits, ecological footprint, prohibition of tokens, security issues, market manipulation and hostile actions, ethical and social issues, and technological stability.

Finally, although the taxonomy provides a structured method for evaluating crypto assets, it is important to recognise that a general recommendation in favour of or against a token based on this classification is not possible. For banks facing the decision to include a token in their offering, for example, the decision may vary depending on each bank's starting position, priorities, and strategic objectives. Consequently, the characteristics of a token and its underlying protocol, as well as its corresponding tokenomics, should be considered in the context of the individual requirements and risk appetite of each bank, rather than relying on a universal standard. However, the taxonomy presented can serve as an orientation framework for such a decision-making process.

7. Conclusion and Outlook

The latest edition of the "Crypto Assets Study" presents an overview of the crypto assets investment ecosystem in Switzerland and Liechtenstein. The key findings are condensed into the subsequent conclusions and hypotheses:

The crypto asset ecosystem continues to grow. Between July 2023 and June 2024, the prices and market capitalisation of Bitcoin and other crypto assets increased significantly. At the same time, the Swiss and Liechtenstein ecosystem for corresponding investments has continued to grow in terms of providers and offerings. As of the end of June, the two countries counted a total of 359 companies offering products and services related to investments in crypto assets. The so-called Crypto Valley continues to be centred in the regions of Zug and Zurich, with offshoots in Liechtenstein, Geneva, Ticino, and Vaud.

Adoption still takes place from the bottom up. Crypto assets appear to be developing further as a supplement or partly even as an alternative to the traditional financial system. Initially embraced by a group of distributed ledger technology enthusiasts, in the meantime a relatively broad acceptance has developed, with slightly less than ten percent of the Swiss population owning such assets (Swiss National Bank, 2023). However, the adoption rate among retail customers appears to be higher than among institutional investors, which is rather unusual for financial innovations.

The crypto assets investment ecosystem in Switzerland and Liechtenstein is diverse. Corporate and institutional clients seem to be the main focus of many companies, indicating the importance of B2B business models. Their offerings are diverse, with a focus on centralised investment services (e.g., brokerage) for direct and indirect investments. For companies offering services in the area of blockchain-based decentralised solutions, self-custody solutions (so-called "Crypto Wallets") appear to be the most common. Furthermore, close to 90 percent of the examined companies in the ecosystem are not limited to national markets, but operate internationally.

The trading volumes show an upward trend. In the first half of 2024, the trading volumes for indirect crypto products on traditional Swiss exchanges experienced a recovery after stagnating at a relatively low level in 2022 and 2023. From January to June 2024, approximately two billion Swiss francs were traded. At the same time, trading volumes from Switzerland for direct investments in crypto assets via crypto exchanges also increased. Notably, derivatives trading surpassed spot trading in volume on these exchanges.

The risks of crypto asset investments are multifaceted. Beyond the market risks, evidenced in the high volatility of prices, there are also significant operational, liquidity, and credit risks throughout the crypto asset investment value chain. These risks vary depending on the type of investment, i.e., whether investments are made directly or indirectly in crypto assets, and whether this is done decentrally via the blockchain (DeFi) or via centralised providers. The variety of options allows market participants to manage risks based on their preferences.

The crypto asset landscape is vast and complex. Navigating the diverse range of crypto assets and understanding their unique characteristics can be challenging. A newly developed framework introduces structure by categorising crypto assets across three key dimensions, i.e., the static token design, the characteristics of the underlying DLT protocol, and dynamic tokenomics. This structured approach can be particularly valuable for enhancing risk management practices.

The investment properties of crypto assets must be viewed in a differentiated manner. A historical analysis of a traditional investment portfolio consisting of shares, bonds, and real estate in Swiss francs demonstrates that the inclusion of a small allocation to Bitcoin offered, on average, enhanced risk-adjusted returns by increasing the Sharpe ratio over the past few years (though not in every individual year). However, it also shows that the absolute risk of loss in the form of the maximum drawdown also increases. Therefore, the decision as to whether (and to what extent) an investment in crypto assets makes sense depends, as with other asset classes, on the risk profile and benefit preference of the market participant and must be analysed on a case by case basis.

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