



# Security token offerings

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**Abstract** This paper posits that distinguishing security token offerings (STOs) from initial coin offerings (ICOs) is important for the study of entrepreneurial finance. We first provide a working definition of a security token and present an overview of the STO market using a unique STO sample. The STO activity developed after the end of the ICO market bubble. The STO market is, however, still a nascent market. STOs are geographically dispersed but concentrated in jurisdictions with accommodating securities laws. Next, we explore STO success factors. We show that various issuer and offering characteristics traditionally used in the ICO literature also matter for STO success. We also find that success is associated with good governance practices, consistent with the corporate finance literature. We conclude by discussing the implications of native digital securities, the next generation of security tokens, for entrepreneurial finance.

**Plain English Summary** The security token offering (STO) market is nascent and thus still under

development but shows promises in the entrepreneurial finance landscape. A security token is a digital representation of an investment product recorded on a blockchain, which comes under the purview of securities laws. Therefore, STOs differ from initial coin offerings (ICOs). After describing the STO process and the scope of the STO market, we explore what factors are associated with successful capital raising. In particular, we find that attaching voting rights to security tokens increases the odds of success. Our study implies that entrepreneurs should carefully design their security tokens and run their offering professionally because doing so may not just help them raise more capital, but it may also foster general awareness of the benefits of a well-developed STO market.

**Keywords** Blockchain · Corporate governance · Entrepreneurial finance · Initial coin offering · Native digital securities · Securities laws · Security token offering · Tokenization

**JEL Classifications** G11 · G32 · G34 · L26 · M13

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## 1 Introduction

The sources of external capital that entrepreneurs can tap to finance their venture have considerably evolved in only one decade. Perhaps the most striking development is the reliance on digital platforms. From

the 2010s, crowdfunding unfolded around the world, allowing entrepreneurs to raise capital online from the public (Mollick, 2014; Vulkan et al., 2016). Later, the years 2017 and 2018 saw an influx of projects raising substantial amounts of money from the public through initial coin offerings (ICOs) (Fisch, 2019; Howell et al., 2020). Now that the ICO market bubble ebbed away, security token offerings (STOs) have emerged, allowing investment in securities recorded on a blockchain.<sup>1</sup> These securities are typically sold to accredited or experienced investors, making STOs more akin to private placements than public security offerings (Janney & Folta, 2006; Wruck & Wu, 2009; Wu, 2004). While the literature has succeeded in providing many insights about the success and failure in both crowdfunding and ICO markets, much less is known about the STO market. In this paper, we attempt to fill this gap by providing an exploratory analysis of STOs.

First, we explain why the STO market, still in its infancy, is an integral part of entrepreneurial finance. Tokens — either security tokens, utility tokens, or payment tokens — are digital assets issued on a blockchain. As their names suggest, these tokens do not all serve the same purpose. The specificity of security tokens is that they are investment products (e.g., stocks and bonds) and thus usually confer cash-flow rights to investors and, in some cases, also voting rights. Security tokens are issued through an STO and, as investment products, represent an alternative way for firms to raise external capital.<sup>2</sup> Utility tokens (issued through an ICO) are originally aimed at supporting and developing a community-based ecosystem by giving consumptive rights to users, while payment tokens (or cryptocurrencies) are means of

payment in a blockchain-based ecosystem. Therefore, taking these differences into account is important in entrepreneurial finance since startup financing and development are the outcomes under study.

Second, we present an overview of the STO market. We construct a unique data set of STOs primarily based on proprietary data supplemented with data from various STO aggregator websites. Our perusal of STOs reveals that one-third of them could not be considered as STOs in the strict sense. Instead, they either turned out to be stablecoins, or ICOs disguised as STOs — that is, utility tokens sold as securities due to regulatory uncertainty. Our sample comprises 183 “true” STOs. We document that the STO market developed after the ICO market bubble concluded STO activity intensified end of 2018 onwards. We also uncover that about 60% of issuers fail in their offering efforts. Although STOs primarily originate from the United States, we observe that other countries with accommodating securities laws (e.g., Singapore and Switzerland) also attract a large number of STOs.

Third, we explore STO success factors. We find that both issuer and offering characteristics matter for STO success and failure. In particular, voluntary information disclosed by issuers, such as source code available on a GitHub repository, is positively associated with the amount of capital raised. However, STOs are most often restricted to accredited or experienced investors and not aimed at the public at large. Therefore, the amount raised through an STO is not affected by a Telegram presence (Telegram being the major mass-market communication channel that is often used in the ICO context). Other offering characteristics, including the use of a softcap and the planned length of the duration of the STO, negatively correlate with amount of capital raised. We also find some evidence that setting high target amounts by issuers reduces the chance of success. A key finding is that corporate governance matters in the STO context. Denying voting rights (control) to investors negatively correlates with STO success (as measured by amount of capital raised). This result is consistent with the notion that investors anticipate the costs associated with concentrated control among insiders (Burkart and Lee, 2008). Our findings are robust to the use of alternative STO success outcome variables and model specifications.

Our paper is related to a rapidly growing literature on ICOs (see Li & Mann, 2019, for a survey). Important theoretical contributions include Chod and Lyandres

<sup>1</sup> Blockchain Capital paved the way with its sale of equity tokens on a blockchain in the second quarter of 2017. In August 2018, American company tZERO successfully completed the largest STO thus far, raising USD 134 million at a valuation of USD 1.5 billion.

<sup>2</sup> Benefits of conducting an STO over other methods of financing ventures may include the lower cost to offer securities to a target audience; the possibility of fractional ownership made possible by the divisibility feature of blockchain (hence, lowering entry barriers); the possibility of peer-to-peer trading between tokenholders; the auditability of transactions directly on an immutable distributed ledger; and real-time transaction settlement. Liquidity is also a benefit commonly put forth (though liquidity in the secondary market is still limited).

(2018), Li and Mann (2018), Malinova and Park (2018), Catalini and Gans (2019), Goldstein et al. (2019), Gryglewicz et al. (2020), and Shakhnov and Zaccaria (2020). Close to our line of inquiry, Gryglewicz et al. (2020) develop a unified model of the issuance and design of tokens. They derive conditions under which an STO is a preferred financing tool to an ICO and show that it crucially depends on developers' ability to generate cashflows in addition to facilitating transactions among users.

Empirical studies largely focus on determinants of ICO success using data from various specialized ICO listing websites such as ICOBench and TokenData. Fisch (2019) studies 423 ICOs and reports that information voluntarily disclosed by issuers, such as whitepapers and source code, positively correlates with amount of funds raised. Deng et al. (2018) further show that governance and team quality are positively associated with amount raised. Davydiuk et al. (2020) find that the fraction of tokens retained by insiders increases ICO success outcomes. Lee et al. (2021) also document that favorable analyst ratings lead to funding success. Interestingly, Bourveau et al. (2019) show that external disclosure channels, such as algorithmic and human ratings, better predict both ICO success and post-listing ICO performance than internal disclosure channels, such as whitepapers and shared source code. Their work resonates with Momtaz (2020a), who finds that information disclosed in whitepapers is systematically exaggerated, inducing a moral hazard in signaling. Masiak et al. (2020) present evidence of cyclicity between cryptocurrency returns and ICO volumes. Other studies also document post-ICO patterns using data from various exchange aggregators such as CoinMarketCap. These include Benedetti and Kostovetsky (2021), Hu et al. (2019), and Momtaz (2020b), whose work examines returns for token buyers in ICOs. Howell et al. (2020) explore various issuer and ICO characteristics on enterprise survival and employment growth. Hornuf et al. (2021) investigate the extent of fraud in the ICO market.<sup>3</sup>

<sup>3</sup> The empirical ICO literature closely relates to the earlier empirical literature on crowdfunding. On determinants of crowdfunding success, see, e.g., Mollick (2014), Ahlers et al. (2015), Vulkan et al. (2016), Bapna (2019), Cascino et al. (2018), and Ralcheva and Roosenboom (2020). On post-crowdfunding patterns, see, e.g., Mollick and Robb (2016), Sorenson et al. (2016), Signori and Vismara (2018), Blaseg et al. (2020), and Eldridge et al. (2021).

Our study does not focus on ICOs and our contribution stands here. We argue that STOs are not ICOs or a subset of it. What ICOs and STOs have in common is the distributed nature of the underlying ledger their tokens are recorded. However, unlike an STO, the idea behind raising money via an ICO is the value creation for a community, and this community is part of the value creation process (Schückes & Gutmann, 2020). This contrasts with an STO that aims to raise capital for startups using “traditional” investment products generally reserved for a small group of accredited or experienced investors. To our knowledge, our paper is the first to consider the STO market in its own right and empirically assess STO success factors.<sup>4</sup> In doing so, we follow recent exploratory studies about new phenomena in entrepreneurial finance (Fisch, 2019; Howell et al., 2020; Mollick, 2014; Vulkan et al., 2016).

This paper also builds on the empirical literature about the governance of entrepreneurial firms. Baker and Gompers (2003) and Hochberg (2012) study corporate governance in companies backed by venture capital (VC). Cumming (2008) and Cumming and Johan (2008) examine VC control rights in relation to exit strategies. Janney and Folta (2006) study the signaling value of private placements of equity for young startups. Cumming et al. (2019) find that decoupling voting from cashflow rights reduces crowdfunding success, using a sample of 491 Crowdcube campaigns. Fahlenbrach and Frattaroli (2021) describe how ICO contributors lack the protection traditionally afforded to investors in early-stage financing. Our paper adds to this literature by showing empirical evidence on the importance of

<sup>4</sup> A contemporaneous work is Ante and Fiedler (2020), which studies the effect of cheap signals on STO success using a sample of STOs between April 2017 and October 2018. Our paper complements this study along three important considerations. First, we propose a definition of a security token based on its purpose, which has important implications for the study of STOs in entrepreneurial finance. Second, we uncover from our unique data set that an STO wave started at the end of 2018 — that is, in the aftermath of the ICO market bubble. Third, we show that good governance practices are significant factors of STO success.

attaching voting rights to security tokens, despite the enhanced transparency resulting from using a blockchain.

## 2 What it is (not) and how it works

To explore what determines STO success, one must first understand the features of an STO. In this section, we begin by providing a working definition of a security token and clarifying how it differentiates from both utility and payment tokens. We then outline the STO process.

### 2.1 Defining security tokens

Digital assets are currently taking on so many different forms and (sometimes misleading) terminologies that the task of defining them is not a simple one. However, this task is important because it is where the contention may come from. We do not claim to be the first to offer a definition and taxonomy of digital assets (see, e.g., Zetzsche et al., 2019, in the law literature; and FINMA, 2018, for a financial regulator's perspective). Our goal is instead to provide a working definition in the entrepreneurial finance context.<sup>5</sup> A security token represents a distinct class of digital assets and its issuance process, the STO, represents a unique method of financing ventures. Our definition is as follows: "A security token is a digital representation of an investment product, recorded on a distributed ledger, subject to regulation under securities laws."

Against this background, a *digital representation* is an electronic record of an analog contract between two or more parties. As an example, most of the shares traded on the stock exchange today are not recorded on a paper certificate but digitally represented on centralized computer databases.

An *investment product* is bought by investors with the expectation of a profit. Investment products include a wide range of securities or group of securities which provide a (mix of) capital gains and/or

(fixed) income generation.<sup>6</sup> The (fixed) income-generating component of security tokens can include dividends (equity tokens), fixed-interest payments (debt tokens), and income-sharing payments (income-share tokens and also fund tokens). However, the underlying securities do not always include an income-generating component as it is the case for some fund units (fund tokens) or derivatives (other security tokens). Moreover, investors in equity tokens can also have control rights, such as voting similarly to ordinary shares. Voting includes participating in decisions on the composition of the board of directors and structural corporate policy changes that would require amendment of articles of association such as changes in registered capital, mergers and acquisitions, major purchases or sales.<sup>7</sup> Security tokens are fit for both startup and mature firms. Their issuance can be conducted early in the lifetime of the firm (usually in the case of equity tokens) or later (often in the case of debt tokens). However, as we show later, the vast majority of STOs are issued by startup firms.

A key feature of a security token is that its issuance and subsequent transactions are recorded and cryptographically secured on a *distributed ledger*. A distributed ledger embodies a database that is shared and synchronized across a network of independent computers (referred to as nodes) that are connected with one another without having to rely on a central computer. A distributed ledger is less prone to cyberattacks and fraud as the network of nodes grows. Therefore, a distributed ledger contrasts with a centralized database (used by traditional regulated exchanges and central securities depositories). The

<sup>6</sup> We group security tokens in five different categories: (i) equity tokens (e.g., stocks), (ii) debt tokens (e.g., bonds and notes), (iii) fund tokens (e.g., fund units), (iv) income-share tokens (e.g., profit-sharing agreements), and (v) other security tokens (e.g., derivatives). Derivatives can indeed be security tokens as long as the tokenized derivative product is issued by the company itself (e.g., warrants). It thus does not include (derivative) products that are issued by exchanges (e.g., forward and future contracts). Furthermore, we also observe that many assets are nowadays tokenized, but in general, they are not security tokens. They are security tokens only if the asset (e.g., fine art and real estate) is first securitized (in the form of, e.g., a bond and a fund unit) and then tokenized.

<sup>7</sup> We refer here purely to control-type of voting rights, not voting in the context of blockchain protocols that often have the objective to decide on the features in a software update and similar community decisions.

<sup>5</sup> See also Block et al. (2020) who offer complementary discussions aimed at comparing ICOs (including STOs) and crowdfunding campaigns in entrepreneurial finance landscape.

blockchain technology is one manifestation of the more general distributed ledger technology (DLT). We mostly focus on blockchains for concreteness. However, our definition encompasses other DLTs besides blockchains.

Security tokens also come under the purview of *securities laws*. This means that all security tokens, as investment products, have the status of regulated securities. However, the converse is not necessarily true. In some jurisdictions, such as in the United States, utility tokens are also considered as “regulated securities,” whereas they are another type of product than investment products. Therefore, our definition is not reciprocal since not all regulated securities are security tokens but all security tokens are regulated securities.

According to our definition, a security token is different from a utility token or a payment token. Table 1 provides a comparison of the different classes of digital assets. Unlike security tokens, the main purpose of a utility token is to grant access to a community-based ecosystem by giving its holders a consumptive right on a product or service (Catalini & Gans, 2019; Howell et al., 2020). It exists to be used/spent in the ecosystem and is more akin to a voucher. It is also important to note that utility tokens are typically issued by nonprofit foundations to the members of their ecosystem. The issuance of utility tokens (through ICOs) often happens at a very early stage — that is, before any product or service has been developed. This contrasts with security tokens that can be issued (through STOs) regardless of the development stage of the firm. STOs thus draw significant parallels with equity-based crowdfunding, whereas ICOs compare to reward-based crowdfunding (Block et al., 2020). However, STOs are usually restricted (by law) to a group of accredited or experienced investors and are thus akin to private placements — that is, privately negotiated investment products sold outside of a public offering (Janney & Folta, 2006; Wruck & Wu, 2009; Wu, 2004).<sup>8</sup> This aspect often goes unnoticed in the literature, while being an important difference

<sup>8</sup> As for tZERO, to give one example, the offering document was explicitly entitled “confidential private placement offering memorandum” and USD 30 million of the offering was taken up GSR Capital, a private equity firm based in Hong Kong. The STO of tZERO was also offered under rule 506(c) of Regulation D that restricts the offering to accredited investors only.

with ICOs and also equity- and reward-based crowdfunding campaigns that generally involve a wider audience. By extension, this is also a fundamental difference with an initial public offering (IPO). Furthermore, retail buyers can acquire utility tokens in a majority of jurisdictions as they are typically not subject to securities laws contrary to security tokens.<sup>9</sup> Utility tokens are meant to deliver products/services that are thus subject, in theory, to ordinary consumer protection and tax laws. The key element that security tokens have in common with utility tokens is that both are issued on distributed ledgers.

Being recorded on distributed ledgers is also what security tokens have in common with payment tokens (i.e., cryptocurrencies). However, the differences between security tokens and payment tokens are many. As a cash equivalent, the primary function of a payment token is instead to facilitate blockchain-based payments. Payment tokens are issued early, when the core team has conceptualized their community project. They are often issued, like utility tokens, by nonprofit foundations. Payment tokens are thus meant to be used by their respective members. Furthermore, payment tokens should be covered by banking and payment services laws but should not be under the purview of securities laws. Payment tokens can typically be bought and sold by anyone, unless a country imposes a ban.

Our definitions of digital assets and, in particular, security tokens do not contradict other definitions proposed earlier by academics (e.g., Zetsche et al., 2019) or regulators (e.g., FINMA, 2018). However, defining digital assets based on their *purpose*, as we do, instead of their “blockchain” commonality, has the advantage of better identifying their respective contribution to the entrepreneurial finance area. Security tokens confer traditional investor rights, whereas utility tokens primarily provide consumptive rights and payment tokens ensure payment functions.

Making such distinction has implications when studying success in launching digital assets. Most studies on ICOs (cited at the outset) focus on success outcomes traditionally used in the entrepreneurial finance literature, such as amount raised,

<sup>9</sup> Blandin et al. (2019), Zetsche et al. (2019), and Howell et al. (2020) discuss the legal status of utility tokens in various jurisdictions.

**Table 1 Digital assets.** This table compares each class of digital assets (security token, utility token, and payment token) based on six dimensions

	Security token	Utility token	Payment token
What	A security token is a digital representation of an investment product	A utility token gives consumptive rights to access a product or service	A payment token (also called a cryptocurrency) is a cash equivalent on a blockchain
Why	The security token is bought by an investor with the expectation of a profit	The utility token is mainly issued to spend it in a developed, community-based ecosystem. It has similar features to a voucher	The payment token is a means of payment in a community-based ecosystem
Who	The issuer usually is a for-profit entity, such as a private limited company. That company's objective is to create value for investors by selling products and services to customers	The original issuers were foundations, not for profit entities, of which tokenholders became community members. The product or service aims to create value for members	The prime example for a cryptocurrency is Bitcoin. Subsequently original issuers were foundations, not for profit entities, of which payment tokenholders became community members
How	The issuance is usually launched through an STO and recorded on a distributed ledger commonly using blockchain technology	The issuance is usually launched through an ICO and recorded on a distributed ledger commonly using blockchain technology	The issuance is usually launched through an ICO and recorded on a distributed ledger commonly using blockchain technology
When	Depending on the type of security, tokens can be issued when a start-up company can articulate information required for a securities prospectus. The issuance can also be conducted later, i.e., by established companies	Tokens are usually issued early, when the core team has conceptualized their community project and described it in a whitepaper	Tokens are usually issued early, when the core team has conceptualized their community project and described it in a whitepaper
Whose	Security tokens fall under the purview of securities laws that is implemented by the respective financial regulator. It is very common to limit access to high-risk securities to accredited investors	Utility tokens are, in most jurisdictions, not considered as securities and, therefore, not governed by securities laws. This removes regulatory obstacles to access them for retail buyers. Since they are more akin to product vouchers, utility tokens are subject to consumer protection and tax laws	Payment tokens are, in most jurisdictions, not under the purview of securities laws. Since they are a means of payment, payment tokens are covered by banking and payment services laws. Except for countries that banned digital assets, as cash equivalent, virtually everyone can buy payment tokens



enterprise survival, and employment growth. These success measures are especially suited to examine STO success like we do. However, other outcomes are surely equally (if not more) relevant to evaluate ICO success. Indeed, outcomes such as technological and community developments would better capture success in a world of utility tokens, while the velocity of payment tokens (i.e., the number of times one payment token is used to buy goods/services within a given period) would be a better measure of success of payment tokens. To our knowledge, two notable exceptions going in this direction are Deng et al. (2018) and Davydiuk et al. (2020), who focus on ICO success outcomes such as user base and technological and product development rather than outcomes traditionally used in the entrepreneurial finance literature.

Two caveats are in order. First, our discussion above considers each class of digital assets taken separately. However, we do not view these classes as mutually exclusive. On the one hand, some security token issuers may also plan to issue a separate utility token to power their ecosystem.<sup>10</sup> On the other hand, true hybrids exist — that is, single tokens exhibiting features of more than one class of digital assets.<sup>11</sup> One can easily imagine a variety of different possible hybrids. Their inclusion in one particular class of digital asset depends on which token feature predominates (security, utility, or payment). As in any emergent field, the industry and academic conceptions of

digital assets are under construction. Therefore, it is essential that our definition allows room for such evolution, as in the case of hybrid tokens. Second, our discussion above suggests that security tokens can represent a wide range of securities, from stocks, bonds, funds, to some types of derivatives. This also means that security tokens encompass the tokenization of both existing and new securities. However, an STO largely relates to the tokenization of new securities since an STO is a primary market — that is, the tokenization process is combined with a capital raising process.

## 2.2 STO process

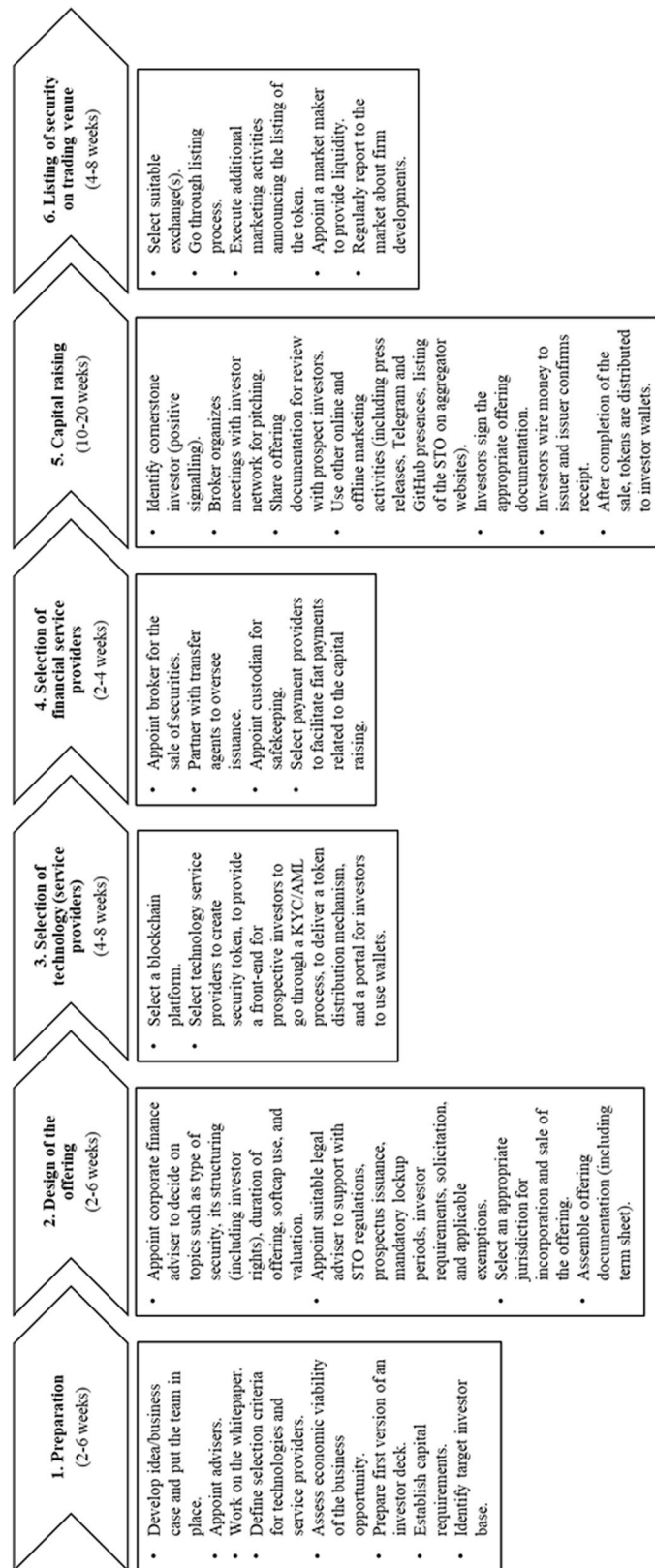
The STO process typically consists of six phases (Fig. 1 provides details on an illustrative STO process).<sup>12</sup> Phase one entails the preparation for the capital raising. Once a team has decided to go ahead with the primary offering of a security token, the process begins with a rough articulation of the idea/business case. This business case can evolve around a new entrepreneurial venture or the tokenization of an investment product aiming to raise new capital. It is at this stage that the team usually considers appointing advisors to produce the whitepaper (equivalent to a prospectus, but technical) and provide inputs on the selection criteria for technology service providers. Such selection criteria include not only blockchain platform considerations (e.g., fork risk and developer adoption) but also reputational and coverage issues for token issuance services and know your customer (KYC), anti-money laundering (AML), and counter-terrorist financing (CFT) services. Advisors can also help validate assumptions formulated in the business case to assess economic viability of the initiative and assist with the preparation of a first version of an investor deck. On this basis, the team can establish financing requirements and identify the target investor base.

During the second phase, the team appoints a corporate financial advisor and a lawyer to help with the design of the offering. The corporate financial advisor is familiar with the STO process, similar to an

<sup>10</sup> This is the case of Healthbank in our sample, which aimed to conduct its capital raising through the sale of a regulated security token (HBE) but also planned to separately issue a utility token (HBC). HBC was thus not part of the STO.

<sup>11</sup> This is the case of Binance Coin (BNB), launched through an ICO by Binance. BNB is primarily a payment token, allowing to make payments for exchange fees, withdrawal fees, and listing fees, among other things. At the same time, BNB displays additional features of a utility token beyond payments: If platform users choose to pay their fees in BNB, a significant discount is applied, for a period of up to 4 years. Utility is created in the form of discounted fees. Moreover, BNB includes a feature of a security token, namely capital appreciation. This “security” feature is a coin burn; that is, every quarter, BNB tokens of the issuer’s reserve are destroyed, based on volume on the trading platform, until only 50% of BNB tokens initially issued are left in circulation. The coin burn implies capital appreciation since the reduction of central BNB supply increases the price of BNB owned by tokenholders. Due to its launch through an unregulated ICO process and its primary feature being payments, BNB is currently not subject to securities laws. Therefore, BNB is not in our sample.

<sup>12</sup> What we describe here are six phases that entrepreneurs running an STO typically go through. This does not mean that they always (or must) go (fully) through each of these phases.



**Fig. 1 Illustrative STO process.** This figure provides an illustrative outline of the STO process with details on the specific actions taken by security token issuers during each phase of the process



investment bank that works on IPOs. The corporate financial advisor can help with selecting the type of security, the security structuring (including conferring investors with specific rights), the duration of the offering, the use of a softcap, and the valuation of the token issue. The lawyer is an expert in securities laws and DLTs and can advise on various matters, including STO regulations, prospectus issuance, mandatory lockup periods, investor requirements, solicitation, and applicable exemptions. Together with its advisors, the team finalizes the offering documents, which typically include an investor deck, a whitepaper, a term sheet, a prospectus, and purchase or subscription agreements.

In phase three, technology (service provider) decisions are made. These decisions include selecting a blockchain platform. Ethereum continues to be the most popular choice among issuers, but other platforms are also entering the arena (NEM, NEO, Stellar, Swarm). Selecting an appropriate blockchain platform requires careful consideration. Although demand-side adoption — that is, the ease of access to the platform for investors via wallets and custodians — is critical, supply-side adoption — that is, the availability of software developers on the job market — plays an equally important role. Other considerations include the platform's ability to depict the entire lifecycle of securities (e.g., exercising voting, paying interest, or dividend), the approach to settlement finality, and the mitigation of fork risk. Technology service providers (e.g., Harbor and Polymath) have a multitude of deliveries in the STO process. One is the creation of the security token according to the security structuring developed in the second phase. Other services enable the issuer to vet prospect investors according to KYC, AML, and CTF regulations. A mechanism to distribute tokens to investors' wallets is also required. In addition, technology service providers customize a portal for issuers enabling their investors to use their wallets.

In phase four, the team selects financial service providers, including brokers, transfer agents, custodians, and payment providers. In many jurisdictions, the sale of securities is a regulated activity carried out by licensed brokers. In some cases, regulators grant exceptions to this “brokerage” requirement. The issuer may also work with transfer agents who oversee the issuance of the tokens and handle claims in case tokens get stolen or lost. The team may engage a

custodian who will safe-keep the tokens once they are created. Payment providers are also required to facilitate fiat payments related to the capital raising.

Phase five is the capital raising activity. Ideally, the team identifies a cornerstone investor as early as possible for positive signaling to the wider market. Then, the team starts marketing the offering. The broker organizes meetings with investors allowing the team to present its pitch. The team can then share the offering documents with interested investors. Other marketing activities are also conducted to attract additional investors' interest — that is, setting up a website, issuing press releases, using mass-market communication channels (e.g., Telegram), listing the offering on STO aggregator websites, and creating a GitHub account to publicly share source code. After the marketing, the actual financing takes place, where interested investors sign the appropriate offering documents. Today, this often happens on paper or through digital signature platforms such as DocuSign or Sign.net. Then, investors wire their money to the issuer, who confirms receipt of the payment. While some issuers mandate traditional fiat currency to be used for investment, others also accept the transfer of bitcoin (BTC) or ether (ETH) to designated wallets. To conclude the offering successfully, all clauses in the offering documents must be met (e.g., the achievement of a softcap, if defined). Tokens are then distributed into investors' wallets.

The sixth and last phase can be the listing of the security on (a) suitable exchange(s). Secondary marketplaces for security tokens are often alternative markets — examples include InvestaX, MERJ Exchange, openfinance, tZERO, and 1exchange.<sup>13</sup> The listing process also implies going through the trading venue's listing modalities, which often requires substantial disclosures. It is accompanied by marketing activities to attract additional interest in the security token. In some jurisdictions, such as the United States and Singapore, the regulator imposes lockups on investors participating in the primary offering. While

<sup>13</sup> In the United States, these marketplaces are called Alternative Trading System (ATS). In Europe, there is a similar licensing regime under the Markets in Financial Instruments Directive (MiFID) called Multilateral Trading Facility (MTF). In Singapore, running such an exchange requires a Recognized Market Operator (RMO) license from the Monetary Authority of Singapore (MAS).

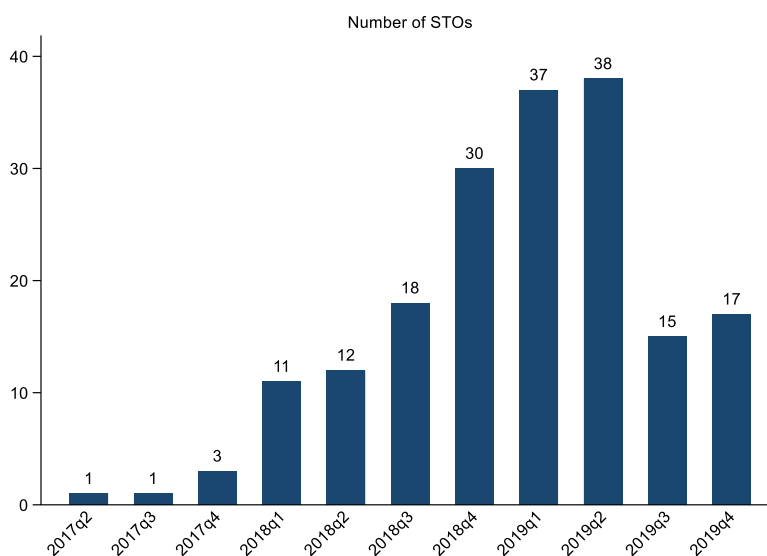
**Table 2 STO Sample.**

This table presents the construction of the STO sample used in this study. Panel A shows the sample construction. The main sample starts with 280 STOs from the initial sources (see the text), excluding ICOs and stablecoins (i.e., tokens that do not match our definition of an STO), traditional offerings (i.e., funds investing in digital assets and not digital assets themselves), capital raising still ongoing after December 31, 2020, and STOs with not enough data available to construct key variables (e.g., amount raised, Github, and target amount). Panel B shows a bar chart of the number of STOs that start in each quarter between April 2017 and December 2019. Panel B includes all the 183 STOs identified as such in Panel A (= 124 + 57 + 2). Panel C shows the top 10 largest STOs in the base sample. The x-axis represents the firm name, and the y-axis represents the amount of funds raised in million USD

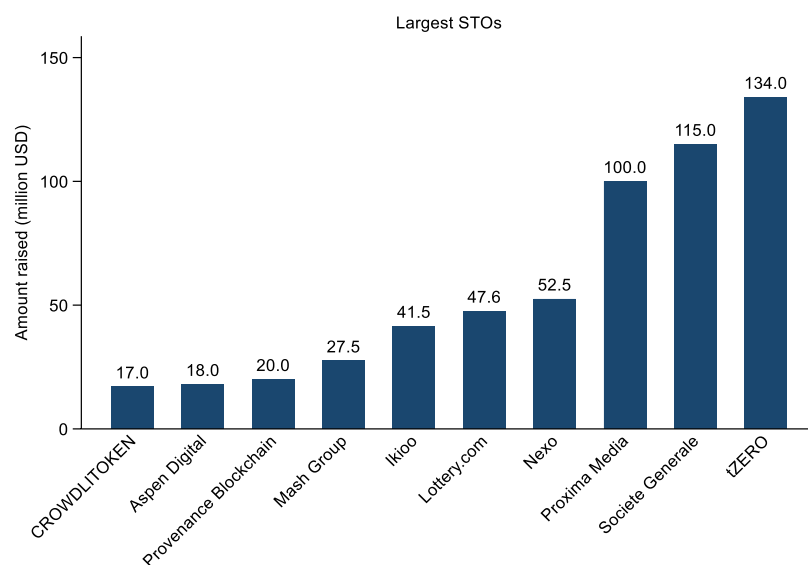
Panel A: Sample construction

All identified STOs	280
- ICOs	86
- Stablecoins	9
- Traditional offerings	2
- Capital raising still ongoing after December 31, 2020	2
- No data available	57
<b>Base sample</b>	<b>124</b>

Panel B: Number of STOs over time



Panel C: Top 10 largest STOs



conceptually listing a token on a secondary market enables buyers and sellers to transact, it does not mean that demand for the token is immediately present after exchange listing.<sup>14</sup> Therefore, issuers can appoint a market maker to provide liquidity for their token. They should also regularly communicate with the market and share information about firm developments.

Last, the duration of the STO process averages around 24 and 56 weeks (see Fig. 1). Regarding the cost of an STO, it generally ranges between USD 180,000 and USD 750,000, excluding fees calculated as a percentage of the offering (e.g., corporate financial advisor and broker fees range between 1 and 8%). The budget includes fees for legal advisers (USD 50,000–350,000), technology providers (USD 10,000–50,000), capital raising expenses (USD 10,000–50,000), financial service providers (USD 10,000–50,000), and listing fees charged by the trading venue (USD 100,000–250,000).<sup>15</sup>

### 3 Sample and data

In this section, we first introduce our data set and give an overview of the STO market. Then, we describe all our variables.

#### 3.1 Market overview

We create a unique and comprehensive data set of STOs, based on proprietary data obtained from Digital Asset Network (DAN) as of December 31, 2019. We augment this data set with additional STOs identified from various other aggregator websites.<sup>16</sup> As shown in Table 2, Panel A, our initial sample includes 280 offerings labeled as STOs. We manually collect additional information for each STO based on

the reading of offering documents, whitepapers, and press releases to determine if the purpose of the token is in line with our definition. Our perusal of each of the STOs leads us to exclude 86 offerings which turn out to be ICOs disguised as STOs. Many ICOs were registered for sale as a security to avoid regulatory uncertainty while really being utility tokens.<sup>17</sup> As an example, the Blockstack ICO was registered under Regulation D with the Securities and Exchange Commission (SEC) even though the offering falls in the utility token class (see Ali et al., 2019, Sect. 2.4). The non-negligible number of ICOs (registered as STOs) indicates that security tokens considered as such in many ICO studies should be interpreted with care. We also exclude stablecoins (9 cases) and traditional offerings (2 cases). We end up with 183 STOs.

Table 2, Panel B, shows the number of STOs by quarter. The first STO was conducted by Blockchain Capital, which successfully raised USD 10 million in the second quarter of 2017. Only a handful of STOs were conducted until the third quarter of 2018, while the STO market gained momentum from the fourth quarter of 2018 onwards. It is striking to see that the rise of the STO market corresponds to the time when the ICO bubble burst.<sup>18</sup> Table 2, Panel C, also shows the top 10 largest STOs in our sample: They all raised at least USD 15 million, with three of them raising USD 100 million or more, namely Proxima Media, Société Générale, and tZERO.

For our empirical analysis, we further drop 2 STOs that did not complete their capital raising by December 31, 2020, as well as another 57 STOs for which data on proceeds are not available (see Panel A). Our base sample therefore comprises 124 STOs for which we have sufficient information on their success outcomes and both issuer and offering characteristics. Together, these 124 issuers who launched their STO between April 2017 and December 2019 raised a total of USD 762 million.

<sup>14</sup> Thus far, we observe a limited liquidity in most exchanges. At the time of the writing, the secondary market is even more nascent than the primary counterpart with few offerings that trade freely: 6.4% (13.2%) of (successful) STOs in our sample.

<sup>15</sup> For cost estimates, we also refer the interested reader to, e.g., Fitzner Blockchain Consulting (<https://medium.com/fitzner-blockchain-consulting/a-guide-to-launching-a-security-token-offering-e55f77be2874>; last accessed: June 18, 2021).

<sup>16</sup> The aggregator websites used are BlockState, Cointelligence, Coinlist, Coinspeaker, Cryptodaily, Cryptoslate, DAS Finance, STOAnalytics, STOCheck, STOWise, and TokenMarket.

<sup>17</sup> We acknowledge that there might also be STOs disguised as ICOs. Such disguise on the side of the issuer could result from ignorance or from active and fraudulent attempt to avoid securities regulation in the respective jurisdiction. The regulator can re-classify of course such disguise according to its definition of a security token. However, we did not systematically track and include STOs disguised as ICOs in our analysis.

<sup>18</sup> Howell et al. (2020) report, among many others, aggregate ICO market statistics indicating the beginning of the ICO market bubble in the first half of 2017 and its end in the first half of 2018 (see their Fig. 2, p. 3937).

**Table 3 Sample composition.** This table summarizes the composition of the sample of STOs used in this study. Panel A reports the frequency of STOs by country of origin of the issuer. Panel B reports the frequency of STOs by their economic purpose

Panel A: Sample composition by country		
Country	Obs	Freq. (%)
Australia	1	0.81
Austria	2	1.61
Bahamas	1	0.81
British Virgin Islands	1	0.81
Canada	2	1.61
Cayman Islands	11	8.87
Croatia	1	0.81
Denmark	1	0.81
Estonia	5	4.03
Finland	1	0.81
France	1	0.81
Germany	5	4.03
Gibraltar	2	1.61
Hong Kong	2	1.61
Ireland	1	0.81
Israel	1	0.81
Kyrgyzstan	1	0.81
Liechtenstein	5	4.03
Lithuania	3	2.42
Luxemburg	1	0.81
Malta	2	1.61
Mauritius	1	0.81
Netherlands	2	1.61
New Zealand	1	0.81
Panama	1	0.81
Paraguay	1	0.81
Puerto Rico	2	1.61
Seychelles	2	1.61
Singapore	5	4.03
Spain	1	0.81
Sweden	1	0.81
Switzerland	10	8.06
United Kingdom	11	8.87
United States	36	29.03
Total	124	100.00
Panel B: Sample composition by economic purpose		
Economic purpose	Obs	Freq. (%)
Debt token	11	8.87
Equity token	54	43.55
Fund token	18	14.52
Income-share token	38	30.65
Other security token	3	2.42
Total	124	100.00

Therefore, the overall STO market is still relatively small compared to the ICO market, which amounts to USD 25 billion in 2014–2018 (Bourveau et al., 2019).

Furthermore, we observe in our sample of 124 STOs that 60% did not successfully raise capital. This statistic suggests that the STO market is nascent and thus still under development. One explanation might be that some entrepreneurs are insufficiently prepared to launch an STO and underestimate the costs and complexity of conducting an STO.

Table 3 shows the composition of our STO sample. Panel A illustrates that issuers are incorporated in 34 different countries.<sup>19</sup> The country of incorporation is where the token is issued, which may differ from the countries where the token is registered for sale. The United States leads (with 36 STOs), followed by the Cayman Islands and the United Kingdom (both with 11 STOs), and Switzerland (10 STOs). These jurisdictions with significant STO activity have typically developed guidance or enacted laws to provide regulatory certainty on STO matters (see Appendix for a brief regulatory overview in these and other jurisdictions). The geography of the STO market thus likely reflects regulatory considerations by issuers, albeit that tax considerations may also play a role.<sup>20</sup> Panel B also shows the frequency of STOs by their economic purpose. Equity tokens account for 44% of securities in our sample, debt tokens 9%, income-share tokens

<sup>19</sup> To determine the country of incorporation, we use the offering documentation when available; otherwise, we use location data from aggregator websites.

<sup>20</sup> Most countries listed in Table 3, Panel A, hold the first places of tax haven rankings, such as the Tax Justice Network ([www.corporatetaxhavenindex.org](http://www.corporatetaxhavenindex.org)). More than two-thirds of the countries in our sample are listed in such rankings of tax havens for corporations, including seven countries within the top ten (i.e., British Virgin Islands, Cayman Islands, Netherlands, Switzerland, Luxembourg, Hong Kong, Singapore). It is beyond the scope of our paper to study what are the specific facilities that drive STO issuers to incorporating in these locations. In particular, our empirical setting does not allow us to disentangle whether issuers value these locations because of their “tax-haven” facilities — enabling to avoid or evade tax laws of other jurisdictions — or “regulatory-haven” facilities — helping them to escape financial (and other) regulations of other jurisdictions.

**Table 4** Description of variables.

Variables	Descriptions
STO success	
Amount raised	Amount (in USD) raised in an STO
Amount raised to target	The ratio of amount of capital raised in an STO to the target amount
Completion	An indicator variable that equals 1 if the STO has raised capital exceeding the softcap requirement (if any) or the STO has raised any capital in the case no softcap requirement is specified, and 0 otherwise
Investor rights	
Voting rights	An indicator variable that equals 1 if the STO issuer confers the investor rights to vote on matters of corporate policy including the makeup of the board of directors, and 0 otherwise
No cashflow rights	An indicator variable that equals 1 if the STO issuer does not confer the investor rights to receive dividends, or payments resulting from income-sharing agreements, or interests (fixed income), and 0 otherwise. This indicator variable can thus only equal 1 if the economic purpose is “fund token” or an “other investment token.”
Issuer and offering characteristics	
Github	An indicator variable that equals 1 if the STO issuer setup a GitHub presence to share its source code publicly, and 0 otherwise
Softcap use	An indicator variable that equals 1 if the STO issuer discloses a softcap requirement that needs to be met for the capital raising to be complete, and 0 otherwise
Target amount	Target amount (in USD) to be raised in an STO
Country indicators	A set of indicator variables that equal 1 if the STO issuer is registered in either of the following “popular” jurisdictions (i.e., more than 10 STOs): Cayman Islands, Switzerland, United Kingdom, or the United States, and otherwise 0
Planned duration	Number of days set by the STO issuer for its offering
Age	Age in years of the company at the time the STO is launched
Telegram	An indicator variable that equals 1 if the STO issuer setup a Telegram presence to communicate with investors, and 0 otherwise
Team size	Number of executive team members of the STO issuer (excluding advisers)
Insider holdings	Percentage of security tokens planned to be held by founding team members (can include advisers)

31%, and fund tokens 15%. Other security tokens make up the remaining 2% of our sample.

### 3.2 Variables and descriptive statistics

In our analysis, we employ three dependent variables measuring STO success: (i) amount raised, (ii) percentage of target amount raised, and (iii) completion status. The variable, Amount raised, measures the USD amount of capital raised by the STO. The variable, Amount raised to target, is the ratio of amount raised to the target amount. The indicator variable, Completion, identifies STOs that have successfully raised capital exceeding the minimum threshold (i.e., the softcap) stipulated by the token issuer (if any) or have raised any capital in the case no threshold is defined. Table 4 describes all variables, while

Tables 5 and 6 provide descriptive statistics and pairwise correlations, respectively. The mean amount raised is approximately USD 6.1 million, with a significant dispersion (standard deviation of USD 19.5 million). The median amount raised is USD 13,000, while many STOs did not raise any capital.<sup>21</sup> The maximum amount raised in our sample is the STO conducted by tZERO, with USD 134 million. These statistics reflect a highly skewed distribution of STO proceeds. The amount raised through an STO

<sup>21</sup> In some cases, entrepreneurs did raise some capital, but not enough and withdrew from the STO process. In such cases, the amount reported can be zero, which partly explains the number of zeros. In our empirical analysis, we use several STO success variables to verify whether our results are affected by such cases.

**Table 5 Descriptive statistics.** This table reports descriptive statistics for the variables used in the study. All variables are described in Table 4

Variables	Mean	Min	Median	Max	Std. dev	Obs
STO success						
Amount raised (million USD)	6.146	0.000	0.013	134.000	19.500	124
Amount raised to target	0.207	0.000	0.000	1.817	0.359	124
Completion	0.427	0.000	0.000	1.000	0.497	124
Investor rights						
Voting rights	0.147	0.000	0.000	1.000	0.356	102
No cashflow rights	0.081	0.000	0.000	1.000	0.273	124
Issuer and offering characteristics						
Github	0.355	0.000	0.000	1.000	0.480	124
Softcap use	0.419	0.000	0.000	1.000	0.495	124
Target amount (million USD)	61.600	0.168	20.000	1,000.000	137.000	124
Planned duration	144.204	0.000	97.000	731.000	140.575	98
Age	5.471	0.000	2.000	155.000	15.303	119
Telegram	0.637	0.000	1.000	1.000	0.483	124
Team size	7.231	1.000	6.000	23.000	4.855	117
Insider holdings	0.084	0.000	0.036	0.950	0.141	76

averages at 21% of the target amount, again with a high standard deviation of 36%. Within our sample, 43% of STOs successfully completed their capital raising.

We regress the above dependent variables on issuer and offering characteristics. Voluntary disclosures by issuers may be an important source of information for potential investors. A key disclosure choice is whether or not STO issuers decide to share their source code

**Table 6 Correlation matrix.** The table reports the correlation matrix for the variables used in the study. Panel A presents the correlation between the STO success variables, Panel B

the variables on investor rights, and Panel C the variables on issuer and offering characteristics. All variables are described in Table 4

Panel A: STO success

	(1)	(2)	(3)
(1) Amount raised (ln)	1.000		
(2) Amount raised to target	0.637	1.000	
(3) Completion	0.858	0.627	1.000

Panel B: Investor rights

	(1)	(2)
(1) Voting rights	1.000	
(2) No cashflow rights	-0.104	1.000

Panel C: Issuer and offering characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Github	1.000							
(2) Softcap use	0.019	1.000						
(3) Target amount (ln)	-0.025	-0.114	1.000					
(4) Planned duration	-0.083	-0.036	0.217	1.000				
(5) Age	-0.128	-0.131	0.105	0.040	1.000			
(6) Telegram	0.314	0.064	-0.103	-0.145	-0.128	1.000		
(7) Team size	0.189	0.190	-0.190	-0.212	0.060	0.228	1.000	
(8) Insider holdings	0.196	-0.005	0.251	0.199	-0.152	0.137	-0.080	1.000



on GitHub, the dominant online code repository. Our indicator variable, GitHub, captures this. Another disclosure choice is whether or not to have a presence in mass-market communication channels through which issuers can disseminate timely information to investors. We use an indicator variable to identify those STOs that have a Telegram presence. Telegram is a major platform commonly used by ICOs (and STOs) to communicate with investors.<sup>22</sup> Table 5 reports that 36% of STOs use GitHub, while 64% are present on Telegram.

We supplement these issuer-supplied disclosures with other STO attributes that may be useful for investors. The indicator variable, Softcap use, captures whether the STO has a stated softcap that needs to be achieved. Forty-two percent of STOs in our sample makes use of a softcap. Another potentially important factor is whether the STO states a specific goal to raise. The variable, Target amount, is defined as the target amount to be raised. All STOs disclose a target amount, which on average stands at USD 61.6 million (median of USD 20 million). We also use indicator variables identifying the issuer location, of which statistics were discussed in the previous section. Furthermore, we define a variable, Planned duration, capturing the planned duration in days of the capital raising campaign as published in the offering document (if available) or reported by aggregator websites and/or DAN. On average, STOs plan to take 144 days to raise capital. We also include the variable, Age, which confirms that young companies primarily launch STOs. The average (median) company in our sample being 5 (2) years old at the time of the launch of the STO). Following the ICO literature, we collect information on the size of the team since a larger team may be indicative of the maturity of the

project startup as well as the level of involvement and commitment of insiders. We measure team size as the number of executive team members associated with an STO. Team size ranges from 1 to 23 in our sample. In addition, we collect information on whether issuers disclose the fraction of tokens allocated to insiders since they may use token retention to alleviate information asymmetries (Davydiuk et al., 2020). This variable, Insider holdings, captures the extent of incentive alignment between insiders and outside investors. On average, insiders retain 8% of security tokens in our sample.

We hand-collect variables on investor rights that capture the ownership and control features attached to security tokens. The indicator variable, Voting rights, captures the “control” dimension by identifying whether voting rights are attached to the security token. Voting rights include participating in key corporate policy matters and director elections. Not granting voting rights to investors, therefore, implies that issuers separate control and ownership. Descriptive statistics reveal that investors are granted voting rights in 15% of STOs, representing 28% of equity tokens in our sample. This suggests that STO issuers tend to insulate themselves from outside control, consistent with recent trends in IPOs (Aggarwal et al., 2021). Although most security tokens are entitled to receive cashflows (i.e., dividends for equity tokens, fixed-interest payments for debt tokens, and income-sharing payments for income-share tokens and fund tokens), this may not necessarily be the case for all fund and other security tokens; some of which are only considered for capital gains by investors. We account for this by constructing an indicator variable, No cashflow rights. Only 8% of security tokens do not assign cashflow rights to investors.

#### 4 Analysis of STO success factors

In this section, we provide initial empirical evidence about the STO market. We explore what factors are associated with success and failure among STOs in a multivariate setting. We focus on three measures of success of the STO in raising capital: amount raised (Sect. 4.1), percentage of target amount raised (Sect. 4.2), and completion status (Sect. 4.2).

<sup>22</sup> Whitepaper-based variables are traditionally used in the ICO literature. Whitepapers usually describe how utility tokens work. However, it is worth mentioning that for an STO, the whitepaper is not necessarily the key document (and may even not be produced by the entrepreneur). STOs are securities and, therefore, the complete offering documentation is usually required. We are not able to construct an offering documentation-based variable because disclosure requirements vary across jurisdictions. Moreover, issuers are not obligated to publish these documents and in fact have an incentive to only show them to KYC’ed prospect investors. Sharing such documentation with the public is considered as illegal advertising of the STO according to securities law in many jurisdictions.

#### 4.1 Amount raised

We examine the relation between the amount raised and a variety of factors relating to issuer and offering characteristics and investor rights. Our specification is

$$\text{AmountRaised}_i = \alpha + \beta X_i + \gamma \text{InvestorRights}_i + \delta_i + \varepsilon_i, \quad (1)$$

in which the dependent variable,  $\text{AmountRaised}_i$ , is the amount raised by STO  $i$  (in natural log scale) and  $\alpha$  is a constant term. The vector of variables,  $X_i$ , always includes GitHub, Softcap use, Target Amount (in natural log scale), and country indicators. We select these variables to account for important characteristics of STO  $i$ , while maximizing sample size. In some specifications, this vector considers further characteristics of STO  $i$ : Planned duration, Age, Equity token, Telegram, and Team size.  $\text{InvestorRights}_i$  contains the variables Voting rights and No cashflow rights.  $\delta_i$  denotes time fixed effects based on the year in which an STO is launched.  $\varepsilon_i$  is the error term. In all regressions, the standard errors are robust to heteroscedasticity.

Table 7 reports the coefficients of tobit models derived from specification (1). Our variable, Amount raised, is left-censored as a failing STO is generally observed as zero in our sample and thus justifies the use of tobit models.<sup>23</sup> Column 1 is the most parsimonious specification regressing Amount raised on GitHub, Softcap use, Target amount, and the country indicators. Notably, we find that GitHub is positively and significantly associated with amount raised. This suggests that voluntary disclosing source code on GitHub may enable potential investors to better assess the underlying quality of security tokens and their potential financial payoff in the future. The coefficients on Softcap use and Target amount are negative, though they fail to be statistically significant at conventional levels. We also observe that the coefficient on Cayman Islands is positive and significant, which may suggest that investors prefer tax havens (such as the Cayman Islands) to deploy their capital,

in turn positively affecting STO success. The country indicator, United Kingdom, enters negatively and significantly in the regression. One possible interpretation, in line with the findings of Hornuf and Schwienbacher (2017) in the crowdfunding context, may be that jurisdictions with tighter investor protection (such as the United Kingdom) may harm capital raising campaigns of small startup firms. The other country indicators are not significantly associated with amount raised.

In column 2, we augment the specification in column 1 with variables capturing additional issuer and offering characteristics (Planned duration, Age, Telegram, and Team size). The results confirmed the ones of column 1, except that the coefficient on United Kingdom turns out to be insignificant. However, we do not find significant coefficients for these additional variables. This includes the indicator variable, Telegram, which captures information about the STO disseminated to potential investors. At the same time, this may indicate that, unlike in the ICO context, a mass-market communication channel, such as Telegram, is less important for an STO as it generally involves accredited or experienced investors.

We now turn to investigate the rights granted to investors in STOs. A large body of research in corporate finance documents the effect of separating voting rights (control) from cashflow rights (ownership) on firm value. It shows that firm value falls when the voting rights of insiders exceed their cashflow rights, consistent with an entrenchment effect (Claessens et al., 2002; Gompers et al., 2010; Lins, 2003). The more concentrated control in the hands of insiders (i.e., managers and controlling shareholders) is, the more entrenched they are and the better able they can extract value — at the expense of the firm's value to outside investors (i.e., minority shareholders and creditors). The agency problem of entrenchment will be less pronounced when there is less divergence between voting rights and cashflow rights because insiders' willingness to extract value is more restrained by their cashflow stake (Burkhart & Lee, 2008).

Firms undergoing STOs also face governance issues arising from the separation of ownership and control. In the case of STOs, these firms sell tokens with cashflow rights to outside investors that, at the same time, may or may not allow these investors to exert voting rights. Investors in an STO may be reluctant to invest in tokens without voting rights because they anticipate the potentially large entrenchment

<sup>23</sup> A potential concern is that the large share of zeros on our dependent variable (see descriptive statistics displayed in Table 5) may attenuate our estimations. The main results presented in this section do not change qualitatively if we exclude from the sample STOs with an amount raised nil. These results are available upon request from the authors.

**Table 7 STO success factors.** This table reports coefficient estimates from tobit regressions of ln Amount raised on variables on investor rights and various variables on issuer and offering characteristics. All variables are described in Table 4. Sample sizes vary based on available data. All models include a constant, whose coefficient is not reported. Numbers in parentheses are robust standard errors. \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively

Dependent variable	Amount raised (ln)					
	(1)	(2)	(3)	(4)	(5)	(6)
Investor rights						
Voting rights			10.475*** (3.483)	11.047*** (3.422)	10.363*** (3.477)	10.912*** (3.408)
No cashflow rights					-4.089 (4.933)	-1.883 (5.175)
Issuer and offering characteristics						
Github	6.973*** (2.395)	6.932** (2.677)	5.562** (2.529)	4.684 (2.909)	5.644** (2.518)	4.683 (2.909)
Softcap use	-4.270 (2.577)	-3.617 (2.555)	-4.384 (2.951)	-5.034* (2.752)	-4.303 (2.933)	-4.997* (2.737)
Target amount (ln)	-1.044 (0.634)	-0.970 (0.749)	-0.606 (0.869)	-0.977 (0.969)	-0.493 (0.882)	-0.904 (0.981)
Cayman Islands	5.921* (3.560)	7.743** (3.530)	6.987** (3.394)	6.612* (3.395)	6.749* (3.575)	6.421* (3.578)
Switzerland	-0.052 (5.061)	-0.465 (4.560)	-5.790 (6.107)	-7.592 (5.325)	-6.168 (6.088)	-7.712 (5.325)
United Kingdom	-9.628* (5.408)	-5.685 (6.221)	-13.942*** (4.930)	-9.618** (4.608)	-13.986*** (4.925)	-9.607** (4.627)
United States	-3.135 (2.985)	1.293 (3.360)	-5.324* (3.151)	-1.133 (3.280)	-5.488* (3.140)	-1.186 (3.265)
Planned duration		0.007 (0.008)		0.019** (0.009)		0.018** (0.009)
Age		0.289 (0.249)		0.200 (0.230)		0.188 (0.233)
Telegram		-0.452 (3.004)		2.227 (3.603)		2.258 (3.592)
Team size		0.290 (0.280)		0.083 (0.297)		0.077 (0.296)
Fixed effects						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	124	92	102	79	102	79
Pseudo R-squared	0.039	0.053	0.058	0.072	0.059	0.073

costs associated with concentrated control among insiders. Prior work in both the IPO (Smart & Zutter, 2003; Smart et al., 2008; Taylor & Whitted, 1998) and crowdfunding (Cumming et al., 2019) literature supports this entrenchment hypothesis. However, the negative impact of denying voting rights to investors is less evident in the STO context since the issuance of securities and subsequent transactions are recorded on a blockchain. Specifically, using the blockchain may reduce the cost of accessing (and verifying) information for outside investors and increase transparency on the firm governance. This has the

potential to mitigate the agency problem between insiders and outsiders (Catalini & Gans, 2016).<sup>24</sup>

<sup>24</sup> Of course, the implications of blockchains on the governance of the firm are broader (see Yermack, 2017; Blémus & Guegan, 2019, for discussions). For example, governing a blockchain amounts to having the authority to update its code, which requires in-depth mathematical know-how and experience in programming. Not everyone can take on this role. Core developers of a public blockchain platform therefore become agents having the ability to manipulate governance features themselves. They can also influence others through their “thought leader” status, leading to power concentration and new agency problems (Shermin, 2017).

We explore this hypothesis in the STO context. In column 3, we include the indicator variable, Voting rights, to the specification of column 1. We find that attaching voting rights to security tokens is positively and significantly associated with the amount raised by issuers. Column 4 adds the indicator variable, Voting rights, to the specification of column 2. The coefficient on Voting rights is again positive and highly significant. Our findings for the other issuer and offering characteristics remain as before except for the variables Softcap use and Planned duration. The results in column 4 now show that Softcap use is negatively and significantly associated with amount raised, which is consistent with the notion that issuers need to convince enough investors to reach the softcap and successfully raise money. As for the duration of an STO, we can also see that it is positively and significantly correlated with amount raised, likely because a longer duration gives more time for issuers to identify and convince investors. In columns 5 and 6, we further include the indicator variable, No cashflow rights. As can be seen, estimation results reveal that the indicator variable on no-cashflow rights is not significantly associated with amount raised. However, the importance of entitling investors with voting rights is confirmed, which is consistent with the notion that denying voting rights negatively affects investors' willingness to invest. As for the reported coefficients on the other variables in the last two columns, they corroborate the results from the other columns discussed previously.

In Table 8, we check the robustness of our results, especially on investor rights. For brevity, we focus on the specifications of columns 5 and 6 of Table 7. First, one could argue that STO issuers granting voting rights to investors are more likely to retain a higher fraction of security tokens to compensate for the loss of control. In columns 1 and 2, we test for this possibility by running a horse race between the variable, Insider holdings, and the indicator variable, Voting rights. Although the number of observations drops compared to before, our results for the variable Voting rights remain unchanged. Second, since voting rights are only associated with equity tokens in our sample, in columns 3 and 4, we check whether our results on investor rights hold in a sample consisting of equity tokens only. Again, despite the very small

sample, our results are qualitatively the same. Last, in columns 5 and 6, we estimate our models by OLS instead of tobit. We can observe that the estimation method does not materially affect our results.

#### 4.2 Alternative STO success variables

One important concern about the results in the previous section is that they can be heavily influenced by a very small number of STOs having raised large amounts. In this section, we study alternative STO success variables to ensure that our results capture broad patterns in the data. We focus on the ability of issuers to meet a threshold, either stated as a target amount or as a softcap (if defined). We adapt specification (1) by changing the dependent variable accordingly. The results are shown in Table 9.

In columns 1–4, we use Amount raised to target as the dependent variable and estimate tobit models because the dependent variable is left-censored. We observe that the results are largely consistent with the ones reported in Table 7. The indicator variable, GitHub, enters again positively but fails to be significant in two out of four models. This is likely due to variation in (small) sample size. The coefficient on Softcap use loads negatively and highly significantly across all models. Target amount is negative and turns out to be statistically significant, meaning that the higher the stated goal, the lower the ability of issuers to succeed by raising their target amount. Setting an unrealistically high target amount may indeed send a negative signal and discourage investors. The negative effect of high target amount is also well-documented in the crowdfunding literature (Mollick, 2014; Vulkan et al., 2016). Our results on country indicators remain broadly similar, except that the country indicator, Cayman Islands, loses statistical significance. The coefficients on Planned duration are now insignificant, while we continue to observe insignificant effects for the variables Age, Telegram, and Team size. However, our earlier results on voting rights are confirmed across models: attaching voting rights to security tokens corresponds to an expected increase in the ratio of amount raised to target of 43 to 51%.<sup>25</sup> The coefficient on the indicator variable, No cashflow rights, remains insignificant.

<sup>25</sup> That is,  $e^{0.361} \approx 43$  (column 3) and  $e^{0.409} \approx 51$  (column 2).

**Table 8 Robustness checks.** This table reports coefficient estimates from regressions of ln Amount raised on variables on investor rights and various variables of issuer and offering characteristics. All models are similar to columns 5 and 6 of Table 7. Columns 1 and 2 further include the variable Insider holdings. Columns 3 and 4 restrict the sample to equity tokens (the indicator variable, No cashflow rights, is dropped as all equity tokens include cashflow rights, while the country indi-

cator, Cayman Islands, is dropped as an equity token offering is only observed once for this country in our sample). Columns 5 and 6 are estimated using OLS models. All variables are described in Table 4. Sample sizes vary based on available data. All models include a constant, whose coefficient is not reported. Numbers in parentheses are robust standard errors. \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively

Dependent variable	Amount raised (ln)					
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Investor rights</b>						
Voting rights	21.535*** (6.799)	27.901*** (8.326)	6.980* (3.818)	7.283* (3.917)	5.380** (2.117)	6.508*** (2.270)
No cashflow rights	-4.141 (8.432)	6.451 (7.304)	-	-	-2.531 (2.524)	-1.279 (3.105)
<b>Issuer and offering characteristics</b>						
Github	8.985* (5.050)	6.531 (4.697)	5.496 (3.541)	5.479 (4.036)	3.087** (1.444)	3.063 (1.896)
Softcap use	2.865 (5.443)	-4.759 (4.457)	2.778 (4.130)	-1.904 (4.641)	-2.654* (1.583)	-3.144* (1.713)
Target amount (ln)	-1.304 (2.124)	-7.609*** (2.741)	-0.338 (1.195)	-0.710 (1.499)	-0.125 (0.489)	-0.405 (0.632)
Cayman Islands	22.662*** (7.735)	30.314*** (7.648)	-	-	3.803* (2.263)	3.915 (2.407)
Switzerland	4.769 (9.238)	-0.272 (6.846)	-10.497 (6.242)	-14.907* (7.373)	-3.059 (3.059)	-3.934 (2.951)
United Kingdom	-1.643 (7.404)	-2.464 (8.776)	4.698 (4.485)	4.391 (4.408)	-6.327*** (1.928)	-5.108*** (2.341)
United States	-7.087 (8.349)	5.482 (9.523)	0.709 (4.266)	1.254 (4.498)	-2.918* (1.714)	-0.959 (2.218)
Planned duration		0.042*** (0.012)		0.001 (0.014)		0.010* (0.006)
Age		1.204* (0.625)		0.802** (0.354)		0.145 (0.136)
Telegram		24.179** (9.634)		0.615 (5.407)		1.183 (2.272)
Team size		0.715 (0.641)		-0.115 (0.336)		0.056 (0.191)
Insider holdings	10.462 (15.615)	21.041 (33.132)				
<b>Fixed effects</b>						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Description	Controlling for insider holdings		Equity token subsample		OLS estimations	
Observations	65	47	40	33	102	79
Pseudo R-squared	0.150	0.240	0.071	0.090	-	-
R-squared	-	-	-	-	0.253	0.317

**Table 9 Alternative STO success variables.** This table reports coefficient estimates from regressions of alternative STO success variables on variables on investor rights and various variables on issuer and offering characteristics. Columns 1–4 are estimated using tobit models (left-censoring limit), while columns 5–8 report average marginal effects of probit

models. All variables are described in Table 4. Sample sizes vary based on available data. All models include a constant, whose coefficient is not reported. Numbers in parentheses are robust standard errors. \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively

Dependent variables	Amount raised to target				Completion			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Investor rights</b>								
Voting rights	0.363** (0.163)	0.409** (0.169)	0.361** (0.163)	0.407** (0.169)	0.332** (0.140)	0.365*** (0.132)	0.330** (0.140)	0.362*** (0.132)
No cashflow rights			-0.098 (0.164)	-0.023 (0.157)			-0.072 (0.162)	-0.046 (0.180)
<b>Issuer and offering characteristics</b>								
Github	0.189* (0.099)	0.116 (0.121)	0.190* (0.099)	0.115 (0.121)	0.099 (0.090)	0.061 (0.106)	0.102 (0.090)	0.062 (0.106)
Softcap use	-0.308*** (0.116)	-0.347*** (0.113)	-0.307*** (0.116)	-0.347*** (0.113)	-0.301*** (0.090)	-0.349*** (0.102)	-0.300*** (0.091)	-0.348*** (0.102)
Target amount (ln)	-0.079** (0.037)	-0.089** (0.042)	-0.076** (0.038)	-0.089** (0.042)	-0.053* (0.032)	-0.064* (0.037)	-0.051 (0.033)	-0.062 (0.038)
Cayman Islands	0.113 (0.135)	0.193 (0.133)	0.108 (0.137)	0.191 (0.132)	0.069 (0.142)	0.031 (0.150)	0.064 (0.142)	0.026 (0.151)
Switzerland	-0.149 (0.200)	-0.134 (0.172)	-0.157 (0.202)	-0.135 (0.173)	-0.107 (0.178)	-0.179 (0.166)	-0.114 (0.176)	-0.182 (0.166)
United Kingdom	-0.668*** (0.184)	-0.466*** (0.164)	-0.669*** (0.184)	-0.466*** (0.164)	-0.409*** (0.068)	-0.416*** (0.091)	-0.409*** (0.069)	-0.416*** (0.092)
United States	-0.196 (0.127)	0.021 (0.139)	-0.200 (0.127)	0.020 (0.138)	-0.140 (0.098)	-0.066 (0.120)	-0.142 (0.098)	-0.066 (0.120)
Planned duration		0.000 (0.000)		0.000 (0.000)		0.001 (0.000)		0.001* (0.000)
Age		0.005 (0.008)		0.005 (0.008)		0.002 (0.009)		0.002 (0.009)
Telegram		0.083 (0.161)		0.084 (0.161)		0.036 (0.126)		0.037 (0.126)
Team size		0.014 (0.010)		0.014 (0.010)		0.006 (0.011)		0.006 (0.011)
<b>Fixed effects</b>								
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	102	79	102	79	100	77	100	77
Pseudo R-squared	0.197	0.315	0.198	0.315	0.173	0.214	0.174	0.214

Next, in columns 5–8, we estimate specification (1) using Completion as the dependent variable. We use probit models to fit the binary nature of this dependent variable and report average marginal effects for all variables. Again, the results are qualitatively similar

to those reported and discussed previously. Notably, Softcap use, Target amount, and United Kingdom exhibit negative and significant coefficients, meaning that they are associated with a lower likelihood of successfully completing the capital raising. We



find weak evidence on the positive effect played by planned duration. Regarding GitHub presence, it does not seem to appear as a significant factor for completing the capital raising. Importantly, we find that the indicator variable, Voting rights, enters positively and significantly in the regression models. We can see that the average marginal effects of voting rights range from 33 to 37 percentage points. That is, everything else equal, one would expect a 33–37 percentage points increase in the likelihood to complete the capital raising when investors have voting rights, which is economically meaningful.

To sum up, our findings point out that issuer and offering characteristics do affect STO success and failure. Important STO attributes include Github presence, softcap use, target amount, planned duration, and the jurisdiction of the country of incorporation. In addition, our results indicate that granting voting rights to investors is positively associated with STO success. Of course, these results have to be interpreted with care given the small sample size. However, their consistency across STO success variables and model specifications gives us confidence in their soundness.

## 5 Conclusion

In this section, we summarize our findings and discuss their implications for entrepreneurial finance.

### 5.1 Summary

In this paper, we present an overview of the STO market: (i) It started in the second half of 2018 when the ICO bubble ebbed away, (ii) it is still nascent and thus under development, and (iii) it is dispersed across the globe but concentrated in jurisdictions with accommodating securities and tax laws. We also show that various issuer and offering characteristics traditionally used in the ICO literature (especially, Github presence, softcap use, target amount, planned duration) matter as well for STO success. In addition, we find that granting voting rights to investors is positively associated with STO success, in line with the corporate finance literature. Our work contributes to the literature by discussing the importance of distinguishing between classes

of digital assets (security, utility, and payment tokens) in the entrepreneurial finance context and presenting an early empirical assessment of STO success.

### 5.2 Entrepreneurial finance and the future of security tokens

Although the start of the year 2020 saw a slowdown in overall STO market activity, some market segments experienced a significant boost. This is especially the case of real estate STOs (Chang, 2020). The year 2020 also gave rise to important developments in terms of both tokenization and trading of security tokens with the appearance of tokenization providers, such as Vertalo in the United States, and market infrastructure providers, such as Archax in the United Kingdom and INX in the United States.

Security tokens continue to evolve to address several challenges faced by entrepreneurial firms and their stakeholders. First, as per our definition, a security token is a “digital representation” of an investment product; it is not the product itself. Therefore, legally, the primary record in many jurisdictions is still paper-based or stored in a government-owned, centralized database. This makes any amendments to records (such as the capitalization table) inefficient and costly for issuers and investors alike. For example, STO issuers and exchanges setup a complicated and dedicated trust structure off-chain (i.e., not natively on the blockchain) to enable the transfer of legal ownership of underlying securities, while the technical transfer of the token is simple.

Second, the widely used ERC-20 protocol to issue security tokens on a blockchain has limitations: it only supports the issuance of tokens, the fixing of the token supply, the verification of token balances, and the transfer of tokens from one wallet to another. A language to comprehensively describe investment products does not exist yet, which results in two main obstacles for entrepreneurs. The first is that the full lifecycle of a security — including corporate actions such as dividend payments, stock splits, mergers and acquisitions, rights issues, and spin-offs — cannot be depicted off the shelf. This increases complexity and costs as corporate actions are either documented off-chain or involve substantial and customized software development efforts. The second obstacle is

that comprehensive financial-product term sheets — that is, the description of features concerned with the securities' maturity/expiration date, denomination, (floating) rates, and payoff schedule — cannot be represented. In this case, an off-chain record needs to document agreements on specific terms between entrepreneurs and investors. These agreements are costly to maintain as modifications often require wet signatures and third party involvement (e.g., corporate secretarial firms).

Third, another important (technical) challenge for entrepreneurial firms relates to fork risk (e.g., adopting novel rules that nodes work by on a blockchain). Forks represent a risk to security issuances because versions of a blockchain that are “abandoned” by nodes can become vulnerable to malicious hacker attacks or even cease to be operational (Webb, 2018).

The next generation of securities is unlikely to be mere digital representations of existing paper securities. They are likely to come as digital natives on the blockchain, that is, programmable securities. We call them *native digital securities* or in short, NDS. We define NDS as a legally accepted primary record of securities created as a smart contract on a distributed ledger. A jurisdiction that would support NDS is therefore Liechtenstein with the Blockchain Act that came into force in January 2020. Indeed, the law considers that primary records on a distributed ledger supersede those stored elsewhere. As such, all features of the security can be depicted and executed on-chain. NDS have the potential to overcome the challenges discussed above. First, on-chain amendments (e.g., to the capitalization table) can easily and cheaply be executed and viewed by stakeholders, increasing in turn transparency. Second, a flexible description language depicting all possible features and variants of an investment product is in sight. Such contract description language exists in the

centralized world but not (yet) on a blockchain (Eber et al., 2000). If migrated to a distributed ledger, this description language would enable the digital creation of investment products with any combination of corporate actions and securities product features. Third, by opting for a protocol that is fork resistant when issuing NDS, related risks can be managed for the benefit of all stakeholders.<sup>26</sup>

The advent of NDS thus opens up new possibilities for entrepreneurs not only in their capital raising, but also in the governance of their venture (Blémus & Guegan, 2019; Yermack, 2017). Understanding the interlinkages between entrepreneurial finance, corporate governance, and tokenization assuredly represents an important and fruitful area of future research.

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<sup>26</sup> The Tezos whitepaper proposes “a procedure for stakeholders to approve amendments to the protocol, *including* amendments to the voting procedure itself” to manage fork risk on the platform (Goodman, 2014, p.1).

## Appendix. A brief note on STO regulatory framework

**Table 10 Regulatory framework applying to security tokens in the United States.** This table provides a brief overview of the regulatory framework for security tokens in the

United States. The numbering from 1 to 6 always refers to the corresponding regulation mentioned in “Specific regulations applying to STOs.”

Jurisdiction	The United States
Relevant regulator	SEC ( <a href="http://www.sec.gov">www.sec.gov</a> )
Specific regulations applying to STOs	<p>There are no specific regulations implemented just for security tokens in the United States. If the token is a security, any offering of securities (whether in token form or not) is subject to existing securities laws, specifically the Securities Act of 1933.</p> <p>Other regulations applicable:</p> <ol style="list-style-type: none"> <li>1) Regulation Crowdfunding (CF)</li> <li>2) Regulation A + Tier 1</li> <li>3) Regulation A + Tier 2</li> <li>4) Rule 506(b) of Regulation D</li> <li>5) Rule 506(c) of Regulation D</li> <li>6) Rule 504 of Regulation D</li> </ol>
Amount that can be raised without prospectus	<ol style="list-style-type: none"> <li>1) USD 1.07 million</li> <li>2) Annual offer of USD 20 million</li> <li>3) Annual offer of USD 50 million</li> <li>4) Unlimited</li> <li>5) Unlimited</li> <li>6) Annual offer of no more than USD 5 million</li> </ol>
Lockup period	<ol style="list-style-type: none"> <li>1) 12 months unless transfer/resale to accredited investor</li> <li>2) No restrictions on resale</li> <li>3) No restrictions on resale</li> <li>4) Restricted resale either 6 months or 12 months</li> <li>5) Restricted resale either 6 months or 12 months</li> <li>6) Restricted resale either 6 months or 12 months</li> </ol>
Filing requirements	<ol style="list-style-type: none"> <li>1) The JOBS Act raises the record holder threshold for registration for all exempt offerings from 500 to either: (i) 2,000 persons, or (ii) 500 non-accredited persons. Issuers must file Form C with SEC electronically through intermediary</li> <li>2) Issuers must file Form 1-A with SEC including an “offering circular” and are also required to include audited financial statements in their offering documents and to file annual, semiannual, and current reports with the SEC on an ongoing basis. However, they are exempt from State Blue Sky laws: State filings are not required</li> <li>3) Issuers must file Form 1-A with SEC including an “offering circular” and are also required to include audited financial statements in their offering documents and to file annual, semiannual, and current reports with the SEC on an ongoing basis. However, they are exempt from State Blue Sky laws: State filings are not required</li> <li>4) There is no registration required but issuers must file Form D electronically with SEC after the first sale of the securities. There is no requirement to comply with State Blue Sky laws: There is no need to file in each state where the offer is made</li> <li>5) There is no registration required but issuers must file Form D electronically with SEC after the first sale of the securities. There is no requirement to comply with State Blue Sky laws: There is no need to file in each state where the offer is made</li> <li>6) There is no registration required but issuers must file Form D electronically with SEC after the first sale of the securities. There is no federal preemption which means that state filing in each state where the offer is made is required under State Blue Sky laws</li> </ol>

**Table 10** (continued)

Jurisdiction	The United States
Investor requirements	<ol style="list-style-type: none"> <li>1) All investors but investor amounts subject to limits: (i) If either an investor's annual income or net worth is less than \$107,000, then the investor's investment limit is the greater of: \$2,200 or 5% of the lesser of the investor's annual income or net worth. (ii) If both annual income and net worth are equal to or more than \$107,000, then the investor's limit is 10% of the lesser of their annual income or net worth. (iii) During the 12-month period, the aggregate amount of securities sold to an investor through all Regulation Crowdfunding offerings may not exceed \$107,000, regardless of the investor's annual income or net worth</li> <li>2) Accredited and non-accredited investors</li> <li>3) Accredited and non-accredited investors (subject to cap on amount of investment: no more than: (i) 10% of the greater of annual income or net worth (for natural persons); or (ii) 10% of the greater of annual revenue or net assets at fiscal year-end (for non-natural persons)</li> <li>4) Accredited and non-accredited investors (up to 35 participants)</li> <li>5) Accredited investors only</li> <li>6) Accredited investors and unlimited number of non-accredited investors</li> </ol>
General solicitation allowed?	<ol style="list-style-type: none"> <li>1) No</li> <li>2) Issuers are allowed to "test the waters" by conducting a publicity campaign and to solicit indications of interest from the public to assess the level of interest in investing in the company</li> <li>3) Issuers are allowed to "test the waters" by conducting a publicity campaign and to solicit indications of interest from the public to assess the level of interest in investing in the company</li> <li>4) No</li> <li>5) Yes</li> <li>6) Yes</li> </ol>
Additional information	<ol style="list-style-type: none"> <li>1) All transactions must take place through a SEC-registered intermediary, either a broker-dealer or a funding portal. This has been amended recently to increase the amount to USD 5 million. However, this is still under 60-day commentary period in the Federal Registry</li> <li>2) For offering of USD 20 million or less, issuers can proceed under Regulations A + Tier 1 or Tier 2</li> <li>3) For offerings of over USD 20 million and less than USD 50 million, issuers can proceed with A + Tier 2</li> <li>4) 35 non-accredited investors must be "sophisticated" and have sufficient financial and business knowledge</li> <li>5) The company must take reasonable steps to verify that the investors are accredited investors, which could include reviewing documentation, such as W-2 s, tax returns, bank and brokerage statements, and credit reports. As a balance to allowing general solicitation to the public and investor protection, this regulation only allows general solicitation of accredited investors</li> <li>6) N/A</li> </ol>

In this appendix, we provide a brief overview of the most important regulatory frameworks. The regulatory framework is likely to influence the choice of location of STO issuers (see Table 3, Panel A, for our sample composition by country of origin of the issuer). We recommend Blandin et al. (2019) for a

comprehensive overview of regulatory frameworks applying to digital assets in several jurisdictions around the world.

In most jurisdictions, existing securities laws apply to STOs (e.g., in Germany, Singapore, Switzerland, United Kingdom, and the United States).

For example, Singapore confirmed its securities laws apply to STOs (Securities and Futures Act, Chapter 289), adopting a technology-agnostic approach to regulations (MAS, 2018). Besides securities laws, also other existing laws may apply when issuing, holding, and transferring security tokens. For example, banking laws in Germany are relevant for STOs, in particular in the area of digital asset custody, and regulations beyond the Securities Act of 1933 apply in the United States (see Table 10 for details). In other jurisdictions, new laws were enacted to govern STOs. This is the case of Liechtenstein with its Blockchain Act of January 2020.<sup>27</sup> The Blockchain Act requires issuers of security tokens to publish basic information on the tokens and notify the Financial Market Authority (FMA) of Liechtenstein of the issuance. Other countries, such as the Cayman Islands, do not stipulate any particular prospectus and filing requirements with respect to STOs.

In several countries, STO issuers qualify for available regulatory exemptions offered by securities laws. For example, Germany, Liechtenstein, Singapore, Switzerland, and the United States have disclosure exemptions in place for offerings below a certain issue size threshold.

In addition, legislators strive to protect investors by limiting the amount that they can invest. To protect retail investors, the most vulnerable category since no in-depth financial knowledge is assumed, most jurisdictions limit the amount to be invested in an STO by a retail investor (see Table 10 for the restrictions applicable in the United States). In several cases, only accredited and professional investors can invest — that is, individuals who must prove that their annual income and/or net worth is above a certain threshold. Regulators in some jurisdictions also stipulate a lockup period before investors in the primary offering can trade security tokens freely on a secondary market (e.g., in Singapore and in the United States), while other jurisdictions pay particular attention to secondary market trading (e.g., in Switzerland where the operator of a platform may be subject to license requirements).

<sup>27</sup> For more information about the Blockchain Act, see [www.fma-li.li/en/fintech-and-tvtg/tvtg.html](http://www.fma-li.li/en/fintech-and-tvtg/tvtg.html) (last accessed: April 10, 2021).

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