Nova School of Law and Nova Information Management School

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Blockchain-based Bonds:

an alternate possibility for post-trading efficiency

Dissertation submitted in accordance with the requirements for the degree of Master in Law and Financial Markets.

Supervisor: Dr. Miguel de Azevedo Moura,
Professor at Nova School of Law

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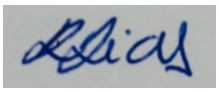

Renata Dias

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Abstract

Blockchain is known as the underlying technology behind Bitcoin. However, its application has reached areas beyond cryptocurrencies. Today, blockchain is used to enable the tokenization of all kinds of assets in the crypto-assets market, from payment coins to utility tokens and, most importantly, securities tokens. The potential impact of such distributed ledger technologies, in addition to the development of smart contracts, is especially interesting to the financial sector, in which different pilot projects are being developed to facilitate operations. The focus of this work will be the use of blockchain in the secondary financial markets and the potential benefits for post-trading processes. In order to provide a better visualization of possible solutions of DLT technologies, the European corporate bonds market will be used as an example of the possible disruptive power of blockchain technology through blockchain-based bonds. For such, relevant characteristics, functions and risks related to security tokens will be analyzed, as well as the challenges for their development and adoption, specifically regulatory challenges. First, it will be addressed the qualification of securities tokens as financial instruments under European law, as well as how their issuance, trading, and settlement work differently from traditional markets. Once these matters are clarified, it will be possible to assess the key European securities legislation framework that are applicable, specifically the MiFID II/MIFIR Regime, the Settlement Finality Directive, and the Central Securities Depositaries Regulation, and their suitability to fit the referred crypto-assets. In addition, it will be discussed the European Commission's adoption of the Digital Finance Package with a particular focus on the Commission's proposal for a Regulation on a pilot regime for market infrastructures based on distributed ledger technology and the relevance for the European corporate bonds market, taking into consideration the blockchain-based bonds market.

Resumo

A blockchain é conhecida como a tecnologia subjacente ao Bitcoin. No entanto, sua aplicação vai além das criptomoedas. Hoje, blockchain é usada para permitir a tokenização de todos os tipos de ativos no mercado de cripto-ativos, desde moedas de pagamento até *tokens* de utilidade e *tokens* de títulos. O impacto dessa tecnologia, além do desenvolvimento de *smart contracts*, tem sido especialmente relevante no setor financeiro, no qual diversos projetos-piloto estão sendo desenvolvidos para facilitar operações diversas por meio de *distributed ledger technologies.* O foco deste trabalho será o uso de blockchain em mercados financeiros secundários e os potenciais benefícios para processos de pós-negociação. A fim de fornecer uma melhor visualização da potencial adoção em larga escala de tecnologias *DLT*, o mercado europeu de títulos corporativos será usado como um exemplo do possível poder disruptivo da tecnologia blockchain por meio de títulos baseados em blockchain. Para tanto, serão analisadas funções e riscos relevantes relacionados aos *security tokens*, bem como os desafios para seu desenvolvimento e adoção, especificamente os desafios regulatórios. Em primeiro lugar, será abordada a qualificação de *security tokens* como instrumentos financeiros, bem como a forma como sua emissão, negociação e liquidação funcionam de forma diferente dos mercados tradicionais. Uma vez que essas questões sejam esclarecidas, será possível avaliar o quadro da legislação de valores mobiliários europeia aplicável, especificamente o Regime MiFID II / MIFIR, a Directiva relativa ao carácter definitivo da liquidação de valores mobiliários e o Regulamento das Centrais de Valores Mobiliários, e a sua adequação em relação aos referidos cripto-ativos. Adicionalmente, será discutida a adoção pela Comissão Europeia do Pacote de Financiamento Digital, com particular destaque para a proposta da Comissão de um Regulamento sobre um regime piloto para infraestruturas de mercado baseadas em *distributed ledger technology* e a relevância para o mercado europeu de obrigações corporativas, levando em consideração o mercado de títulos baseados em blockchain.

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Abbreviations and Acronyms

AML – Anti-Money Laundering

BIS – Bank for International Settlements

BoC – Bank of China

CBA – Commonwealth Bank of Australia

CCP – Central Counterparty Clearing House

CFT – Combating Financing of Terrorism

CSD – Central Securities Depository

CSDR – Central Securities Depository Regulation

CTP – Crypto-assets Trading Platform

DFP – Digital Finance Package

DLT – Distributed Ledger Technology

DvP – Delivery Versus Payment

EBA - European Banking Authority

EBSI – European Blockchain Services Infrastructure

EC – European Commission

ECB - European Central Bank

EEA – European Economic Area

EP – European Parliament

EPTF – European Post Trade Forum

ERC-20 – Ethereum Request for Comment

ESAs – European Supervisory Agencies

ESMA – European Securities and Markets Authority

EU – European Union

EVM – Ethereum Virtual Machine

FATF – Financial Action Task Force

FCA - Financial Conduct Authority

FinTech – Financial Technology

FoP – Free of Payment

FSB – Financial Stability Board

GDPR - General Data Protection Regulation

HTLC – Hashed Timelock Contract

ICMA – International Capital Market Association

ICOs – Initial Coin Offers

ICSD – International Central Securities Depository

IOSCO – International Organization of Securities Commissions

IPO – Initial Public Offer

ITSA – International Token Standardization Association

KYC – Know your Customer

LIBOR – London Interbank Offered Rate

MAR - Market Abuse Regulation

MDP – Multi-dealer Platform

MICA – Markets in Crypto-Assets

MiFID – Markets in Financial Instruments Directive

MiFIR – Markets in Financial Instruments Regulation

MTF – Multilateral Trading Facility

NCA – National Competent Authority

OTC – Over the Counter

OTF – Organised Trading Facility

P2P – Peer-to-Peer

PKI – Private Key Infrastructure

PoW – Proof-of-Work

RegTech – Regulatory Technology

RFQ – Request For Quote

RM – Regulated Market

ROFIEG – Regulatory Obstacles to Financial Innovation

SDP – Single-dealer Platform

SFD – Settlement Finality Directive

SG – Société Générale

SGX – Singapore Exchange

SI – Systematic Internaliser

SPV – Simplified Payment Verification

SSS – Securities Settlement System

STP – Straight Through Processing

STO – Security Token Offer

T2S – Target2-Securities

I. Introduction

The implementation of Distributed Ledger Technology in financial services is promising, as institutional players seem to be investing in the development of innovative solutions in a wide range of services, including insurance, wealth management, payments, and securities markets.

Among DLT, the evolution of blockchain and smart contracts applications have brought to the current market the opportunity to transform assets into digital tokens, including cryptocurrencies, utility tokens and securities tokens. The latter is especially relevant for financial markets.

More specifically, the use of blockchain in securities markets through the tokenization of securities might be significantly beneficial in terms of operational processes efficiency, speed, and costs in the post-trading environment of security tokens, considering both regulated markets and OTC markets.

For a better understanding of how securities markets could take advantage of blockchain technologies, the European corporate bonds market will be used as example. Such market seems particularly interesting for the intended purpose of this work, considering that it presents opportunities for innovation and improvements, as will be investigated based on a potential blockchain system to understand how a trade life cycle could be merged into it.

Blockchain is a novel and complex technology that requires certain efforts for its adoption. It is not only challenging due to technological and operational particularities, but also due to its unique nature that makes regulatory attempts a difficult task. Thus, the development of solutions for post-trading infrastructures and its adoption is still limited in the securities markets and, consequently, the potential benefits for market participants and the European market itself are hindered.

In this context, it is relevant to analyse the potential impact of the European Commission's Digital Finance Package, more specifically the proposal on a Regulation on a pilot regime for distributed ledger technology in market infrastructures, on the development of blockchain and DLT solutions for the post-trading of crypto-assets that qualify as financial instruments. Once assessed the

likely transformation enabled by blockchain, it will be possible to reasonably speculate how it will unwind for the European corporate bonds market.

II. Blockchain beyond Bitcoin

2.1. Tokenization and financial instruments

Initially, Bitcoin[1] seemed particularly interesting to many speculators and to those who strongly disapprove the financial system once it overlies a protocol with unique characteristics of a transparent automated system, originally established as an open and decentralized public ledger, disintermediated, immutable, and secure, created by Nakamoto (2008), that enables transactions without intermediaries. However, blockchain[2] has outgrown Bitcoin, with the development of new capabilities from the transfer of digital currencies to decentralized applications relying on such decentralized technology.

The development of blockchain and DLT technologies are particularly important for the financial sector. The impact of blockchains technologies´ disruptive power in financial services might be summarized in the transformation of the following set of activities, called by Tapscott & Tapscott (2018, p. 61-63) as "the golden eight": (i) authentication of identity and value: in financial transactions, blockchain allows the establishment of trust and the verification of identity by peers in a robust and cryptographically secure way; (ii) movement of value: blockchain can lower costs, improve speed, reduce friction and boost economic growth of anything of value, such as currency and bonds; (iii) storage of value: blockchain supports the storage of value as an alternative to traditional repositories of value for individuals and as an improved mechanism for institutions; (iv) lending: blockchain enables the direct transaction of debt instruments, enhances the trade lifecycle, reduces friction and risk and increases speed and transparency; (v) exchange of value: blockchain increases speed and efficiency in the post- trade stage (clearing, settlement and storage of value) of the trade´s life cycle; (vi) investment and funds: blockchain enables new models for peer-to-peer financing

[1] In accordance with Nakamoto (2008) peer-to-peer electronic cash system built on a set of algorithms created to facilitate transactions between networks of peers connected in a chain of blocks of records, based on an underlying technology known as blockchain.
[2] It is a new technology, among distributed ledger technologies, with the power to change how people exchange value (Tapscott & Tapscott, 2018).

and could improve efficiency, transparency and security of coupons payment, for instance. (vii) risk management: bockchain increases transparency and improves risk management in insurance activities, especially; (viii) accountability: blockchain supports new account methods of greater transparency and speed which may be particularly interesting for regulators.

More than a database, but "*both a new technology for data storage and a novel variant of programmable platform that enables new applications such as smart contracts.*" (Finck, 2019, p. 7), blockchain facilitates the trade of digital currencies and other assets, as well as *"the creation of computer processes known as smart contracts, which can execute autonomously*." (Filippi & Wright, 2018, p. 2). In the other words of Finck (2019), transactions rely on smart contracts´ automated execution, regardless of intermediaries and trust, with lower costs and risks, supported by the tamper-proof nature of its underlying blockchain infrastructure. Despite the progress, the technology promotes benefits and have limitations that still needs to mature[3]. However, smart contracts are not only developed to generate and manage digital currencies but also to generate crypto-tokens that represent tangible or intangible assets on a blockchain-based network, in accordance with De Filippi & Wright (2018).

In this context, the most common blockchain, or DLT applications, in financial services are crypto-assets, digital representations of value. Or as defined by ESMA (2019, Appendix I, Glossary) a "*type of private asset that depends primarily on cryptography or Distributed Ledger Technology (DLT) or similar technology as part of their perceived or inherent value.".* The current crypto-asset

[3] Such as for example, challenges regarding the lack of legal qualification of smart contract. Although they can produce legal effects, the legal effect of an intelligent contract lies in the parties' intention to be contractually bound by. In addition to the limitation related to their strict and rigid-code rules that do not match linguistic ambiguity often necessary to execute legal contract (although they might benefit from the feeding of relevant data from oracles or third parties intermediaries, in order to adjust performance obligations) smart contracts are limited by its transparent and autonomous nature when it comes to privacy concerns or the parties' rights in a transaction between pseudonymous parties. Also, by the core characteristics of blockchain regarding disintermediation and tamper-resistance that might present obstacles to law intervention and facilitate criminal or anti-competitive contracts, according to De Filippi & Wright (2018).

spectrum is wide, and it includes cryptocurrencies and crypto-tokens that might vary from utility tokens to security tokens or even to a form of both.

Crypto-tokens have emerged among cryptocurrencies representing the various forms of tradable assets. They are essentially crypto-assets that might be defined as "*a digital good tracked through a blockchain or blockchain-based application*" (Finck, 2019, p. 16). Tokens can be native to a blockchain network, existing only in a DLT form, such as non-certificated securities, or can even be created through the phenomenon of tokenization, or digitalization of existing assets on a distributed ledger, enabled by the development of blockchain technology. Tokenization allows the digital representation of any kind of assets (e.g., real state, intellectual property, music), more specifically, the representation on a blockchain of rights or a unit of asset ownership (Tapscott & Tapscott, 2018). And, according to Delloite (2018), the process of issuing a blockchain token is similar, in many ways, to the traditional process of securitization "*with a modern twist"*, through a type of initial coin offerings that can not only create payment and security tokens, but also utility tokens, and can be traded on the secondary market.

Crypto-tokens, in a broad sense, might include any type of crypto-asset, regardless of the distributed ledger technology behind it, in accordance with Ferreira (2020), who explains that, in a strict sense, tokens are defined as such when issues on public and permissionless blockchains, and thus, the meaning giving to tokens might be different across regulatory, legal and businesses contexts. As a result, there is no common taxonomy of crypto-assets, until this date. However, as highlighted by Ferreira (2020) and the European Commission's Regulatory Obstacles to Financial Innovation - ROFIEG (2019), there is a common approach to distinct tokens by their functional purpose, in three recognized categories: cryptocurrencies, security/investment, utility. In addition, there are hybrid tokens which cannot be precisely defined due to features that might change over their life cycle and span more than one category.

In addition to cryptocurrencies, such as bitcoin and ether, known for its quality of a means of exchange and storage of value, that function as a means of payment for goods or services external to the platform (Hacker & Thomale, 2018), some crypto-tokens are defined by the value based on underlying assets along with the

promise of positive future cash flows, that possess an investment component. These are known as security or investment tokens.

According to the BNY Mellon Bank (2019), tokenization can be applied to financial instruments such as stocks and bonds and might be particularly interesting to assets in need of increased transparency in payment and data flows to improve liquidity and tradability. This because tokenization of securities has the potential to provide key benefits, such as those related to the fact that tokenization can open the market to a new set of investors through the representation of fractions of ownership enabled by such technology. Also, blockchains, both public and private, allow a broader geographic reach. In this context, Delloite (2018) also believes tokenization can promote more liquidity in illiquid assets (through access to a broader base of traders) and increase trading volumes. In addition, it can enable a new financial system, more accessible and transparent, less costly, faster, and simpler through processes of digitalization and automation. These might reduce the need for multiple intermediaries and manual intervention in the process of data and information reconciliation, reducing human-error risks, increasing the speed and efficiency of operations, according to PWC (2017). As a result, this might cause a decrease in back-office costs. Also, through a digital and automated network, transparency of ownership might be increased, and collateral management might be enhanced.

Today, there are few examples of security tokens representing transferable securities. In the case of bonds, the focus of this work, some pilot projects have been developed by financial industry players to experiment issuance, trading and settlement through blockchain technologies (see Annex 1).

More and more, there are utility tokens that enable access to specific products/services, in other words, rights to a service or product provided by the crypto-token issuer (ROFIEG, 2019). For example, the ERC20[4] standard tokenization smart contract of Ethereum platform enables the generation of tokens that convey functional utility to investors by allowing the access to their platform of smart contracts and for other tokens.

[4] https://ethereum.org/en/developers/docs/standards/tokens/erc-20/ .

In addition, there are hybrid tokens, a more complex type, once they serve more than one scope, representing a "*hybrid type of finance-cum-consumption product*" (Finck, 2019, p. 16) and, consequently, they might fall under conflicting existing legal rules and regulations.

The different categories of tokens, in addition to the novel nature of tokenized assets and the exchange of blockchain-based tokens raise complex issues, especially challenges related to the regulation of crypto-assets (Ferreira, 2020). For example, the different types of financial technology, or FinTechs[5] and, especially, the different types of services and products that are offered require a different regulatory treatment (Moreira et. al., 2018). However, for the purpose of this work, the focus will be on security tokens, considering blockchain seems especially stimulating for the primary and the secondary financial markets as some believe they might "*become the common standard for the movement of anything of value – currencies, stocks, bonds and titles – in batches big and small, to distances near and far, and to counter-parties known and unknown*" (Tapscott & Tapscott, 2018, p. 64).

2.2. Potential benefits for post-trading in the European corporate bonds market

For a better understanding, and within the purposes of this work, the analyses of the possibility of disruption of post-trading in the European corporate bonds market will be used as an example. As defined by Fabozzi & Choudry (2004, p. Chapter 1), bonds are fixed income instruments considered to be debt securities with terms to maturity over one year and that are many types of bonds that might be issued representing a financial contract between the issuer and the bond holder which receives interest-bearing obligations from the issuer in addition to the repayment of the principal. Corporate bonds are part of the large debt market that is also composed by municipal, government and agency bodies securities that range from short term (e.g., money market instruments) to long term (e.g., bonds) instruments, from different characteristics and trade differently, in accordance with Weiss (2006, 2ed, p. 184). Therefore, it is worth mentioning that

[5] A field that "*promotes new business models, applications, processes or products with an associated material effect on financial markets and institutions and the provision of financial services*", according to the Financial Stability Board (2017).

an extensive analyses of bonds instruments and the overall debt market exceeds the scope of this study[6], which focuses on corporate bonds instruments.

Securities transactions are a complex process that involves a pre-trade and a post-trade process developed in a market infrastructure formed by market participants and intermediaries who perform whether supporting the issuance, distribution, buy and sell matching, transaction agreements, affirmation, and confirmation of deals, or enabling the determination of each party´s obligations, the clearance and settlement of financial products, and the safekeeping and custody of assets. Intermediaries, such as central exchanges, brokers and dealers, custodians and payment agents, and central clearinghouses and central securities depositaries, compose the critical infrastructure for the functioning of securities markets, as they impose institutional rules, define circumstances for trading of securities, manage the flow of information about trades (updated lists of prices for securities levelling the playing field for market participants), maintain a ledger of relevant information regarding trades, and so on, as explained by De Filippi & Wright (2018) and ESMA (2019).

The role of market participants and the conditions of issuance, trading, clearing, and settlement depend on market structures features. For example, the International Capital Market Association (ICMA, 2020) highlights that the bonds market structure is fundamentally different from the equities market. The management, execution, and transfer of ownership of bonds are not as centralized, the liquidity of the instruments available for trading is lower, and sizes are generally higher. According to the European Commission Expert Group on Corporate Bonds (2017), bonds, especially corporate bonds, are mostly unsuitable for exchanges, due to their heterogeneity and to their intrinsic illiquid nature, that tend to be episodically active in the secondary market. Fabozzi & Choundry (2004), affirm that corporate bonds are less liquid than most other public market financial assets and trading is usually concentrated in new and large issues. In 2019, as per ESMA Annual Statistical Report 2020 on EU securities markets (2020), most bond trading volumes in Euro, 18% from

[6] For an analysis in detail of the debt market see Fabozzi, Frank, *The handbook of fixed income securities*.

corporate bonds[7], were off exchange, mainly in Over the Counter – OTC markets, with larger sizes, representing 50% of total bond trading in the EEA. Also, through Systematic Internalisers – SI (e.g., Barclays Bank), in which there has been an increase in volume and trade size. However, in terms of number of bond instruments traded by market type, most bonds were traded in Multilateral Trading Facilities – MTFs (e.g., Bloomberg Trading Facility). Statistics have also showed that, since MiFID II[8], the number of bond instruments available on EEA trading venues has increased, but the overall number of bonds available for trading has declined. Most available bonds for trading were issued by EEA domiciled issuers. Between those, corporate bonds were the most issued instruments, while sovereign bonds were the most traded. The number of transactions for both sovereign and corporate bonds was low, as transactions are less frequent and larger in the EEA bond market, in comparison to the equities market. Finally, corporate bonds showed lower liquidity in the secondary market.

In OTC markets trades are often executed between dealers and clients, in a bilateral and private form. As explained by the Board of IOSCO (2018), and Bech et al. (2016), and the ICMA (2020), transactions are facilitated by dealers, and the efficiency of the market relies on market-makers whose services generate liquidity. They often assume sale and buy positions in deals with their customers acting in a principal capacity. However, the Commission's expert group on corporate bonds (2017) has identified a transition to agency capacity following the 2008 crisis and related regulatory changes. In OTC markets, negotiations are conducted in a less formal manner when compared to regulated markets, which imply fewer rules, standards, and a common lack of transparency and liquidity, that contributes to a fragmented post-trade environment.

Systematic Internalisers – SI consists of investment firms that deals on own account executing client orders against their proprietary inventory, outside a regulated market, MTF or OTF, as per Article 4(1)(20) of MiFID II, in a systematically manner, in the bilateral OTC environment, as pointed out by

[7] The second instrument type in terms of number of transactions and trading volumes.
[8] Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU.

Moloney (2016) in regards of frequent and systematic requirements for a firm to qualify as SI. A single-dealer platform could qualify as a SI and work with certain instruments, not general. In this scenario, regulatory burdens are not as strict as to regulated markets.

MTFs are defined as "*a multilateral system, operated by an investment firm or a market operator, which brings together multiple third-party buying and selling interests in financial instruments – in the system and in accordance with non-discretionary rules – in a way that results in a contract*…", in accordance with Article 4(1)(22), of MiFID II. Moloney (2016) clarifies that MTFs operations are subject to a customized regulatory regime which addresses operational and transparency regulation, in a similar way to the regulated market regime. Thus, MTFs are also neutral venues that do not execute client orders against proprietary capital and do not include bilateral systems, in principal trading.

According to the Commission´s expert group on corporate bonds report (2017), issuances have increased over the last years, and the same is true for issuances in 2020. Private placement platforms and MTFs have been emerging, especially for smaller issues, and although this promotes the access to the market and trading of corporate bonds by qualified investors, there is still a need for more standardization in issuances. MTFs have been indicated by ESMA (2020) as the market type with outstanding number of bonds transactions in 2019, even though it was one of the market types with lowest average volume in comparison to OTC market, where there is a predominance of institutional/sophisticated investors. Taking this into consideration for the purpose of this work, the definition of MTFs and the related statistics concerning bonds markets will be relevant when addressing crypto-assets regulation, more specifically, the European Commission's effort towards regulation of DLT-based MTFs.

According to Moloney (2016, p. 502), the post-trading environment is composed by processes "*through which ownership in a financial instrument is transferred from the seller to the buyer in return for payment and involves a number of stages*". These starts after the buy and sell terms are agreed and the trade is booked and validated, with the affirmation and confirmation of the relevant details and the transaction is prepared for settlement, when the exchange of securities for payment is finalized and the update of records of ownership is arranged.

It is a highly complex cycle, crucial for the efficiency of financial markets, and supported by services provided by financial market infrastructures, such as broker, dealers, custodian banks and payment agents, clearinghouses, and Central Securities Depositories – CSDs. Thus, it concentrates every process after the execution to the final settlement of a transaction, including back-office processing. According to Weiss (2006, 2ed), the back-office is responsible for processes of comparison, confirmation, margin monitoring, settlement, security control, financing, client account servicing, and books and records, of an executed order.

The Commission´s expert group on corporate bonds (2017) identified the fragmentation of the post-trade environment in the European market characterized by a multitude of intermediaries (e.g., central counterparty clearing houses and CSD), that represent a barrier efficiency in all asset classes. The same was recognized by the European Post Trade Forum (2017). More specifically, the fragmented fixed income post-trade environment and the restrictions for opportunities for greater liquidity have been addressed by the EC expert group on corporate bonds (2017) which has addressed a few fixed income clearing barriers related to the lack of liquidity of corporate bonds, referring to the lack of transparency in post-execution. And, the cross-border settlement limitation, also addressed in the EPTF report (2017) on national restrictions on the activity of primary dealers and market makers in sovereign bonds market. In this context the group has pointed out that, most corporate bonds are not cleared through Central Counterparty Clearing Houses ('CCPs')[9] that lack open access, despite MiFIR[10] non-discriminatory access requirement to trading and clearing infrastructures, once the nature of the market is not proper to fulfil the liquidity requirements of CCPs. As pointed out by the EC expert group (2017), margin

[9] CCPs play a relevant role in securities market by ensuring, for example, that payment obligations are met by market participants. They support their members in case of an event of default through a process known as 'novation', through which they become legally responsible for the transactions of their members, assuming counterparty risk. For this reason, CCPs services are conditioned to certain requirements that work as risk management measures. For example, they demand the provision of margin and contributions to maintain a reserve fund in order to support default management.

[10] Regulation (EU) No 600/2014 of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Regulation (EU) No 648/2012.

schemes demanded by CCPs are not always reasonable to illiquid corporate bonds, and although MiFID II and transparency requirements could improve the visibility of liquidity required for CCPs services purpose, such measures may not be sufficient to reach reasonable margin schemes requirements, considering that there is a lack of standardization among the multitude of corporate bonds and structures. Also, it points out that cross-border settlement innovation through the adoption of the Target2-Securities – T2S[11] platform, supported by the provisions of the Central Securities Depositories Regulation - CSDR[12], can be stifled by market infrastructures lack of interoperability (e.g., between CSD and International Central Securities Depositories – ICSDs). The group believes that non-cleared fixed income trades could beneficiate from the extension of CCP services designed to simplify trade processing and settlement, without legal novation, allowing a more standardized and efficient operational process similar to cleared trades, including centralized processing, netting and optimisation services.

Considering such fragmentation that leads to inefficiencies in post-trading (e.g., related to data reconciliation, manual processing, long custody chains and others), there is a possibility that the use of DLT, including blockchain, in the securities market will be more widely introduced in the post-trading environment, in which more benefits might be realized, than from trading to settlement, in accordance with Priem (2018), who believes that DLT adoption will be, most likely, a gradual step-by-step evolution towards the application to the entire trade lifecycle.

In regards of corporate bonds, the current market structure often fails in terms of efficient transparency and liquidity due to inefficiencies present both in the pre-

[11] It facilitates transaction between EU countries, reduces cross-border securities settlement costs, increases competition among clearing and settlement service providers, reduces settlement risk and increases financial stability by using central bank money for transactions on the platform, in accordance with the ECB, in https://www.ecb.europa.eu/paym/target/t2s/html/index.en.html . However promising, still need to be fully embraced by the fixed income market infrastructure in order to dismantle settlement barriers, according to the Commission expert group on corporate bonds (2017).

[12] Regulation (EU) No 909/2014 of the European Parliament and of the Council of 23 July 2014 on improving securities settlement in the European Union and on central securities depositories and amending Directives 98/26/EC and 2014/65/EU and Regulation (EU) No 236/2012.

and post-trade processing. Regarding post-trade, in a non-standardized market structure such as of bond markets, the complexity can even be higher. In fact, the overall efficiency of bonds market is affected by its fragmented post-trade environment, in which prevails a lack of financial integration in the EU between market participants and the existing multiple intermediaries involved in a bond trade life cycle (Chen & Wang, 2020). In the same way it affects pre-trade, some predominant challenges are hindering the current scenario, as in the case of: (i) reconciliation inefficiencies that create redundant workflow and additional risks to post-trade processing (e.g. related to a great reliance in manual-work and human intervention in operational process); (ii) the lack of interoperability between centralized database systems, in addition to great reliance in operational manual-work due to the lack of automation and digitalization, which hinder the benefits of Straight-Through Processing – STP in electronic trading; and the sum of these give rise to lengthy and costly settlement cycles, increased operational costs (back-office), and additional risks (i.e., settlement failure and human error related) (Chen & Wang, 2020).

The existing inadequacies have a relevant impact on the market's transparency and liquidity, thus, affecting market efficiency. Therefore, it is important to highlight the interconnection between transparency and liquidity, two essential factors for market efficiency that is greatly affected by the referred market structure and its inefficiencies. As pointed out by the (ICMA, 2020), for the past decade, the corporate bonds market liquidity has been in decline due to a culmination of factors. According to the EC Expert Group on corporate bonds (2017), liquidity decrease could be related to some market changes. As their report shows, over the last years, the corporate bonds market has faced an increase in issuances, trade ticket sizes have gotten smaller, larger positions have been instituted through primary markets, demand has increased and so has the segmentation of the market functioning. Some changes in market participants roles have been noted, for example, the role of dealers have been transitioning to an agency model, and inventories have been reduced, as a post-financial crisis result and due to the impact of recent regulatory changes regarding: (i) the increase of capital requirements, under Basel III, therefore a more expensive market making business with less incentives, namely increased difficulty in

hedging activities and decreased profitability; and (ii) the additional compliance costs, under the pre- and post-trade transparency requirements of MiFID II. For example, MiFID II pre-trade transparency requirements caused the separation of execution and research costs which might have a greater impact for investors who must now be charged for access to bond research by dealers, increasing corporate bonds trading costs. Investors might be challenged to adapt. However, in this context of the MiFID II transparency rules, the current provisions do not seem to have caused relevant changes in the bonds market liquidity since it has been rolled out (ICMA, 2020). Also, neither has it increased public transparency as it was intended with the regulatory reform. Nevertheless, as advised by IOSCO (2019), regulatory frameworks for transparency must be balanced to achieve post-trade transparency and market efficiency in harmony with the creation of liquidity. ICMA (2020) agrees and adds that an over-transparent framework could undermine market liquidity. The reason behind it being the sensitivity to information of pricing in bonds market, taking into consideration how liquidity is mainly created by market-makers.

According to the Commission expert group on corporate bonds (2017), electronic trading could be an alternative source of liquidity for European corporate bonds market. The evolution of the *electronification* of European bonds markets' (Bech et al., 2016) in recent years has been driven by three main factors: technological advances, demand for liquidity and regulatory incentives. Technological advances have enabled automated trading, including the automation of settlement process, known as Straight Through Process – STP model which contributes to lowering trading costs, as well as search and operational costs. Also, it promotes incentives for electronic trading, the rise of electronic platforms, and establishes a competitive environment for e-trading platforms that corroborates the reduction of trading prices. The demand for liquidity factor is based on the support e-trading provides for pre- and post-trading transparency through single-dealer platforms - SDPs and multi-dealer platforms – MDPs which enable a more efficient means of monitoring markets, comparing prices and documenting trades executed with the best price, and through automated record-keeping mechanisms that facilitate formal inspections of executed trades. In addition, as electronic trading platforms grow and improve competition, trading

costs are reduced, as well as costs of developing trading systems due to technological advances. In this way, market makers can be beneficed with lower costs to provide liquidity, compensating the reduced liquidity provision that followed the regulatory changes mentioned above. Or even, electronic platforms could enable other market participants to provide liquidity. Thus, e-trading can improve efficiency by providing means to better access information related to pricing and trading, as well as a better adaption to dealer's changing role. However, e-trading platforms seem to be less common for heterogeneous markets (Bech et al., 2016).

Technological advances have been an essential driver of the modernization of the bonds market infrastructure towards a more transparent, liquid and efficient scenario. In this context, blockchain and DLT technologies can be a means of change, considering the promise of simplified operations, improved transactions speed, enhanced transparency, and security, in addition to lower workload, costs and risks. The expectation is that blockchain can have a great influence on securities markets, affecting not only initial sales and distribution of financial products but also their trading in primary and secondary markets and, especially, clearing and settlement and the overall post-trade process by replacing core financial systems with smart contracts code (De Filippi & Wright, 2018). In fact, the EPTF (2017, p. 19) has stated that "*developments in Fintech / Distributed Ledger Technology (DLT) domain could have a significant impact on post trade services, related operational processes and regulatory requirement*s. *However, at this stage an assessment of such impact appears difficult if not impossible."*. In this sense, the EPTF has recognized that its proposed actions to a large extent harmonization and standardization in post trade should be useful in a DLT environment.

In pre-issuance and pre-trade, the adoption of blockchain technologies could be a means of improvement and solution for some of the inefficiencies explained above. For example, blockchain incentivizes the elimination of physical documentation and the simplification of information process flow through automation and digitalization, which could transform manual-work, reducing work-load, and operational risks related to human errors. Also, blockchain works as a transparent and secure single source of truth, which could reduce, or

eliminate as some believe, reconciliation issues and support standardization and transparency, thus, promoting a more competitive market, increased access and participation. This could reduce transactional and operational costs, mitigate risks and contribute to a better access for regulatory purposes (Chang & Wan, 2020).

However, the expectation is that blockchain will have a greater impact on post-trade, through tokenized securities and smart contracts. The clearing and settlement processing of securities through blockchain technologies might be streamlined and enable the possibility of a global capital markets, according to the following. Tokenization, or the digital representation of certificates of ownership of assets, and the deployment of smart contracts can support simpler and faster transactions allowing the merger of trading, clearing and settlement in one single process, through a single ledger, overcoming issues related to the lack of interoperability between post-trade infrastructures (De Filippi & Wright, 2018). For example, in the case of a transaction processed in the same blockchain-based system by both parties, the process of affirmation, confirmation, clearance and settlement instructions lose relevance based on the validation process of blockchain-tokens. Consequently, the need for data reconciliation is lessened, as well as clearance and settlement times and the risk of errors and counterparty risk. Also, tokenization promotes more security while providing digital asset safe-keeping set-up, based on cryptography, and even contributes to the standardization of financial transactions in the token market. Regarding this subject, the International Token Standardization Association – ITSA has been working on a unique international token identification number, on token classification and on a database for analysis purpose that could promote efficiency in operations, simplification in infrastructures and reduction of administrative costs (Chen & Wang, 2020);

Smart contracts within blockchain enable the auto-execution of pre-defined encoded terms and conditions while keeping all records updated. For example, it facilitates payments and economic rights execution with less intermediaries involved. Thus, it promotes real-time settlement, the reduction of operational and systemic risks, as well as administrative barriers. In this context, tokenization is considered the answer to achieve settlement based on Delivery Versus Payment – DvP, considering transferable securities, such as bonds, have been

transformed into digital assets, as well as fiat money or coin, as in the case of *stablecoins* introduced in permissioned blockchains as settlement coins, or the case of tokenized central bank currencies. Thus, both can be represented on the same blockchain or DLT-based settlement system, allowing same ledger settlement, or even crossing two different ledgers, when security and digital money are not located in the same ledger. Although promising, especially to cross-border transactions, real-time settlement through DvP mechanisms on blockchain is challenged by the automatic and immutable nature of such, which might complicate delayed settlement interests and restrict the possibility of reversing transactions when needed (Euroclear, 2016). However, smart contracts give the option of flexible settlement, which might be written with certain conditions by permissioned parties that can even void and reverse transactions. Thus, the immutability and instant automation of blockchain can be subject to operation schedules and eased in permissioned blockchains. Also, a single source of truth consistent of a decentralized, transparent, tamper resistant network with time-stamped records of each trade network sustains the promise of a more transparent marketplace, considering relevant price information in OTC markets (Chen & Wang, 2020).

However, the above expectations regarding blockchain adoption are limited, as explained in previous chapters, by existing technical challenges consisting of technical implementation barriers. According to Priem (2018), the DLT solutions are restricted by technical issues (e.g., data access, types of permissioning, consensus mechanisms and stability), as well as by the complexity of the transition to DLT from legacy systems, lack of trust from the public, inertia in the mainstream adoption of the technology and regulatory uncertainty. The related regulatory issues and challenges will be addressed next.

Moreover, there is an additional challenge to blockchain adoption regarding market structures disruption, once the technology might be seen as a potential threat to traditional financial institutions and their privileged position in business (Tapscott & Tapscott, 2018). In addition, the promise of better transparency through the use of blockchain technologies can cause an adverse effect for brokers/dealers in the bonds market due to the strengthened competition among

market makers and dealers. As explained above, transparency in excess might affect the market liquidity.

The next chapters will be dedicated to the analyses of how the regulatory issues are currently dealt with in the European securities markets, focusing on the application of existing rules to crypto-assets, more specifically, those that qualify as financial instruments, as well as on what is the regulatory approach to the future of these digital assets.

III. Challenges for the development of crypto-assets markets in Europe

3.1. Innovation and regulatory challenges

As demonstrated above, blockchain along with DLT technologies have the power to transform traditional marketplaces, business models and operational processes. However, from a functional perspective, great changes are often limited by different factors. For this work, the focus will be on regulatory challenges.

In accordance with Finck (2019), regarding the possibility to regulate code, or a technology of such nature, the idea that "code is law"[13] can be developed in two different senses: (i) blockchain is ruled by code only and cannot be subject to government regulation, as an autonomous system; (ii) code is as normative as law and does not supersede it. Code might work as a method of implementing self-regulation, as well as externally imposed regulatory constraints as a means of law and regulatory enforcement (e.g., RegTechs that promote regulatory processes through technology). On the other hand, code might be used to avoid regulatory compliance (e.g., for tax avoidance and money laundering activities).

Firstly, it is worthy to highlight that, that are a variety of blockchain systems. For example, depending on the structure of the governance model, the access and power of validation and update in the network is limited. Blockchain networks are not all fully decentralized as Bitcoin's model, they can be divided into public and permissionless or private and permissioned. Public and permisionless blockchain networks enable a trustless protocol to validate transactions. Thus, the

[13] A common statement between researchers such as De Filippi and Wright (2018), when discussing the opposition between the rule of code and the rule of law.

verification and validation process of transactions is deployed by a decentralized and distributed network, that relies on a cryptographic private key that certifies ownership regarding securities, and thus, overrides the need of trust in participants. While in private and permissioned blockchains, only trusted parties are allowed to perform such activities, centralizing the control of the network transactions in a few nodes.

According to De Filippi & Wright (2018), permissioned blockchains have emerged as an alternative to public and permissionless blockchains which impose challenges by their unique open, decentralized, and pseudonymous characteristics, especially in heavily regulated areas as banking and finance. Thus, the access and storage of data could be limited by a central authority or a consortium, on a peer-to-peer private network protocol. It is usually created with a specific purpose and the parties who integrate the network are known or trusted. Their main advantage is speed and predictability provided by alternative validation mechanisms applied to the preselected participants, such as proof of stake as mentioned before. On the other hand, a relevant limitation related to security raise concerns related to the risk of parties able to collude as well as to technical failures, corruption, and hacking once the nodes selected to validated and record information on the network are single point of failures. Private and permissioned blockchains might be better suitable in terms of adoption in financial services, once they enable the traditional financial institutions to enjoy the benefits of the technology with a more centralized control, overcoming the idea of a technological threat to their privileged position. Also, in terms of regulatory intervention, considering that a certain degree of centralization can enable the identification of a central point responsible for requirements of Know your Customer - KYC, Anti-Money Laundering - AML and protection of consumer/investor matters, thus, being compliance friendly system, from a regulatory perspective. Also, they believe that, whereas blockchain technologies is relatively new and the forthcoming scenario is quite uncertain, it is possible to imagine three possibilities for the future: (i) permissioned blockchains will turn public blockchains obsolete; (ii) permissioned blockchains are a temporary solution; (iii) both permissioned and permissionless blockchains will work together in harmony.

Therefore, considering that there are different models of blockchain systems, with different governance rules, the possibility of regulatory intervention, as well as the challenges for the application and enforcement of regulatory rules, might not be the same, depending on the design and particularities of each system. For example, some systems support networks with more controlled access points to it[14], where regulators can focus on. This is the case of permissioned, partially centralized, or hybrid blockchains, that might serve as an easier path for regulation. The ROFIEG (2019) has stated that when the governance of the blockchain network is centrally controlled and depending on the design and rules established by the network's participants, the potential benefits of blockchain might be achieved with less limitations. For example, the records that are stored on such system might not be immutable, enabling updates and deletion, allowing GDPR compliance[15]. Also, according to Finck (2019), regulatory approaches might be focused on different factors other than centralized servers and developers, avoiding a scenario where blockchain would be an "unregulatable" technology, or a perfect decentralized technological structure that would make regulatory enforcement technically impossible due to technological progress towards the removal of the centralized point of failure[16] combined with the widespread adoption of blockchain. In this context, De Filippi & Wright (2018) explain that governments will have direct or indirect forms to regulate blockchain even in a future possible scenario where the technology is widespread, considering their four regulatory levers, laws, code, market forces and social norm.

A blockchain and DLT financial regulatory framework can either promote the development of technological solutions or restrict it, as recognized by the European Commission (EC, 2018), also by De Filippi & Wright (2018) and Hashimy & Sandner (2020). The possibility to regulate distributed ledger

[14] Finck (2019) and De Filippi & Wright (2018) compare the regulatory milestone and evolution of the Internet to a potential regulation of blockchain, pointing out the fact that the Internet passed from a decentralized structure to one partly physical based on elements of centralization that allowed regulatory access points to it.
[15] This is explained latter in this chapter.
[16] Finck (2019, p. 61) in considering the opinion of Viktor Mayer-Schonberger on the impossibility to regulate blockchain. In this context, she brings up the cases of Napster and Pirate Bay, both distributed networks that make regulatory enforcement a difficult and burdensome task as its central nodes are not to be found.

technologies might be beneficial in the sense that it would facilitate and promote the development of blockchain operations and build consumer's confidence supported by legal certainty, the creation of incentives for the technology development, support legal stability and recognition. On the other side, an over-regulatory approach could restrain innovation, considering that a premature regulation in such an early stage of the technology could hamper the emergence of new applications (De Filippi & Wright, 2018). In fact, as Priem (2018) highlights, most regulators believe it is early to draft hard law, considering the future adoption of DLT in the securities markets is unclear, also innovation could be hampered by regulatory reforms[17].

Considering the possibility to regulate blockchain and DLT technologies, and according to Ferreira (2020), the complexity and rapid speed of such technological progress does not make the regulatory task an easy one, considering that regulators must overcome challenges related to legal uncertainty while facing the dilemma of balancing risk mitigation measures and fostering of innovation to enable potential benefits of blockchain and DLT, such as new market solutions. Finck (2019) suggests that such challenges include the very own transnational nature of blockchain, composed by its decentralized, distributed, and disintermediated traits, that challenges not only regulatory intervention, in a code dimension, but also legal and regulatory enforcement efforts in a fragmented transnational scenario. Furthermore, IOSCO (2019) points out that, when regulation is implemented, the variety of rules that might apply to crypto-assets based on blockchain and DLT technologies across jurisdictions can give rise to legal and jurisdictional issues, as well as regulatory arbitrage between jurisdictions, and challenges posed to supervisory and law enforcement thus, posing an obstacle to international harmonization and market development.

The current regulatory scenario is fragmented and the categorization of the different types of crypto-assets is likely the main hurdle faced by regulators, as such requires a comprehension of the technology and of the different nature of each type, that implies different legal and regulatory concerns that may vary across jurisdictions, as highlighted by Ferreira (2020), also by the ROFIEG

[17] This idea will be developed in chapter V.

(2019). This because cryptocurrencies, utility tokens and security tokens guarantee different rights and financial services which requires a different regulation treatment for each. This must be taken into consideration by regulators when analysing tokens status under EU law, in order to first establish if the definition of financial instruments can be extended to crypto-assets, and if so, if the existing securities legislation is adequate (Hacker & Thomale, 2018).

According to Fink (2019), such miscellaneous rules are considered a complex matter that calls for multilateral cooperation for blockchain regulation, and even a global regulation. In this context, the ROFIEG (2019) recommends international cooperation in setting standards that might support interoperability.

Another factor that may burden legal and regulatory enforcement regarding blockchain is anonymity. Since most blockchains are pseudonymous networks based on a combination of cryptography and encryption, anonymity and privacy are native to the network. However, when it comes to data protection it is understood that blockchain does not comply with the European GDPR and, therefore, it must increase its level of data privacy protection in this sense. Contrarily, in the context of law enforcement, the ideal would be to find a balance between anonymity and privacy and law enforcement, once high anonymity might be used wrongfully in law avoidance cases, such as for money laundering and criminal activity financing (Finck, 2019).

Despite the difficulties supported by the borderless, disintermediated, and distributed nature of blockchain, a proper education and understanding of such technologies, on the regulatory and investment side, seems to be essential for the assessment of all the potential and related risks of the adoption of blockchain and DLT solutions in the securities markets. An analysis in this sense seems necessary to define which factors should be regulated in order to minimize risks to investors and the stability and integrity of the market. This must be considered as the lack of proper rules results in risks that might be related to credit and liquidity, to operational and legal matters, in accordance with Ferreira (2020) and Finck (2019). However, how could such issues be solved, considering blockchain application in securities markets is at an early stage and have not yet provided sufficient results of all its potential and risks?

3.2. Possible regulatory approaches

The current regulatory scenario is fragmented, with no common standards, without a homogeneous response, not only across the EU territory, but globally. According to Ferreira (2020), today, there are two prevailing regulatory approaches for crypto-assets. First, the application of existing laws, which can vary between adjustments, prohibitive modifications, and specific extensions. Second, the formulation of bespoke legal framework. For examples in the EU[18] see Annex 2.

At the EU level, the efforts to integrate innovation and technology in the single market started since the adoption of the EU Digital Single Market Strategy[19], in 2015, aiming a world leading position in digital economy by creating opportunities for start-ups, better access to consumers and businesses. Since then, the Commission has taken a relevant approach towards the application of technology-enabled innovation in financial services, of which the EU Fintech Plan[20] (EC, 2019) stands out, with the goal to contribute to financial stability and market integrity in balance with innovation, while covering all kinds of assets, including utility tokens that are excluded from the existing regulatory framework. For such, the EC has established some objectives regarding the mitigation of regulatory arbitrage risk, also of legal barriers, legal uncertainty and compliance requirements, and the access to the market. This plan for the financial sector consists of different steps to enable innovative technologies such as blockchain, artifical intelligence and cloud services, including an EU Fintech laboratory, an EU Blockchain Observatory Forum, and others initiatives on digitisation of information published by listed companies in Europe, on workshops to improve

[18] For this work the focus on crypto-assets regulation is limited to those in the European Union and the European Economic Area – EEA.
[19] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions A Digital Single Market Strategy for Europe – COM/2015/0192.
[20] Communication from the Commission to the European Parliament, the Council, the European Central Bank, the European Economic and Social Committee and the Committee of the Regions FinTech Action plan: for a more competitive and innovative European financial sector – COM/2018/0109.

cybersecurity information, and efforts to present a blueprint with best practices on regulatory sandboxes, and so on[21]. Regulatory matters related to innovation in the financial sector, have been addressed by the European Supervisory Authorities - ESAs mandated to provide advice on the applicability and suitability of the existing EU financial services regulatory framework. Thus, in 2019, the European Securities and Markets Authority has issued an "advice on ICOs and crypto-assets" (ESMA, 2019). Also, it has undertook a survey to National Competent Authorities – NCA, regarding the legal qualification of crypto-assets, with the intent to "*determine the way in which a given Member State had transposed MiFID II into its national law and based on that transposition whether a sample set of six ICO crypto-assets qualified as "financial instruments" under their respective national laws"* (ESMA, 2019a, p. 2). Also, the European Bank Authority – EBA has circulated the "report with advice for the European Commission on crypto-assets"[22].

As a result of the Commission initiatives, including the Digital Finance Outreach events and the work of the ESAs and the European Parliament – EP, the EC has adopted in September 2020 the Digital Finance Package that consists of a Digital Finance Strategy[23], a Retail Payments Strategy, legislative proposals for an EU regulatory framework on crypto-assets, and proposals for an EU regulatory framework on digital operational resilience.[24]. The Commission´s aim is to achieve consistency and harmonization across the EU, as well as to establish global standards when it comes to digital assets, which is an important step towards innovation and competitiveness in the financial sector, ensuring consumer protection and financial stability.

The proposition of a new legislation on crypto-assets, including the proposal for a Regulation on a pilot regime for Distributed Ledger Technology (DLT) Market

[21] https://ec.europa.eu/commission/presscorner/detail/en/IP_18_1403 .
[22] https://www.eba.europa.eu/sites/default/documents/files/documents/10180/2545547/67493daa-85a8-4429-aa91-e9a5ed880684/EBA%20Report%20on%20crypto%20assets.pdf .
[23] Digital Finance Strategy: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee of the Regions on a Digital Finance strategy for the EU COM/2020/591
[24] https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1684 .

Infrastructures (the "pilot regime")[25] is a relevant milestone that should be the subject of analysis of the present study aimed to address the benefits and limitations of the application of blockchain and DLT technologies in the post-trade processing of securities, particularly corporate bonds. However, firstly, it is necessary to assess the application of the existing EU securities regulation and its suitability for crypto-assets, especially considering security tokens´ nature and definition under the MiFID II, as well as some key provisions of the Settlement Finality Directive - SFD[26] and the Central Securities Depositories Regulation - CSDR[27] that might apply to the trading and settlement of crypto-assets that qualify as financial instruments.

IV. Crypto-assets that qualify as financial instruments

4.1. Security tokens

As previously mentioned, the legal qualification of crypto-assets based on blockchain, or crypto-tokens, is a major challenge faced by regulators. Tokens can be distinguished based on their utility, legal status, underlying value, and most importantly, on their purpose (payment, utility, and investment). In addition, they can be differentiated depending on their technical layer of placement (tokens can be issued on any type of DLT), permissionless or not. Also, tokens can be issued as native to a specific blockchain network such as Bitcoin, or as a result of the tokenization of assets (digitalization and recording on blockchain or DLT) ever since the launch of the Ethereum network. For example, in 2019, Santander has sold blockchain-based bonds though the tokenization of bonds on Ethereum, instead of issuing native securities on such network[28]. The issuance was of USD

[25] Proposal for a Regulation of the European Parliament and of the Council on a pilot regime for market infrastructures based on distributed ledger technology, COM/2020/594.
[26] Directive 98/26/EC of the European Parliament and of the Council of 19 May 1998 on settlement finality in payment and securities settlement systems.
[27] Regulation (EU) No 909/2014 of the European Parliament and of the Council of 23 July 2014 on improving securities settlement in the European Union and on central securities depositories and amending Directives 98/26/EC and 2014/65/EU and Regulation (EU) No 236/2012 Text with EEA relevance.
[28] Santander launches the first end-to-end blockchain bond https://www.santander.com/en/press-room/press-releases/santander-launches-the-first-end-to-end-blockchain-bond.

20 million over a process of two-token including the tokenized money and the tokenized bond units (Etienne, 2019).

The point is, different types of tokens call for different regulatory treatments. Thus, it is important to highlight that, without an established definition of crypto-assets, the NCAs have focused on different approaches for the purpose of categorizing crypto-assets as financial instruments, excluding payment tokens, according to the survey undertaken by (ESMA, 2019a). The common approach is based on the idea that the EU financial regulatory framework applies to crypto-assets of specific characteristics, depending on how national laws are applied. In this sense, the first consideration that must be made when assessing the applicability of the EU securities legislation framework is the nature of the crypto-asset and its qualification as transferable security under MiFID II. Once defined, the applicability and suitability of such rules can be determined.

In order to establish if crypto-assets are qualified as securities, and thus susceptible to the European securities regulation, is necessary to assess if they fulfil securities qualification requirements. For the purpose of this work, the definition of a security as a financial instrument will be analysed according to (Etienne, 2019) MiFID II regime as the intention is not to address the EU securities regulation in depth but to focus on the provisions of the ones with a more relevant impact on the matter.

Pursuant to Article 4(1)(15) of MiFID II, financial instruments are those specified in Section C of Annex I, that are “transferable securities”, “money market instruments”, “units in collective investment undertakings and derivative instruments”. Transferable securities are defined according to Article 4 (1) (44) of MiFID II:

> “(44) ‘transferable securities’ means those **classes of securities** which are **negotiable** on the **capital market**, with the exception of instruments of payment, such as:
>
> (a) shares in companies and other securities equivalent to shares in companies, partnerships or other entities, and depositary receipts in respect of shares;
>
> (b) **bonds** or other forms of securitised debt, including depositary receipts in respect of such securities;
>
> (c) any other securities giving the right to acquire or sell any such transferable securities or giving rise to a cash settlement determined by reference to

transferable securities, currencies, interest rates or yields, commodities or other indices or measures;" (**emphasis added**)

The interpretation of such Article is not unanimous among the NCAs across the EU Member States. However, as demonstrated by (ESMA, 2019a), there seems to be a common understanding for key features of a security that are not defined by MiFID II. For example, most NCAs have a similar reading of the term "classes of securities". They advocate for the need of similarity of units issued by the same issuer. Which means they impose as a requirement of securities their sufficient standardization to allow easier trading with low search costs for sellers and buyers, avoiding the possibility of individual negotiation with investors. One might argue that the variety in the crypto-assets scenario, in which different types of crypto-tokens are being issued, sold, and distributed under flexible conditions of ICOs, might be limited in this regard, considering that the lack of standardization could deprive tokens from the security negotiability requirement. Nevertheless, from a functional perspective, standardization at the issuer level can be sufficient, under Article 4(1)(15) of MiFID II, as such provision does not establish the level of abstraction or the extension of classes. Moreover, tokens issued by a single issuer share relevant characteristics and even if not standardized according to one model they are capable of being traded on cryptocurrency exchange platforms (Hacker & Thomale, 2018).

In this context, the negotiability criterion is added to the key definition requirements of securities. It concerns the capability of transferable securities being traded on a capital market, as per Article 4 (1) (44) of MiFID II, even if there is not yet a specific market for the product or even if there is a temporary lock up (ESMA, 2019a). Although there is not a definition for "capital market" under the EU securities regulation, there is a common interpretation of such between the European Commission[29], according to Hacker & Thomale (2018) and Hobza (2020), and the majority of NCAs, in accordance with ESMA (2019a), in the sense of a broad concept that includes contexts where buyers and sellers' interests meet. This might incorporate regulated markets, MTFs, or even cryptocurrency exchanges where crypto-assets are traded. In this sense, security tokens might

[29] European Commission: Your questions on MiFID, question no 115.

clearly be defined as negotiable, in accordance with Hobza (2020), as it is recognized by most NCAs (ESMA, 2019a).

More and more, the requirement of negotiability is interconnected with the concept of transferability, part of a three criteria definition of securities. Transferability is nothing but the possibility of assigning to another person the ownership of units of a financial instrument, while negotiability refers to the ease of such transferability as explained before. It is important to state that the status of transferability cannot be affected by limitation on a contractual basis, for example, a contractual restriction of the transfer of a token, unless the limitation makes it impossible to transfer its ownership to third parties. Also, transferability is not prevented by the lack of registered certificate or document, which is relevant when it comes to tokens as they are not evidenced by certificates, as pointed out by Hacker & Thomale (2018) and Hobza (2020).

The earlier mentioned Article 4 allows the addition of a subjective criterion to the definition of securities, that is the functional comparability of a novel type of investment products as crypto-assets with broad categories of securities such as shares and bonds or other forms of securities debt, as the non-exhaustive list of examples. For such comparison, it is important to define to what extent a crypto-asset share the essential characteristics of traditional financial instruments, as well as to establish the regulatory issues related to them that may rise from risks, for example financial risks involved with the investment component of some types of crypto-tokens (Hacker & Thomale, 2018).

For most NCAs (ESMA, 2019a), investment component is a necessary requirement for the qualification of transferable securities according to MiFID II, and it can be the basis of a functional comparability of security tokens with traditional assets (Hacker & Thomale, 2018), such as bonds. Although none of the NCAs has a legal definition for “investment component” their majority understand it as a promise or indication of future profits stemming from the investment, shared revenues, or a direct flow of payments[30]. In the case of security tokens, the investment component relies on the provision of economic

[30] Whether the expectation of flow of payment is direct from the issuer or not was not considered necessary for most NCAs and it was even highlighted that MiFID II makes no requirement (ESMA, (2019).

and profit rights offered to token buyers (De Filippi & Wright, 2018), for example in the form of future cash flows in cryptocurrency with a high potential for negotiability on crypto exchanges and conversion on fiat money, or in the form of price appreciation, dividends or revenue share. Which is comparable to the investment component of bonds, for example, that consists of economic rights represented by a certificate of debt that generates, in general, financial claims of the principal amount of the loan plus fixed periodic payments as a reward for the lender (Cordeiro, 2016). Considering bonds issued on blockchain/DLT network, the economic rights of such security token's holders to receive periodic payments could be encoded by smart contracts used to facilitate payment obligations and token transfers (De Filippi & Wright, 2018).

Whether investment component is an essential requirement for the definition of crypto-assets as securities or not is still a pending matter that needs to achieve consistency across the EU. Otherwise, there will not be a reasonable European regulatory approach that includes those types of crypto-assets that may not have an investment component, such as utility tokens, or that are defined by its unclear nature, such as hybrid tokens (Hacker & Thomale, 2018).

In this context, the Securities and Market Stakeholder Group (SMSG, 2018) has stated in its advice to ESMA that if securities tokens give right to a financial entitlement, representing features of either bonds or shares, they share relevant characteristics of transferable securities under MiFID and might be defined as such. And more, the group affirms that every organization of secondary market for security tokens should also be defined under MiFID, such as MTFs or OTFs.

However, the purpose of the present paper is not to analyse such complex matter, but rather to review the application and suitability of the EU securities regulation framework to crypto-assets, such as blockchain-based bonds, when they are qualified as transferable securities. Thus, it is reasonable to first establish that securities tokens are equated to transferable securities as bonds on their investment component. Therefore, in the case of security tokens, the common understanding between NCAs is in the sense that they can be defined as transferable securities under MiFID II.

Most importantly, as part of the Digital Finance Package, the EC has recently proposed[31] the broadening of the definition of financial instruments under MiFID II to include financial instruments based on blockchain and DLT which corroborates the argument that, from a functional perspective, security tokens might have a similar structure to transferable securities with an investment component and could be compared to traditional bonds. In fact, as referred on previous chapters, there are a few examples in the securities token's markets of pilot projects of bonds issuance on blockchain. These might serve as a guide on the quest of blockchain-based bond regulation.

Once established that a security token is a transferable security, the uncertainty remains around the application of the existing EU securities legislation framework in financial services. In order to understand why such approach might not be fully adequate for the development of DLT-based solutions for greater efficiency of post-trading processes and progress of the EU corporate bonds market, the purpose of the next chapter is to address the application of key securities legislation on crypto-assets qualified as transferable securities, with a special focus on those applied to securities settlement.

4.2. Issuance and trading

As before mentioned, the blockchain-based token economy is based on crypto-assets that digitally represent traditional assets, either through the process of tokenization, or by direct issuance into a specific blockchain or DLT network as a native asset (e.g., bitcoin and ether). Although it supersedes the scope of this work, it is worthy mentioning that crypto-assets are, in general, are issued through an Initial Coin Offering ('ICO')[32], understood as the "*Blockchain IPO*" by Tapscott & Tapscott (2018) once it might present similar traits to Initial Public Offerings – IPOs of traditional securities such as shares. Most ICOs do not follow the same

[31] Proposal for a Directive of the European Parliament and of the Council amending Directives 2006/43/EC, 2009/65/EC, 2009/138/EU, 2011/61/EU, EU/2013/36, 2014/65/EU, (EU)2015/2366 and EU/2016/2341 – COM(2020)596.

[32] Defined by ESMA (2017) as: *"an innovative way of raising money from the public, using so-called coins or tokens and can also be called an initial token offering or token sale. In an ICO, a business or individual issues coins or tokens and puts them for sale in exchange for fiat currencies, such as the Euro, or more often virtual currencies, e.g. Bitcoin or Ether".*

operational structure of IPOs, however, a structural pattern might be noticed, as noticed by Dell'Erba (2018). According to ESMA (2017), ICOs could provide benefits for crypto-assets, provided that the relevant safeguards are in place, when applied as a digital alternative of capital raising for FinTech startups or other innovative business as a more straightforward and less costly way to funding source. Also, ICOs could be an opportunity for those smaller investors that usually do not have access to early-stage financing investments. In addition, specifically regarding the tokenization of assets, it can bring benefits to market participants and investors, considering tokenization provide faster issuances with lower costs in comparison to traditional issuance processes. And it can streamline the process of transfer of ownership of some assets (e.g., unlisted shares, syndicated loans) and improve liquidity in these cases. However, it should be noticed that ICOs and crypto-assets trading activities are in the early process of regulatory intervention, and thus far, are said to pose many risks, especially to retail investors due to the high scale of information asymmetry and lack of transparency.

Crypto-assets can be traded on specialized trading platforms for fiat currency or other crypto-assets. Currently, the majority of crypto-assets traded is cryptocurrencies such as bitcoin and ether[33], however, the expectation is that the number of security tokens will significantly increase in the next five years[34].

According to ESMA (2019), the platforms where digital assets are distributed and/or transacted, the known Crypto-assets Trading Platforms ('CTPs'), are differentiated by the range of services offered, from broker/dealer services activities to multilateral trading systems; by business models, some are centralized and other are decentralized or even hybrid; and by their level of sophistication, while some platforms are built on top of simple technology others are developed to incorporate good practices from traditional securities venue.

Currently, there are three main categories of activities/services provided by such platforms, in accordance with ESMA (2019). Firstly, there are platforms with central order book and/or match orders under other trading models that connect

[33] https://www.investopedia.com/where-are-cryptocurrencies-headed-2019-4580342 .
[34] https://www.coindesk.com/security-token-industry-global-growth .

buyers and sellers, similarly to multilateral trading systems, to negotiate and agree upon transaction details through direct communication. For those platforms that use order book, this can be off-chain or on-chain. In this case, they can use smart contracts or a liquidity pool that fills submitted orders algorithmically, as usually performed by decentralized platforms. Such platforms are prone to risks of fraud and, for this reason, obligatory deposits of crypto-assets might be required to cover potential risks related to trading, or atomic swaps might be introduced, either on-chain or off-chain. Atomic swaps are defined by ESMA (2019, p. 45) as a "*mechanism to ensure trust by releasing funds and assets when every part to the transaction has fulfilled its obligation"*. This will be addressed in more depth later on this paper. Other platforms might perform similar activities to those of brokers/dealers, for example, they might be used for the sale and buy of cryptocurrencies, such as Bitcoin, according to the price offered by dealers. In addition, there are platforms that are used to advertise buying and selling interests. There are also hybrid business models that consist of those platforms that fall under the three categories as they provide different types of services and activities.

Furthermore, for the distinction of CTPs categories through business models it must be considered the centralized, the decentralized and the semi-decentralized or hybrid models. As ESMA (2019) further explains, a platform is considered centralized when crypto-assets are held on behalf of their clients, having the control of their private keys (they assume the custody/safekeeping of the assets) or keeping client's crypto-assets under the platform's private key. Platforms can also hold fiat money on behalf of their clients. In such case, customer's assets are migrated to the platform prior to trading. The capability of such platforms to segregate and safeguard their customer's asset is a matter of concern. A common feature of such platforms is that the matching of orders, the execution of orders, and the correspondent transfer of ownership between users is usually recorded off-chain, in the traditional books of the platform. While the recording of transactions on-chain is performed after operations. In other words, the settlement of trades happens off-chain and do not need to be recorded on a distributed ledger. Thus, there is no congestion risks, nor stability risks. However, there is a material counterparty risk to investors in relation to the platform, the

only party with access to the confirmation of the transfer of ownership, in addition to cyber-risks (e.g., hacking) related to the existence of a single point of failure is an issue. Centralized platforms are indicated by ESMA (2019) as the current dominant model.

Decentralized platforms are characterized by the opposite; therefore, the clients are responsible for holding their own assets and trade settlements are validated and recorded on-chain. In this way, marketplaces are directly placed on a distributed ledger, in which transactions are governed by code[35], and not by a central authority or intermediary. It is important to mention that, ESMA (2019) highlights that fully decentralized platforms are by design limited to crypto-to-crypto transactions and are still in the process of being developed. Currently, they are considered slower than centralized platforms, due to the process of validation of each transaction, and increased security risks and technological complexity. Platforms can also work under partially decentralized or hybrid models in which servers are centralized and might host orders books but not hold private keys ESMA (2019). The variety of technological developments applied by platforms must also be considered when differentiating CTPs types in order to assess potential issues, risks, and regulatory requirements. Some platforms take more advantage of the technological capacity available to enhance potential speed and safety benefits in different areas, such as for KYC and AML practices, that require a robust and reliable process to ensure all risks related are addressed and to guarantee compliance with regulatory requirements.

According to Priem (2018), there is still uncertainty in the financial industry whether DLT might have a relevant role in trading of securities, thus, for now, the focus is on post-trading efficiencies. The regulatory matters related to the

[35] In this case, the idea that code as law overrides legal systems, in the sense that a blockchain system implements self-regulation, is one of the possible arguments in the rule of code versus rule of law discussion (see footnote 38). If the rule of code is as normative as law, than it could not be regulated by external norms. On the other hand, if the rule of code needs the rule of law for its development, it can work as a means of implementing regulation. For a more detailed discussion, see Finck (2019) and De Filippi & Wright (2020). For the purpose of this work, the understanding is that code and law might support each other, once that code can be designed in accordance with regulatory norms.

issuance and trading of crypto-assets, specifically of those qualified as financial instruments, will be analysed when appropriate.

4.3. Custody/Safekeeping and settlement

Firstly, it is important to acknowledge that the intention of the author is not a deep examination of all kinds of blockchain systems with different governance models and consensus protocols, but to highlight the most relevant particularities for the purpose of this work[36].

Nowadays, most securities are immobilized, dematerialized and maintained in electronic book-entry forms in an account at a Central Securities Depository - CSD, as mentioned by the Bech et. al. (2020), based either on a direct holding system[37] or on an indirect holding system[38]. The latter being the more common system, the multiplicity of CSDs in the Euro market corroborates the existing fragmentation of information regarding the ownership of records, and the related issues of reconciliation of relevant data and information.

Considering indirect holding settlement systems, the use of blockchain and DLT technologies[39] can be beneficial for securities safekeeping functions and settlement processing services normally provided by CSDs, by reducing intermediation of recordkeeping and improving transparency of the chain of custody through direct access to a single source to issuers and CSDs (even if records are partially transparent to end investors and regulators). Also, the adoption of blockchain and DLT systems could increase data security, and reduce operational and custody risks. The benefits might be even greater when smart contracts are added, once they enable simpler and faster operations based on automatic execution of pre-determined actions (i.e., corporate actions) or transactions, when the established conditions are met (Bech et al., 2020).

[36] For a more detailed analysis see Euroclear (2016) and ECB (2017) and (2021).
[37] Consists of individual accounts of beneficial owners maintained with CSDs (Bech et al., 2020).
[38] Securities are held by intermediaries on behalf of their clients (Bech et al., 2020).
[39] Used here as a general denomination for blockchain networks and DLT.

In this context of a "*multi-tier securities custody model*"[40], it has been pointed out by Euroclear (2016, p. 6), that "*by obviating the need for reconciliation, and removing database redundancies*", post-trading processes could be streamlined. For example, in the case of a consensus-based distributed database information can be kept in a single distributed ledger and the need for reconciliation of data and information prevenient of different central database layers in the holding chain (e.g., records held by custodians and CSDs) can be reduced, or even eliminated. Consequently, settlement latency could be reduced and drive efficiencies, reducing settlement risk and contribute to liquidity increase.

To what concerns reconciliation procedures, the European Central Bank ECB (2017) points out that in case of interoperability arrangements for settlement, a further reconciliation procedure could be necessary. For example, the same set of data on securities holdings (of all types of crypto-assets, including native tokens) must be available in a distributed ledger and in a traditional recordkeeping system in order to cover the risks that ledgers organized in hierarchy, such as in a custody chain, might imply. Thus, real-time and transparent reconciliation procedures are necessary. However, the effectiveness of reconciliation procedures would depend on the architectural design of the specific DLT system. If the relevant data and information is simultaneously displayed and accessible on the distributed ledger and then reported to the client, the need for reconciliation could be eliminated. Such theory raises doubts related to the distributed nature of the ledger, such as whether it could be performed by any internal reconciliation.

In the case of a securities market that adopts a direct holding system, a model not commonly used in a global context, those benefits of certain blockchain and DLT-based systems, depending on the structure of governance model might be already provided by CSDs, according to Euroclear (2016). For example, on private systems the access to the network is restricted to known and selected participants, who can perform transactions on the platform. Thus, the competence to validate transactions is limited. In addition, in terms of structure, private and permissioned blockchain networks that provide settlement activities

[40] The common model in cross-border holding, in which prevails a multiplicity of banks or custodians of different accounts and related information that require the alignment of data before settlement (Bech et al., 2020).

of digital assets can be compared to electronic book-entry systems, the most common settlement system involving CSD structures and intermediaries that currently represent value digitally. Furthermore, restrictions are also applied to the access to all information on the ledger, as well as to hold a copy of it, through hierarchies, which, according to Bech et al. (2020) this centralization measure is a replication of account-based systems (as in CSDs) restrictions where the use of accounts is conditioned to authorization. It is true that some structural elements of permissioned networks are comparable to traditional settlement systems and might not be as disruptive. However, the similarity to existing systems that facilitate trading and settlement does not exclude the potential improvement of post-trading and settlement efficiency, at least in some dimensions.

Is worth mentioning that, the redundant workflow in case of reconciliation procedures is one of the main inefficiencies currently identified in post-trading of the European corporate bonds market, as mentioned previously. By streamlining the reconciliation process in post-trade, thus reducing such unnecessary workflow, DLT-based systems can also support cost reduction. However, the ECB (2021) calls the attention of investors, banks and financial markets infrastructures to some considerations that should be addressed for the adoption of such technologies. Thus, it should be considered if the expected costs improvements are significant, in comparison to the investment required, and if DLT potential benefits are unique to its nature or if the same could be achieved within the current ecosystem or other ways. For example, immediate settlement is not a market practice at present, although technically feasible. Also, it should be considered if end investors could benefit from lower fees, and if issuers could benefit from greater transparency, as a result of reduced costs associated with automated asset servicing via smart contracts.

In addition, it is important to mention that the validation of updates in a DLT, or settlement instructions, in a DLT network, for example, might occur without a specific allocation of responsibilities among validators who act on behalf of the operator providing the DLT infrastructure, which could be a CSD, considered the account provider in this case, according to the ECB (2021). There is also the possibility of validation by end investors, in an open and unrestricted distributed ledger, for example, where investors hold their assets directly. In such scenario,

the CSD may be considered the provider and administrator of securities account, from a functional perspective, recognizing end investors as validators. Also, the validation of updates could be outsourced. In this case, a specific participant of a DLT securities settlement system would be appointed by each client as the primary validator of all update requests related to each client's asset holdings (based on a contractual relationship with the client itself), and the other participants would contribute to the validation of such updates (based on a contractual relationship between the SSS operator and its participants). Although the selected SSS participant might provide a securities account to its client, assuming the administration of the client's securities positions, the control over the system and its related responsibility and liability by the CSD would remain, according to Article 30(1) of the CSDR.

Regarding clearing and settlement, specifically, the exchange of securities via book-entries has modernized and improved securities settlement allowing the current cycle of two to three days (T+2= trading day plus two days, as harmonized by the CSDR), that includes the process of clearing and the process of settlement. Clearing involves the reconciliation and confirmation of the details of a transaction through which trade obligations can be netted, one of the biggest benefits of clearing, and, as addressed on the previous chapter, it might involve a central counterparty. While settlement is the transfer of ownership of securities, per se, a process that involves the transfer of securities from the seller to the buyer, known as delivery leg, in addition to the transfer of the corresponding payment from the buyer to the seller, called the payment leg. This consists of the Delivery versus Payment – DvP model, known as the most secure form to mitigate principal risk. In case of securities loans in which there is no payment leg, the settlement method is called as Free of Payment – FoP.

The ECB (2017, p. 43) highlights that, although DvP has been implemented as principal risk mitigation measure that requires the simultaneous exchange of securities for cash payment, DvP is possible "*even when the cash leg and the securities leg of a transaction are not processed simultaneously, and the cash leg is instead netted into a single position and settled at the end of the settlement cycle*".

According to the Deustche Borse AG (2005), DvP settlement is divided in three models: (i) gross basis settlement: trades are settled individually; (ii) gross basis settlement of the delivery leg and netting basis settlement for cash payment (iii) settlement on net basis (Deustche Borse AG, 2005). The linking of delivery and payment legs can occur on the same technical platform, when securities accounts (at a CSD) and cash accounts (with a central bank through CSDs) are connected and handled by the same platform (e.g., T2S) for settlement purposes. Another possibility, as it used to happen before T2S, is an integrated model where central banks outsource the management of their settlement accounts to CSDs, and these are responsible for the management of both accounts. More and more, both legs are also linked through internalized settlement (internal booking), where the counterparties accounts are located at the same custodian, which assumes the clearing and settlement function, without a booking at the CSD level, even if it assumes the central safekeeping function of securities, considering "omnibus accounts". Investment firms, classified as Settlement Internaliser – SI, often apply this model, where there is no Securities Settlement System – SSS. In OTC markets, settlement do not always involve a CSD either, instead, counterparties select a common institution for settlement purposes, where they maintain securities accounts, such as global custodians and International Central Securities Depositories – ICSD, that can also act as payment agents for cross-border trades. For example, Eurobonds (international bonds) often settle through Euroclear or Clearstream. In accordance with Bech et al. (2020), delivery and payment legs can also occur across coordinated platforms in an interfaced model, where usually a SSS is in place operated by a CSD, where a security is held for safekeeping at a CSD, and the trading parties are not customers of the same custodian. In this case, settlement requires interactions between CSD´s SSS and participant´s accounts.

Where blockchain and DLT systems are used to clear and settle securities transactions, it might be performed in different formats, distinguished using stored procedures executed outside the DLT, or through smart contracts encoded into the DLT to settle transactions (ECB, 2017). The technology enables full "on-chain" settlement, when both legs might be tokenized, as well as partially "on-chain" settlement, where the delivery leg might occur with the use of blockchain,

while the transfer of the corresponding cash, the payment leg, still follows the traditional model, and vice-versa. In case of a tokenized delivery leg or a payment leg, DLT and traditional accounts are linked to each other. According to Bech et al. (2020), DvP models on blockchain might work as: (i) account-based securities versus cash tokens, or security tokens versus cash in accounts: both require interoperability across different types of platforms, namely token- and account-based systems, to ensure transactions are verified and validated by counterparties; and (ii) tokenized delivery leg versus tokenized payment leg, either on the same ledger ("single-ledger approach" (ECB, 2018)) or between two ledgers ("cross-ledger model" (ECB, 2018)).

When securities tokens and cash tokens are located on the same ledger settlement is facilitate by a smart contract programmed to perform what is called an "atomic settlement", which means both securities and cash transfers are instant and simultaneous. This approach is like DvP settlement on a single integrated platform, such as T2S (Bech et al., 2020). In case of securities and cash recorded in two separate ledgers, it is required a link between two different ledgers (e.g., interaction between a DLT and a non-DLT payment system) (Euroclear, 2016). The linking between both assets might rely on a connection between ledgers in an "analogous" model to the interfaced model, in which an intermediary (usually a trusted intermediary), or a single entity, facilitates the coordination between two different systems to allow the blocking of securities to be delivered. Where there is no connection between two ledgers, or without a third party, the necessary interoperability between blockchains is enabled by certain functionalities, such as "cross-chain atomic swaps", developed with digital signatures and Hashed Timelock Contracts – HTLC (consists of a cryptographic hash function plus a timelock function) (Bech et al., 2020). First, the counterparties involved in a transaction must block the assets supposed to be delivered with a hash-function of the "secret value" generated by one of them. Secondly, the latter retrieves the asset, or the cash, through such "secret value", which is simultaneously disclosed to the other counterparty, who should then retrieve the securities, in this scenario. The operations are conditioned to pre-established time-period to completion, thus, the timelock function, which guarantees the refund of assets to the original holders in case of failure.

The first and second arrangements are already in use, as in the case of Bond-i, a security token issue by the World Bank and the Commonwealth Bank of Australia, that are transferred in exchange for cash in accounts. Also, the Société Générale SFH, a subsidiary of such, has already settled tokenized securities in Euros, and in 2020, along with SC, the group has settled tokenized bonds transactions with central bank digital currency supported by the Banque de France using blockchain[41]. More recently, in April 2021, as part of the Central Bank Digital Currency project developed by the Banque de France, the European Investment Bank[42], in collaboration with Goldman Sachs, Banco Santander and Société Générale, issued its first digital bond (digitally native tokens of green bonds) on the Ethereum platform.

The third arrangement (token versus token) has recently been accomplished by Banco Santander, which in 2019 has settled on Ethereum blockchain both sides of a bond trade executed with one of the Group´s units, on test purposes. The "*on-chain delivery-versus-payment*" exchange was concluded with a two-token process conducted over an investor wallet and an issuer wallet, both presumably handled by Santander. The process began with the bond tokenization, after the security´s creation off-chain and storage with a custodian that digitalizes its relevant economic details in a smart contract that is send to the issuer wallet. Meanwhile, the fiat money stored with an off-chain custodian was also tokenized and minted into the smart contract, and then sent to the investor wallet (Etienne, 2019). The second layer consisted of the transfer of the cash token to the issuer´s wallet based on DvP atomic settlement with HTLC. The issuance and sale of Santander´s tokenized bond "*has reduced the number of intermediaries required in the process, making the transaction faster, more efficient and simpler*"[43].

Real-time or near-real time settlement is a straightforward method and has its benefits, however, entities such as the ECB (2017) and Euroclear (2016) have considered that it might give rise to issues and concerns related to market

[41] https://www.societegenerale.com/en/news/newsroom/societe-generale-performs-first-financial-transaction-settled-central-bank-digital .
[42] https://www.eib.org/en/press/all/2021-141-european-investment-bank-eib-issues-its-first-ever-digital-bond-on-a-public-blockchain .
[43] https://www.santander.com/en/press-room/press-releases/santander-launches-the-first-end-to-end-blockchain-bond .

instability caused by inefficiencies in individual settlement systems based on smart contracts, at the same time, such immediacy might raise liquidity risks related to the decrease in netting possibilities. According to the ECB (2021), it could reduce credit risk, such as the risks of counterparty fail in delivery securities or pay the required cash, but only pre-funded transactions could eliminate it. Therefore, a DLT-based settlement system design should consider the integration of trading activity into the settlement process, a single process, by making a distinction between trading position and settlement position, considering that today the actual settlement position may differ depending on settlement cycles and fails, or by implementing an 'instant settlement at trading model'. In such case, to minimize risks of settlement failure, to commit a settlement transaction it would be required a fully settled position, or a pre-trade process (disposition check), or fail lending processes would be automatically triggered through a smart contract. If settlement cycles could be reduced, the need of reconciliation could also be reduced with STP operations and the need of human intervention could also be eliminated, or reduced, thus, simplifying settlement discipline regimes for settlement with CSD and for internalised settlement (ECB, 2017). Thus, by closely aligning trading and settlement positions, based on economic considerations, the ECB (2017) believes that DLT-based systems could be designed to reduce settlement failure risks by limiting it to operational errors, eliminating failed deliveries, through 'settlement at trading' model, or near-real time. However, it recognizes that instant settlement can affect the liquidity management of market participants, considering the condition of a fully settled position of the participant trying to conclude a trade. In this context, IOSCO (2019) indicates as an issue the fact that transfers of ownership related to the execution of orders can be recorded in the internal ledger of the DLT trading platform but not on the underlying ledger of assets which could give rise to issues regarding counterparty risk in relation to clearing and settlement. It shows there is a common approach in the EU jurisdictions towards the implementation of policy development related to clearing and settlement risk of crypto-assets, that include requirements such as fully-funded trading to minimize risk of settlement failure, disclosure of delayed settlement, for example, in case of network congestion, clear process for efficient settlement, clear disclosure of the

obligations of the CTP regarding delivery of crypto-assets or cash, and risk management measures.

As understood by the ECB (2017), the specific arrangements of clearing and settlement on a DLT network might raise issues regarding funding and market liquidity. It considers that overall liquidity might be affected by closed-loop networks on DLT, such as in case of privately issued securities as native tokens, that can result in liquidity management issues, in fragmented liquidity pools and it can hamper the overall adoption of DLT-based solutions. Also, in case of traditional securities fully migrated to a DLT system, without tokens, for example where securities are issued and recorded in the conventional system, but custody and settlement activities take place on DLT, the ECB (2021) foresees increased costs for the issuers and providers, as well as efficiency loss and liquidity risks during the migration period. Or, in case of securities issued and recorded both in conventional and DLT systems, in parallel, the overall liquidity might be reduced considering the securities would be available in only one and 'frozen' in the other system. As a fourth possibility, DLT-based systems are bridged together by a token for settlement, used to enable the transfer of the value and rights embedded in the conventional security referenced by the token, such as in the case of tokens used in back office for operations (e.g., collateral transfer or lending facilities). The ECB (2021) states that these tokens would not be considered securities, considering that an underlying security exists separately from the token (kept in custody in the traditional system simultaneously), thus, the market liquidity could be reduced once securities regulations would not be applicable, which might result in efficiency loss and market fragmentation.

In this context, Euroclear (2016) questions whether it would be possible to minimize the current liquidity requirements applied to CSDs and custodians in order to maintain market stability, in a scenario where blockchain was widely adopt and every security was its own settlement system.

On the other hand, the ECB (2021) affirms that real-time processing of assets with liquidity saving mechanisms could be possible, considering DLT can support the elimination of the need to close incoming/outgoing feed for maintenance or to adhere strictly to batch times. Also, DLT networks can provide nettled settlement when required, under agreement between parties on settlement times and

windows (that can be translated into code within smart contracts), allowing settlement flexibility. Also, blockchain can be structured to provide not only instant settlement, but resilience and automation, what could reduce operational costs and improve liquidity management, considering that its adoption in post-trade process could free up capital held as collateral (Chen & Wang, 2020).

In order to realise the potential benefits of DLT adoption in DvP settlement of securities transactions, the ECB (2017) states that is necessary to achieve harmonization and interoperability among DLT solutions. This is true especially when cross-ledger DvP with HTLC settlement is enabled by functionalities such as 'cross-chain atomic swaps' developed with digital signatures and a cryptographic function combined with a timelock function, where DLT-based services run in parallel with traditional infrastructures. In such case, there is a need for right of access and interoperability in balance with measures to mitigate a potential fragmentation and to increase efficiency in the post-trade market. For these, the non-discriminatory access principle must be adopted, as well as technical standards and consistent regulations ECB (2017). ESMA (2019) considers an issue such need of access of DLT SSS operated by a CSD and links between market infrastructures and trading venues, traditional or DLT based, in the settlement process, especially in case of permissionless DLTs. Euroclear (2016) ratifies that links and interoperability between CSDs and market infrastructures is a necessity for cross-border settlement, and find it technically challenging for a traditional CSD to gain access to a CSD operating a DLT system. Which could evolve to an anti-competitive barrier to entry issue. This would require the adoption of common technical standards and business rules in order to ensure the interoperability requirements on a non-discriminatory and transparent basis to another market infrastructure according to the CSDR. More on regulatory matters related to safekeeping and settlement of crypto-assets will be addressed in the next chapter.

V. Application of the key existing European securities legislation framework

For the purposes of this chapter, the analysis of the application of key existing EU financial regulation will focus on post-trading and securities settlement legislation in Europe. The aim will be to identify relevant issues and gaps, and

the overall suitability of such rules for the use and development of the security tokens market, based on the review of reports published by key regulatory authorities and relevant entities and industry participants. More specifically, the ESMA (2019) *Advice on Initial Coin Offerings and Crypto-Assets*, including *Annex 1 – Survey to NCAs*, the Board of the IOSCO (2019) *Crypto-Asset Trading Platform report*, the ECB (2017, 2021) reports on *The potential impact of DLTs on securities post-trading harmonisation and on the wider EU financial market integration*, and the report on *The use of DLT in post-traded processes*, the Euroclear (2016) *Blockchain settlement* report, and others.

a) The Prospectus Regulation

Although the purpose of this paper is not to analyse the issuance of crypto-assets through ICOs, the regulatory matters concerning the initial sales and distribution of security tokens affect the overall impact of blockchain and DLT technologies adoption. Thus, it is important to acknowledge that the lack of regulation give rise to potential risks imposed to investors related to information asymmetry and lack of transparency, as pointed out by ESMA[44]. And, even though the crypto-assets market does not inflict relevant risks to financial stability in the current picture, according to the Financial Stability Board (FSB, 2018), it is reasonable to say the issue deserves to be proper regulated to achieve not only legal certainty, but consistency and international harmonization. Otherwise, the potential benefits of the referred technology might be hampered. Specifically, to what concerns sale and distribution of tokens through Initial Coin Offerings – ICOs, or Security Token Offerings – STO, might fall under the scope of the existing European securities legislation, particularly the Regulation (EU) 2017/1129, the Prospectus Regulation[45].

In this context, the Digital Finance Package - DFP adopted by the EC in September 2020 includes relevant legislative proposals for crypto-assets. t is a new regulatory framework formulated and proposed with the purpose of

[44] https://www.esma.europa.eu/press-news/esma-news/esma-highlights-ico-risks-investors-and-firms.

[45] Regulation (EU) 2017/1129 of the European Parliament and of the Council of 14 June 2017 on the prospectus to be published when securities are offered to the public or admitted to trading on a regulated market, and repealing Directive 2003/71/ECText with EEA relevance.

achieving four main goals (EC, 2020)[46]: (i) to dismantle cross-border obstacles based on a fragmentation in the Digital Single Market; (ii) to ensure a proper balance between digital innovation and consumer protection as well as market efficiency; (iii) to promote data-driven innovation while ensuring compliance with the GDPR; (iv) to promote resilience, data protection and appropriate prudential supervision while addressing the issues and risks related to the digital transformation. Regarding tokenization, issuance, storage, and transfer of financial instruments on a distributed ledger, the EC has proposed a pilot regime on DLT market infrastructures that will be addressed next. While for crypto-assets that do not qualify as financial instruments, the DFP includes the Regulation on Markets in Crypto-Assets – MiCA that establishes specific requirements for the issuance of crypto-assets, of asset-referenced tokens and of e-money tokens, as distinguished by the regulation. An in-depth analysis of the proposed rules would escape the scope of this work, but in short, the proposal includes the following (EC, 2020)[47]: (i) for issuers of crypto-assets: the publication white paper with specific information regarding the crypto-asset, including a detailed description of the issuer, as well as all the relevant information on the project and planned use of funds, conditions, rights and obligations, and risks; the fulfilment of probity standards; (ii) for issuers of asset-referenced tokens: additional white paper requirements, obligatory authorization, governance requirements, rules on conflicts of interest, disclosure of stabilization mechanism, and investment rules; (iii) for issuers of e-money tokens: regulatory requirements of the Electronic Money Directive and the rules set out in the Regulation on Markets in Crypto-Assets.

It is too soon to tell whether the proposed legislation will be appropriate to ensure consumer and investor protection, financial stability and legal certainty for innovative businesses that seek to develop products and solutions based on crypto-assets and the underlying technology, as stated by the Commission (EC,

[46] Question: *What are the main goals of the Digital Finance Strategy?*
[47] Question: *What are the key elements of these proposals?*

2020)[48]. However, it is certainly a milestone towards a regulatory scenario of harmonization and legal clarity.

b) The MiFID II/MiFIR regime

The matters of investor protection, market integrity and stability, deserve to be properly addressed through the adoption of an EU harmonized set of rules applied not only to the issuance of crypto-assets qualified as financial instruments, but also to the trading and post-trading area, covering the whole life-cycle of crypto asset transactions.

As crypto-assets are a challenge for regulators to what concerns their issuance and distribution, so it is their trading and settlement activities, considering there are novel issues and risks that must be properly understood to achieve an adequate regulatory framework. As before mentioned, crypto-assets transactions are commonly facilitated by specialized trading platforms that have caught the attention of regulatory authorities such as ESMA and international bodies as the IOSCO, especially on what concerns the application of the existing EU securities legislation framework. These have addressed CTPs differentiation factors (activities/services provided, business models, technology) that are indicative of specific issues and risks that go beyond those related to traditional trading venues, and thus, are particularly important to establish the specific regulatory requirements that are applied for each transaction supported by platforms.

In the regulatory context of crypto-assets qualified as financial instruments, the investment activities/services of placing, dealing on own account, operating an MTF or OTF, or investment advice, that are provided by some CTPs are subjected to the provisions of MiFID II/MiFIR regime regarding organizational requirements, the conduct of business rules, transparency, and reporting requirements, according to ESMA (2019).

More specifically, in the case of CTPs qualified as RM, ESMA (2019) believes they should be subjected to MiFID II rules, either under Title III as RMs, or under

[48] Question: *What are the main benefits of today's measures? 1. Regulation on Markets in Crypto-Assets.*

Title II as MTFs or OTFs, when platforms trading crypto-assets with a central order book and/or matching orders under other trading models qualify as multilateral systems. Or, under Title II where platforms run activities similar to those of brokers/dealers. On the other hand, the category of platforms that deals with advertisement of buying and selling interests is not subjected to MiFID II requirements, as per recital 8 of MiFIR, once such platforms might be considered as bulletin boards. Therefore, CTPs that qualify as RM, MTF or OTF should comply with the MiFID II/MiFIR requirements regarding minimum capital requirements (e.g., for investment firms operating MTFs), organizational requirements (e.g., transparent rules and procedures for fair and orderly trading, and arrangements to identify and manage conflicts of interest, applied to MTFs), investor protection measures, access to MTFs, OTFs and RM (e.g., transparent and non-discriminatory rules for access to facilities), pre- and post-trade transparency requirements, transaction reporting and obligations to maintain records of the orders in financial instruments.

However, the investment activities-services that might be provided by such trading platforms, in addition to the novel nature of crypto-assets, might give rise not only to risks related to their business models (centralized and decentralized), but also to new or increased risks that might not be adequately covered by the existing legislation. In this sense, ESMA (2019) has pointed out some gaps and issues related to the application of MiFID II to CTPs. These are related to the referred risks that are often similar to common risks faced by conventional trading venues, related to issues of sufficient resources for business continuity, or regarding arrangements and procedures to ensure fair an orderly trading, as well as risks that might rise from potential conflicts of interest and to the non-discriminatory access to services provided by CTPs. Sometimes, other risks might be exacerbated due to the high price volatility and low liquidity of the market. For example, risks of conflict of interest may be exacerbated due to barriers to entry created for smaller issuances, considering that listing fees on CTPs can be significant, and trading fees are normally higher than for traditional securities.

Also, risks to investors related to business continuity might be increased in case of CTPs due to their novelty and lack of resources. In the context of safeguarding

in the sense of financial resources for continuity of operations, IOSCO (2019) enumerates the insufficiency of capital to support operations in case of financial difficulties, and the liquidity and solvency risks related to price fluctuation and financial inability to cover losses due to technological failures (e.g., cyber-attacks), as the main financial risks for CTPs related to operational continuity. Nevertheless, many jurisdictions have implemented capital requirements for DLT trading platforms to guarantee the continuity of operations, such as requirements to maintain reserves to cover the cost of operations for a specific period of time, and for minimum paid-up capital and shareholder's funds. Also, considering the risks related to CTPs operations, some jurisdictions consider the adoption of measures to compensate participants in the event of a loss (e.g., loss from hacking activities), such as a requirement for insurance policies or to have sufficient funds to cover losses.

ESMA (2019) believes that the lack of consistency across the EU territory that do not share the same understanding regarding the qualification of crypto-assets as transferable securities might conflict with the application of pre- and post-trade transparency provisions. And acknowledges that such lack of sufficient transparency to support market efficiency and fair and orderly trading might give rise to aggravated risks in relation to price discovery and market integrity, which can result in poor liquidity/fragmentation of trading. In this context, it is also a concern whether a platform can establish and enforce proper rules against market abuse. It says that, until a common understanding regarding the definition as transferable securities of some crypto-assets is not achieved in the EU, transparency requirements will not be applied in a consistent manner. Thus, it recognizes that some amendments to the pre- and post-trade transparency requirements applicable to venues trading crypto-assets are necessary, or the introduction of a bespoke piece of rule in MiFIR or an amendment to the current definition of multilateral trading venue and the various types of trading models available. Overall, there is a need for greater clarity around crypto-assets services providers and those services and changes to existing rules and data standards that are not currently suitable for transactions of crypto-assets.

In this context, data reporting and record keeping requirements will, most likely, be adapted and will require the development of market participants to comply with

such. ESMA (2019) identified that data reporting and record keeping requirements established by the Regulatory Technical Standards have not been designed to crypto-assets and might give rise to issues related to the lack of a clearly identified operator and the reliance on self-executing pieces of code, especially in the case of decentralized trading platforms. For example, there is no transparency regarding the role of the trading platform operator, and there is a lack of disclosure regarding governance and enforcement of trading standards, which are potential risks in relation to market integrity, when considering market manipulation and investors losses. In the context of CTPs governance, the possible insufficiency of arrangements of the technology might also cause risks to the custody of assets as well as counterparty risk in relation to clearing and settlement.

Regarding market integrity, ESMA (2019) points out that the direct access by retail investors to CTPs, as it is enabled by some, is a matter of concern once such platforms may not conduct necessary checks regarding the reputation of participants and their trading knowledge, in large number. According to IOSCO (2019), the direct access to DLT trading platforms by retail investors might raise risks associated with the lack of standards for the on-boarding of clients considering that most crypto-assets trading platforms apply limited standards, with minimal KYC/AML checks compared to the requirements that must be fulfilled by traditional venues, which facilitate the use of DLT trading platforms for fraudulent, criminal, and illegal activities, and more, facilitate the access from prohibited jurisdictions raising risks of jurisdictional arbitrage. In addition, it is not a common practice between CTPs to undertake suitability assessments to allow participants to trade, which are important investor protection tools. Therefore, most jurisdictions stated by IOSCO (2019) that the direct access for retail investors allowed by CTPs needs a regulatory enhanced level, that might include requirements applicable to intermediaries (e.g., KYC, due diligence, and AML), in accordance with the related specific and increased risks associated with the decentralized nature of DLT and the performance of anonymous, or pseudonymous, transfer of crypto-assets that it allows. In addition, some jurisdictions promote the applicability to CTPs of the requirements related to fairness applicable to trading venues. Also, the direct access to DLT trading

platforms by retail investors might raise risks associated with the lack of understanding of the operations of the platform. This is related to the insufficiency of information disclosed to investors and regulatory authorities regarding CTP operations, including trading and operational matters, which is associated with market integrity and fairness risks. In this context, some jurisdictions have suggested that CTPs should provide information to investors in order to cover matters of trading and operational matters, order types, order execution methodologies, rules preventing market manipulation and abusive activities, volatility control mechanisms, policies and procedures when trading is suspended and/or an outage occurs, deposit and withdrawal procedures, custodial arrangements and dispute resolution mechanisms.

Risks related to trading platforms that facilitate the secondary trading of crypto assets can be unique and linked to the technological uncertainty, such as cybersecurity and system failures risks, and/or to the lack of understanding of the operations of CTPs. According to IOSCO (2019), many jurisdictions are not only considering the application of business continuity requirements in order to ensure system resiliency, integrity and security, but also the maintenance of a high degree of reliability, availability and security through the implementation of system control frameworks. In this context, some jurisdictions consider the establishment of control frameworks and or adherence to cyber security standards as appropriate rules for CTPs and related cyber security risks.

More and more, there is a need for clarification of how hybrid platforms should be qualified and if they can be qualified as RMs, MTFs, OTFs, or investment firms, considering they can provide matching order services and rely on smart contracts for order executions. In case of platforms qualified as RM or MTFs and that provide direct access to individual, it would be required timely and costly checks on clients and many would not be approved.

Despite the issues and risks highlighted related to crypto-assets trading platforms, both ESMA (2019) and IOSCO (2019) also recognized that some of those, depending on the operational model of the CTP, might be already addressed, and mitigated by the existing legal framework. For example, risks of traditional trading venues as counterparty risk might be mitigated by decentralized business models. However, CTPs are still a novelty in development

that require continuous study and research of law makers and regulators to ensure theirs risks and issues, as well as potential benefits are properly addressed.

In this context, the matter of services provided by CTPs is addressed on the EC's proposed bespoke regime, including a Regulation on Markets in Crypto-Assets, that will be applied for issuers of crypto-assets falling outside existing EU financial services legislation, in Europe, and crypto-asset service provider with the intention to develop their activities in the single market. While for market infrastructures that use DLT and provide trading and settlement services for crypto-assets that qualify as financial instruments, the EC's proposed pilot regime will be applied, as a *sandbox* approach, in addition to existing legislation[49]. This will be discussed later in this paper.

It is worthy noticing that, for crypto-assets understood as utility and payment tokens, and not subject to the EU securities legislation, the safeguards proposed might be summarized as: a physical presence in the EU will be a requirement for crypto-asset service providers, whose activities will be conditioned to an authorization from NCAs: depending on the type of crypto-asset service provider, several requirements will be implemented, such as capital requirements, governance standards, obligation to segregate their client´s assets from their own assets, as well as IT requirements, surveillance, and enforcement mechanisms to prevent market abuse, prudential requirements, organizational requirements, rules on safekeeping of clients' funds and rules on mandatory complaint handling procedures and conflicts of interest (EC, 2020)[50].

More and more, the considerations presented here invoke others of great relevance related to the application of key legislations for trading, post-trading and settlement services on blockchain/DLT-based solutions for crypto-assets qualified as transferable securities, such as the SFD and the CSDR, addressed next.

c) **The SFD and the CSDR**

[49] https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1684 .
[50] Question: *What are the key elements of these proposals?*

The potential benefits of blockchain and DLT technologies application on securities post-trading and settlement can be limited by some issues of legal and regulatory matters related to governance, accountability and liability, for example regarding provisions on financial risks as well as systemic risk, which might be amplified while the lack of a harmonized regulatory approach remains.

Blockchain-based settlement of transactions involving crypto-assets qualified as transferable securities might be subject to the SFD and the Central Securities Depositories Regulation – CSDR, the main existing legislation on securities settlement systems in the EU.

The SFD on designated systems for participants (e.g., banks, CSDs and CCPs) to transfer financial instruments and payments aims the mitigations of risks related to settlement finality, especially to insolvency of transaction participants. While the CSDR promotes improved securities settlement in the EU by establishing uniform requirements for such and rules on the organisation and conduct of CSDs.

CSDs are defined as legal persons that operate securities settlement systems – SSS, according to Article 2(1)(1) of CSRD, that provide, at least, one of the following services: initial recording of securities in a book-entry system (‘notary service’), providing and maintaining securities accounts at the top tier level (‘central maintenance service’), and operating a SSS (‘settlement service’).

According to ESMA (2019), when a DLT settlement system is qualified as a SSS under art. 2(a) of the SFD, it must comply with some relevant settlement finality provisions. For example, when DLT platforms, on which crypto-assets are executed, are qualified as a securities settlement system, they need to be operated by a ‘system operator’, defined as the entity or entities legally responsible for the operation of the system, according to Article 2(p) of the SFD. The system operator, as per Article 16(1) of CSDR, would need an authorization to perform as a CSD from the competent authority of the Member State where it is established, in case of crypto-assets traded on a trading venue or transferred following a financial collateral arrangement, and qualified as transferable securities represented in book-entry form, immobilized and dematerialized

according to Article 3(1) of CSDR[51], and recorded in a CSD, as per Article 3(2) of CSDR. Alternatively, the operator could work with a CSD, but in both scenarios the operator would need to comply with Title III of CSDR, which implies an organizational and costly burden that ESMA find as an issue to permissionless DLTs, especially regarding the role of miners under CSDR governance and technical requirements. In addition, IOSCO (2019) addresses the difficulty to establish or identify the precise location of the operator of a DLT trading platform or the place of regulated activity. The same has been identified by the French regulatory authority Autorité des Marchés Financiers – AMF (2020) in the sense that a trading platform managed by a market operator or by an investment service provider running a centralized business model enables the identification of its manager, while a hybrid or decentralised platform does not. Making the note that the development of tokenization solutions might enable the identification of a platform manager with control over transactions, even if when the underlying blockchain network is public and decentralized. However, the French authority recognizes that, within the existing framework, public and decentralized blockchains are excluded, considering the lack of a central system operator responsible for the orderly functioning of the blockchain.

In the context of blockchain as a method for the recording of securities in book-entry form in CSDs, the CSDR will apply for safekeeping and record keeping of such securities at the EU level, whether the service is a notary service, a central maintenance service or a settlement service provided by CSDs. Also, other legislations might be applied, such as MiFID II or the UCITS V Directive/AIFM Directive at the investor level considering custody/safekeeping functions, and the Financial Collateral Directive, without prejudice of national legislations that might be applicable, once the EU legislation framework is not harmonized in the EU.

ESMA (2019) points out that the legal nature and effects of securities accounts and book entry form are regulated by national law which could impose restrictions for such use of the technology. Also, it highlights that the main concern here is the definition of safekeeping service and the control of private keys hold by

[51] Regarding the issuance of transferable securities, the book entry form requirement pertaining Article 3(1) of CSDR will apply from January 2023 to those issued after this date and from January 2025 to all transferable securities.

customer that is performed by CTPs and blockchain/DLT networks, where "*the rules of safekeeping and segregation of customer assets should apply to the providers of those services*" (ESMA, 2019, p. 35), including the Article 16(8) of MiFID II regarding investment firms holding financial instruments belonging to clients. It states its opinion on the sense that the control of private keys on behalf of clients can be regarded as safekeeping services and that rules to ensure the safekeeping and segregation of client assets should be applied in such cases.

According to ECB's (2017) functional definition of securities accounts, these fulfil functions of attributing rights in securities and flowing from securities, evidencing ownership rights or interests, and transferring securities (settlement). And based on that, it assesses whether or not securities accounts exist in DLT systems. In accordance with such considerations, where the operator of a DLT network for securities not issued in a CSD, or non-tradeable securities, is a financial institution, CSDR and SFD regulatory constraints do not apply, except when the DLT network constitutes an SSS. And, such securities could be issued, without an issuance account at a CSD, in a DLT ledger operated by any financial or non-financial entity (e.g., the issuer of the securities), and transactions could be settled without a securities account. In such cases, where the CSDR do not apply to financial securities on blockchain not admitted to the operations of a CSD (e.g., securities in the registered form), the AMF (2020) comments in its analysis of the application of financial regulations to security tokens that the French Blockchain Order 2017 legitimizes the issuance and transfer of securities tokens, in the form of units or shares in CIUs not admitted to operations of a CSD, and negotiable debt securities, and equities or bonds not listed on trading venues within the meaning of MiFID II (e.g., OTC and brokerage platforms). Thus, within the scope of such order, the AMF (2020) believes that securities tokens might be traded and settled on blockchain with no legal issues. For example, because the French law allows the registration of security tokens as financial instruments, the EIB has recently issued bonds using the Ethereum blockchain under such jurisdiction (Goldman Sachs, 2021).

On the other hand, where the operator of a DLT network is a financial institution acting as a settlement internaliser, according to the ECB (2017), the functional

definition[52] of securities account under CSDR applies, and it defines as contractual the relationship between account holder and account provider, in which the latter would be identifiable either in the intermediary who manages the DLT network, when the SI works exclusively for it own clients, or identified through a bilateral agreement signed by users with a specific intermediary, when the SI work in a consortium.

In this context of custody arrangements, IOSCO (2019) identifies the failures of such (e.g., insufficient technology governance arrangements) as operational failures attributed to DLT trading platforms. These might expose investors to increased risks, even in case of self-custody, such as hacking and cyber-risk, or the loss of private keys. Also, the referred report lists other risks in relation to assets held by a crypto-asset trading platform, such as risks related to asset segregation and inadequate protections in the event of default, lack of disclosure of custody procedures, insufficient custody standards, lack of investor protection funds and lack of clarity regarding legal ownership of crypto-assets.

In addition to system operators, SSS participants might be an institution, a central counterparty, a settlement agent, a clearing house, or a clearing member of a CCP, as defined by Article 2(f), of the SFD. Institutions, however, as defined by Article 2(b) do not include individual participants, and the majority of the current participants of many crypto asset trading platforms and DLT networks is retail investors. Thus, according to ESMA (2019), the lack of qualification of entities that do not qualify as institution under the SFD might give rise to concerns regarding the direct access of clients to blockchain networks activities. As previously mentioned, the obligation of intermediation in the case of platforms that qualify as MTFs under MiFID, might restrict the development of security tokens platforms, as pointed out by the AMF (2020).

Furthermore, the provisions of Articles 3 to 9 of SFD would be applied. Article 3 establishes rules on netting and transfer orders, that shall be legally enforceable and binding on third parties, even in the event of insolvency proceedings. While

[52] According to the ECB (2017), securities accounts fulfill functions of attributing rights in securities and flowing from securities, evidencing ownership rights or interests, and transferring securities (settlement).

Article 4 enables Member States to provide on the use of funds or available securities to fulfil participants obligations in case of insolvency proceedings. Article 5 establishes that a transfer order cannot be revoked from the moment defined by the rules of the system. Articles 6 through Article 8 regulates the referred insolvency proceeding. Lastly, Article 9 foresees the guarantee of the rights of holders of collateral securities, in case of insolvency proceedings.

In addition, securities settlement systems are further regulated by the settlement rules specified on Articles 5 to 8 of CSDR, regarding settlement periods on the intended settlement date[53] and settlement discipline (measures to prevent and to address settlement fails)[54], that would be applied to crypto-assets trading platforms qualified as RMs, MTFs, OTFs, and investment firms, according to ESMA (2019).

The CSDR regime also applies to internalized settlement, where securities transactions settle outside securities settlement systems, according to the provisions of Article 9 of CSDR. In this case, transfer orders are executed on behalf of clients of a settlement internaliser or on its own account, that might be any institution, often investment firms, as established by Article 2 (1)(11) of CSDR. The SFD would not apply in such scenario, where crypto-assets trading platforms or blockchain networks that do not qualify as SSS, thus, investors could not benefit from those safeguards, as pointed out by ESMA (2019). Furthermore, settlement internalisers are obliged to report to competent authorities fulfilling the requirements specified in the Commission Delegated Regulation (EU) 2017/391 and the Commission Implementing Regulation (EU) 2017/393.

[53] According to Article 5(2) of CSDR, the settlement date must be no later than two days following the execution date, or 'T+2', for transferable securities executed on a trading venue. This rule does not apply to transactions negotiated privately and executed on a trading venue, to bilateral transactions reported to a trading venue and to the first transaction where the transferable securities concerned are subjected to initial book entry.

[54] According to Article 6(1) of CSDR, trading venues must adopt procedures to enable the confirmation of relevant details of transactions in financial instruments on the execution date. Investment firms also ought to establish measures to limit the number of settlement fails, as per Article 6(2) of CSDR, including arrangements to ensure the prompt communication of an allocation of securities to the transaction, confirmation of that allocation, and confirmation of the acceptance or rejection of the terms in good time before the intended settlement date.

As stated by ESMA (2019), settlement finality as well as DvP settlement in a DLT environment might impose some challenges related to key questions regarding (i) the definition and enforcement of settlement finality in decentralized DLT business models from an operational and legal perspective, taking into consideration operational risks, such as forks, related to consensus validation mechanisms; (ii) DvP settlement and cash leg off-chain. How to achieve DvP on DLT? And more, how to implement the practice of settlement in central bank money encouraged by CSDR?; (iii) the timeline required by the CSDR and the time of completion of DLT transactions. Can these comply with the current T+2 rules?; (iv) access to a permissionless DLT system, considering KYC and AML processes; (v) the necessary interoperability between financial markets infrastructures and trading venues. Could this become an issue?; (vi) the initial book entry form recording of securities at CSDs. Could blockchain be used for as a method?

According to Euroclear (2016, p. 30-32), in a future where blockchain technology is widely adopted for clearing and settlement of tokenized securities, some concerns should be considered, such as:

(i) questions of accountability for ownership ledger maintenance as private issuers of tokenized securities might change roles with CSDs and take on more responsibilities (securities registers) supported by smart contracts; (ii) regarding systemic risk and efficiency: will possible liquidity requirements (for market efficiency and stability) be reasonable in automated individual settlement systems? Will it be possible to avoid and solve an eventual instability caused by smart contracts inefficiencies? ; (iii) KYC and AML burdens might be outsourced which might be a challenge when it comes to regulation of such services, as well as of liability for errors or fraud, considering the anonymity provided by such new technology; (iv) how will compliance with legislation on settlement finality, namely the SFD, be enforced in case tokenized securities are individually settled, in its own settlement model, through smart contracts? The lack of adequate regulation for the matter would add uncertainty to every transaction; (v) In case of default of major holders or issuers, could regulatory entities intervene to correct or reverse a transaction, considering the conditioned access to smart contracts and the process of verification of transactions? ; (vi) Considering the roles and

responsibilities of intermediaries, such as CSDs, CCPs, custodians, investment firms, and so on, might merge and break down with blockchain technologies. A single platform might provide trading and settlement services of securities issued by the same issuer who set-up the platform. Could regulators oversee the new systems, avoiding a fragmented financial system? ; (vii) Could market infrastructures based on Blockchain be widely adopted and efficiently work without coordination or management?

In the context of settlement finality, considering that, according to the SFD, transfers orders entered into the securities settlement system cannot be revoked or otherwise invalidated, even when a participant in the system becomes insolvent, Euroclear (2016) states that correctability, or the possibility to reverse a transaction in case of error, or regulatory or legal mandate in DLT settlement systems, is a possibility depending on the blockchain protocol's design and on the presence of a central authority. For example, in a scenario where the technology is not constrained, when settlement models rely on individual smart contracts, regulatory intervention in case of default events and related correctability might be challenging in terms of access to relevant smart contracts and of validation of changes and reverse of transactions. Thus, DLT settlement systems can ensure SFD protections where transactions could be undone through the creation and confirmation of a 'fork' in the blockchain in order to exclude or change an error. For such, a private permissioned blockchain would facilitate the intervention of a central authority with the power to oversee the operation of the settlement system and to correct or reverse bad transactions. In this sense, Euroclear (2016) makes the observation that regulators could have a node on the blockchain to propose forks when regulatory intervention is needed, giving regulators the power to compel participants to verify such forks, and to agree with other participants about indemnification of those parties with lack of interest in the reverse of a transaction.

In this sense, the ECB (2017), while assessing DLT-based settlement systems, recognized that they can be designed in multiple different ways and, thus, the appropriate way to discuss regulatory requirements would be based on the question of how should a DLT-based system be designed to accommodate the

applicable regulatory requirements, instead of whether or not they can fulfil the existing requirements for finality of securities settlement. In this sense, the definition of settlement finality in a DLT based system should consider each settlement system level separately. And, in regards of the regulatory requirements for finality of securities settlement, the ECB disregard the question of feasibility of DLT and proposes the discussion about the different designs of DLT technologies adapted for the fulfilment of such requirements related to the moment of entry of transfer orders into the system, the moment of irrevocability of transfer orders and the irrevocability of settlement. DLT systems might vary between a fully decentralized system without a central authority, a partially centralized system in which a central authority certifies ledger updates validated by participants, and even a centralized data-base system based on blockchain. More specifically, ESMA (2019) believes that the current uncertainty regarding the concepts of settlement and settlement finality are related to the distinction between permissioned and permissionless DLTs, considering that, for example, mining and consensus set-ups vary across networks, in other words, the validation of transactions and associated updates of the network might be restricted to permissioned parties (e.g. CSD operating a DLT SSS, DLT SSS specific or all participants), either fully or partially centralized, or unrestricted. The main concern are permissionless DLTs, which seem more problematic in terms of governance, privacy and territoriality. This because the distributed nature of DLTs and the consensus mechanisms to validate transactions and the use of smart contracts in permissionless networks make it difficult to establish responsibilities and liabilities. Also, the role of 'miners' in the settlement process is pointed by ESMA (2019) as another issue once it is not clear how the existing rules apply in this case. They perform activities of verification and validation of transactions that are conditioned to financial incentives and limited to few participants, which can raise problems regarding an eventual suspension of activities that might result in pending transactions, and regarding pricing and competition issues. In addition, forks '*could split away market participants, increase the number of crypto-assets or make some crypto-assets obsolete*'. These affect the suitability for the processing of financial instruments. It is worthy to remember that most security tokens, or DLT transferable securities, such as blockchain-based bonds, rely on permissioned DLTs, in which transactions are

validated through a proof of stake mechanism, in which few parties, or a central authority, have control of the network. Therefore, the related risks and issues are not exacerbated as they are in permissionless networks. More and more, although the pilot regime presents a broad definition of DLT, without a clear distinction between permissioned and permissionless networks, it defines DLT market infrastructures and limits it to DLT MTFs, that admit DLT transferable securities to trading and are operated by an investment firm or a market operator, as well as to DLT SSS, operated by authorized CSDs that can handle the settlement of DLT transferable securities against payment, thus, excluding the possibility of a system without any centralized control.

More and more, according to Euroclear (2016, p. 12), achieving finality '*should not be a challenging obstacle for private, permissioned blockchains, whose protocols and architecture can be designed with the principle of settlement finality in mind*', thus, 'finality requirements should not be inconsistent with the application of DLT to post-trade settlement process'. Thus, it is a misconception that DLT systems cannot offer settlement finality.

In addition, in response to the Commission's mandate the ESAs have assessed the applicability and suitability of the existing financial services regulatory framework to crypto-assets and both EBA (2019) and ESMA (2019) have found that most crypto-assets fall outside the scope of the EU financial services legislation and are not subject to provisions on consumer and investor protection, market integrity and so on. However, for crypto-assets that might fall within the scope of EU legislation the effective application of such is not straightforward. Some provisions of the existing EU framework might inhibit the use of blockchain and overall DLT technologies. Also, the fact that different Member States have legislated on the matter gives rise to market fragmentation[55].

The application of the SFD and the CSDR current regime on blockchain-based systems settlement is uncertain, gaping, inadequate and insufficient to cover all functionalities and risks associated with the use of blockchain technologies in the post-trade of securities tokens. According to the EC (2020)[56], the application of

[55] ESMA, Advice on Initial Coin Offerings and Crypto-Assets, 2019 and EBA report with advice on crypto-assets, 2019.
[56] Question: *What is the Commission proposing and why?*

the existing EU financial services legislation might hamper innovation and the adoption of blockchain/DLT in the financial sector, thus, the potential benefits of this technology. Considering it is the Union's interest to develop and to promote the uptake of blockchain and DLT technologies in the financial sector[57], the referred proposal of a "pilot regime", the proposed Regulation on Distributed Ledger Technology (DLT) Market Infrastructures, to be applied to the infrastructures that trade and settle transactions in financial instruments in crypto-asset form is an important step.

The pilot regime, along with key provisions of the digital finance package, will be addressed in the next chapter, to understand how crypto-assets that qualify as transferable securities will be regulated in the near future and if the new regulatory framework has the potential to promote the adoption of blockchain and DLT systems in the post-trading and settlement in balance with investor protection.

VI. The future of the EU security tokens regulatory framework

6.1. Overview of the Commission's proposal for Regulation on a pilot regime for market infrastructures based on distributed ledger technology

The Digital Finance Package adopted by the European Commission, in September 2020, represents an important step towards regulatory harmonization and legal certainty to support the crypto-assets market by addressing the different nature of existing crypto-assets by distinguishing the types that can be qualified as financial instruments and the ones that cannot, including the proposal of a bespoke regulatory regime for the latter. In addition, by establishing a common definition of key terms for the proper application of the existing and the new legislation, such as the definition of distributed ledger technology, *stablecoins*, DLT market infrastructures, DLT transferable securities and so on.

The Commission recognizes that for those crypto-assets that qualify as financial instruments under MiFID II, some of the provisions of the existing EU financial

[57] Recital 1 of the proposed pilot regime.

services legislation that might apply[58] can "*preclude or limit the use of DLT in the issuance, trading and settlement of crypto-assets*"[59]. Accordingly, the current lack of DLT market infrastructures, in the terms of the EC, as well as the absence of a large scale and liquid crypto-asset secondary market hinders the expansion of the respective primary market[60].

Today, DLT and blockchain protocols, as well as smart contracts underpinning crypto-assets qualified as financial instruments, are not subject to specific requirements regarding transparency, reliability and safety, including novel cyber-risks forms imposed by the new technologies[61]. And, the application of existing legislation requires some flexibility of interpretation, or modifications, to best adept to do a subject that it was not originally part of the scope of such rules for the conventional securities market. According to the EC, at the same time that it is premature to significantly modify the existing legislation in face of the limited use of DLT in financial services, especially in market infrastructures which currently have few projects in operation for the trading and post-trading of the referred crypto-assets, the existing legislation is not adequate for such digital assets and DLT technologies which constraints the development of DLT financial market infrastructures[62]. Thus, after a proper assessment of the impact of possible approaches towards crypto-assets regulation, the Commission has decided to propose a pilot regime for the creation of a DLT market infrastructure, rejecting the option of proposal of targeted amendments to the SFD and the EU framework on financial services to achieve a high degree of legal certainty. This was based on the conclusion that the potential amendments would be limited, as well as the impact to support the uptake of financial instruments in DLT form, once it is soon to identify all regulatory obstacles[63].

The Commission's intention behind a *sandbox* approach, in the form of a pilot regime, is to allow regulators to experiment derogations from existing rules to the use of DLT in market infrastructures in balance with the mitigation of risks to

[58] The Prospectus Regulation, the Transparency Directive, the Market Abuse Regulation, the Short Selling Regulation, the CSDR, and the SFD.
[59] Recital 3 of the proposed pilot regime.
[60] *Ibid*.
[61] Recital 4 of the proposed pilot regime.
[62] Recital 4 of the proposed pilot regime.
[63] Impact assessment of the proposed pilot regime.

investor protection, as well as to allow companies to also experiment how to apply the rules[64].

Thus, the proposed pilot regime aims to enable market infrastructures' development towards potential novel solutions for the trading and post-trading of crypto-assets by allowing temporary exemptions (for a period up to six years) from some specific requirements established by the existing legislation, under a new Union status of DLT market infrastructures, either as a DLT Multilateral Trading Facility – DLT MTF or as a DLT Securities Settlement System – DLT SSS operated by a CSD. This should be in balance with a high level of financial stability, market integrity, transparency and investor protection[65] in order to achieve the proposed regime purposes including general objectives as legal certainty and the support of innovation. For such, the proposed Regulation establishes the operating conditions for the referred DLT market infrastructures, including specific permission requirements, and supervision processes and cooperation with competent authorities and ESMA. Its scope englobes market participants such as investment firms, market operators and CSDs.

Firstly, it is important to note that the pilot regime defines DLT, in the proposed Article 2, as "*a class of technologies which support the distributed recording of encrypted data*"[66]. Considering blockchain is a type of DLT, as addressed in chapter I of this work, it is reasonable to understand that the referred definition must include such technology. Secondly, the pilot regime ratifies key definitions such of transferable securities and of financial instrument as established by MiFID II, as per Articles 2(5) and 2(8). Also, the pilot regime defines DLT MTF, according to the Article 2(3), as a MTF "*operated by an investment firm or a market operator, that only admits to trading DLT transferable securities and that may be permitted, on the basis of transparent, non-discretionary, uniform rules and procedures*.".

Under the pilot regime, DLT market infrastructures[67] are enabled to trade and settle transactions of crypto-assets that qualify as financial instruments, the so-

[64] European Commission, Digital Finance Package, Press Release, September 2020
[65] Recitals 5 and 6 of the proposed pilot regime.
[66] Article 2(1) of the proposed pilot regime.
[67] Article 2(2) of the proposed pilot regime: 'DLT market infrastructure means either a 'DLT multilateral trading facility' or a 'DLT securities settlement system'.

called DLT transferable securities[68]. Those are recognized as DLT multilateral trading facility and DLT securities settlement system operated by CSDs.

In accordance with ESMA (2019), the Commission's definition of DLT MTF applies to trading platforms that facilitate transactions of crypto-assets qualified as transferable securities by offering investment services connecting buyers and sellers, akin to multilateral trading systems. Therefore, DLT MTFs fall under the scope of MiFID II/MiFIR regime.

DLT MTFs might be operated by permissioned investment firms or market operators by request of such eligible participants[69]. These must be subjected to the terms and conditions of the proposed pilot regime, or of the proposed Directive to amend MiFID II among others. Pursuant to the proposal in question, the request should be made under Article 4(2) in case of a DLT MTF, or under Article 5(1), if a DLT SSS, to the competent authority, which is required to consult with ESMA before reaching a decision. In accordance with the proposed Article 7, the request should be justified and present any compensatory measures proposed, in addition to the arrangements to comply with the conditions attached to exemptions[70].

The requirements for such market infrastructure to operate, including authorization and specific permission, are the same under the framework of the MiFID II/MiFIR regime, or any other EU financial services legislation that might be applied with derogations by NCAs, for the use of the new technologies where the existing rules[71] precludes or limits their use, pertaining to the proposed Article 4 and Recital 8[72].

Additionally, not only settlement services might be offered by DLT MTFs, but the activities/services they provide might include the initial recording of DLT transferable securities and the safekeeping of these (including client's funds), as per Article 2(3), letters a, b and c, of the pilot regime. It is true that such

[68] Article 2(5) of the proposed pilot regime: 'DLT transferable securities means 'transferable securities' within the meaning of Article 4(1)(44) (a) and (b) of Directive 2014/65/EU that are issued, recorded, transferred and stored using a DLT.'
[69] Investment firms or market operators for DLT MTFs, and CSDs in case of DLT SSS.
[70] Article 7(g) of the proposed pilot regime.
[71] Recital 11 of the proposed pilot regime.
[72] Detailed provisions of the proposed pilot regime.

services/activities mentioned are normally performed by a CSD, as pointed out in the pilot's regime Recital 9, however, the Commission recognizes that DLT technologies enable the merger of trading and post-trading activities that have been performed by separate market infrastructures so far, and might provide a decentralized version of a CSD role. In such case, DLT MTFs also assume the related responsibilities applied to activities normally performed by CSDs to ensure the integrity of the issues on the distributed ledger, to establish and maintain procedures to ensure the safekeeping of the DLT transferable securities, and to complete the settlement of transactions and to prevent settlement fails, according to Recital 15 and Article 4(2).

Where a DLT MTF record on its own distributed ledger transferable securities that are admitted to trading but are not recorded in a CSD, the proposed pilot regime allows them to require exemptions of the book-entry requirement and the rule of recording of transferable securities admitted to trading with an authorized CSD set by Article 3(2) of Regulation (EU) 909/2014[73], the CSDR[74]. From a functional perspective, it would be redundant to a security trade life cycle to replicate the recording on the distributed ledger by an authorized CSD, obliged to intermediate, once the "*recording of a transferable security and the settlement of related transactions could potentially take place on a distributed ledge*"[75].

Therefore, DLT MTFs may be exempted from the book-entry requirement and the rule of recording transferable securities admitted to trading with an authorized CSD, once the use of DLT technologies is recognized as a method for the initial recording of DLT transferable securities by DLT market infrastructures.

The EC's proposition to enable DLT market infrastructures to safe keep funds, collateral and DLT transferable securities, and the means to access these, including in the form of cryptographic keys, includes the obligation of operators of DLT MTFs and DLT SSSs, for example, to have adequate arrangements to safeguard participants', members', issuers' or client's assets. These include the prohibition of using such assets on their own account other than with the express consent, as well as the segregation of funds, collateral and DLT transferable

[73] Article 2(3) of the CSDR.
[74] Recital 15 of the proposed pilot regime.
[75] *Ibid*.

securities, and the means of access to such assets, from its own assets and from the same assets of other members, participants, issuers or clients. Also, the operator should maintain safe, accurate, reliable and retrievable records of the referred assets and the means of access to these. In addition, IT and cyber arrangements to ensure the protection of assets against fraud, cyber risks, and malfunction[76] must be put in place, as per Recital 31 and Article 6(5) of the proposal. Thus, the pilot regime addresses safekeeping matters, not only at the level of notary function, but also at the investor level of custody/safekeeping function.

The overall IT and cyber arrangements, in the case of safekeeping services, must ensure the funds, collateral and DLT transferable securities and that the means of access to these are protected against unauthorized access, hacking, degradation, loss, cyber-attack or theft. Also, the proposed Article 6(4) and Article 6(5) of the pilot regime addresses novel cyber security risks posed by DLT and establishes additional requirements of adequate IT and cyber arrangements applicable to DLT market infrastructures. For adequate, the pilot regime requires it to be proportionate to the nature scale and complexity of the DLT market infrastructure business, and capable to ensure the continued transparency, availability, reliability, and security of their services and activities, including the reliability of smart contracts, as well as to ensure the integrity and confidentiality of any data stored, and the availability and accessibility of such data. In addition, a specific operational risk procedure for the risks posed by the use of a DLT and crypto-assets and they would be addressed in the case of the event of such risks. More and more, for purposes of security of network and information system to ensure a high level of digital operational resilience, the Commission is also proposing the Regulation on Operational Resilience to be applied to investment firms, CSDs, CCPs, trading venues, and so on, as before mentioned. Thus, it is possible to say that the Digital Finance Package appropriately address the novel cyber security risks related to the use of DLT technologies and also considers

[76] In this context, the Commission is also proposing the Regulation on Operational Resilience to be applied to investment firms, CSDs, CCPs, trading venues, and so on, for purposes of security of network and information system to ensure a high level of digital operational resilience.

minimum reliability and safety requirements regarding DLT specific risks, which goes in alignment with ESMA's advice on the matter (ESMA, 2019).

In addition to the traditional eligible members and participants in an MTF, including investment firms, credit institutions, and others with sufficient level of trading ability, competence, and with adequate organizational arrangements and financial resources[77], a DLT MTF might be exempted from the obligation of intermediation embedded in the referred Directive to provide direct access to retail investors. Such exemption is enabled by the pilot regime along with the proposal of amendment of the MiFID II, where the adequate safeguards in terms of investor protection are in place, and provided that "*such retail investors are fit and proper for anti-money laundering and combatting the financing of terrorism purpose*"[78]. This is especially relevant considering that many crypto-assets trading platforms provide a disintermediated and direct access to individual customers[79]. In this context, the risks and concerns that have been raised by authorities such as ESMA and the ECB, addressed in the previous, seem to have been taken into consideration by the EC, once the referred exemption is conditioned to the provision of adequate safeguards capable to ensure investor protection in addition to the identification and verification of customers that must be fit and proper for the purpose of anti-money laundering and combatting the financing of terrorism. Also, not only the existing rules for MTFs are applied, but also additional requirements laid down in Article 6 in order to guarantee an equivalent level of protection as it is applied to traditional market infrastructures. In accordance with Article 6(2), the operators of DLT MTFs must define the rules for accessing the DLT, in addition to the participation of validating nodes, addressing potential conflicts of interest, and risk management including any mitigation measures.

CSDs operating DLT SSS are also allowed to request an exemption from the notion of participant as set-out by the CSDR to provide to retail investors direct access to settlement and delivery systems, without intermediation through a

[77] For example, investment firms are subjected to capital requirements in accordance with Article 15 MiFID II and Directive 2013/36/EU and Regulation (EU) No 575/2013.
[78] Recital 17 of the proposed pilot regime.
[79] *Ibid*.

credit institution or an investment firm, when identified that they are of sufficient good repute and fit and proper for purposes of anti-money laundering, and that they have sufficient level of ability, competence, experience and knowledge of post-trading and the functioning of DLTs, according to Recital 22.

In the context of additional requirements, the pilot regime addresses general concerns of organizational requirements demanded of DLT market infrastructures, that might be summarized as follow in accordance with Article 6: (i) a clear business plan that details the DLT purposes and use, as well as the legal arrangements put in place[80], providing transparent rules and procedures as it is required from conventional MTFs to ensure fair and orderly trading; (ii) the rules on the functioning of the proprietary DLT including rules to access and admission, rules for the participating nodes and the rules to address potential conflicts of interest, and risk management measures[81]; (iii) clear and unambiguous information, on their website, on the performance of their functions, activities and services, explaining how the type of DLT and how its use is different from the traditional services provided by MTFs or CSDs operating a SSS[82]; (iv) specific and robust IT and cyber arrangements that should be proportionate to the nature, scale and complexity of the DLT market infrastructure's business plan, that should be able to ensure the continued reliability, continuity and security of the services provided, as well as the reliability of potential smart contracts. It should also be established measures capable to ensure the integrity, security, confidentiality, availability and accessibility of data stored on the distributed ledger, especially for audit purposes requested by the competent authority[83]; (v) in case of safekeeping of client's funds services, adequate asset safeguard measures. Such services include the safekeeping of cash or cash equivalent, or DLT transferable securities, or access to these, even in the form of cryptographic keys. The referred arrangements should include the prohibition of using client's assets on own account, the segregation of client's accounts (funds, DLT transferable securities, or access to such) from its own assets or other client's assets. The IT and cyber arrangements adopted by DLT market infrastructures

[80] Recital 27 and Article 6(1) of the proposed pilot regime.
[81] Recital 28 and Article 6(2) of the proposed pilot regime.
[82] Recital 29 and Article 6(3) of the proposed pilot regime.
[83] Recital 30 and Article 6(4) of the proposed pilot regime.

should guarantee the protection of assets against fraud and cyber risks, as well as malfunctions[84]; (vi) a credible exit strategy, in case the regime on DLT market infrastructures should be discontinued, or in case of withdrawn of the specific permission, or exemptions, granted for such[85].

In regards of MiFIR regulatory technical standards on data reporting and pre- and post-trade transparency requirements, it is important to highlight that, the Commission recognized there are gaps in the existing legislation for the application to crypto-assets that qualify as financial instruments and such requirements are not well adapted for such, as stated in Recital 41, of the pilot regime. In this sense, it is established that the provisions of the regulatory technical standards under the Regulation EU No. 600/2014 "*should be capable of being effectively applied to all financial instruments, regardless of the technology use*".[86] Thus, the EC recognizes the competence of ESMA to provide an assessment of such matter in order to propose any amendments to ensure that the MiFIR rules are effectively applied to financial instruments issued on distributed ledger technology.

In terms of DLT transferable securities that can be admitted to trading on, or recorded by, DLT market infrastructures, the proposed Regulation imposes some liquidity limitations of the eligible securities "*to allow innovation and experimentation in a sound regulatory environment while preserving financial stability*"[87]. For this, it sets some value thresholds as the ones described in Article 3(1)(a) and (b), such as a market capitalisation or a tentative market capitalisation of less than EUR 200 million for shares, and an issuance size of less than EUR 500 million for convertible bonds, covered bonds, corporate bonds, other public bonds and other bonds.

In the case of bonds, in order to avoid any risks to financial stability, the proposed Regulation does not admit the trading or record of sovereign bonds by DLT market infrastructures. Also, it is established that the total market value of DLT transferable securities recorded by a CSD operating a DLT SSS, or by a DLT

[84] Recital 31 and Article 6(5) of the proposed pilot regime.
[85] Recital 32 and Article 6(6) of the proposed pilot regime.
[86] Recital 41 of the proposed pilot regime.
[87] Recital 12 of the proposed pilot regime.

MTF, should not exceed EUR 2.5 billion[88]. Furthermore, the proposed Regulation allows NCAs to require reports from DLT market infrastructures to confirm compliance with transferable securities limitations. And, to ensure a level playing field with transferable securities admitted to trading on a traditional trading venue, as well as to ensure a high level of market integrity, the provisions of the Market Abuse Regulation should apply to DLT transferable securities admitted to trading on a DLT MTF.

The exemptions that might be granted to DLT MTFs are conditioned to certain obligations and conditions established by the proposal as an attempt to cover novel risks related to cybersecurity and the use of DLT, and to guarantee equivalent requirements to traditional MTFs. According to Article 4(1)(b), any exemption is conditioned to compliance with Article 4, paragraphs 2 to 4, and with any additional compensatory measures deemed appropriate by the NCA, as well as with additional requirements on DLT market infrastructures set out in Article 6,

Such compensatory measures, in accordance with Article 4(2), must ensure the recording of transferable securities on the digital ledger, along with the integrity[89] of the issue and the possibility of segregation[90] of accounts, as follows.

Article 4(3) foresees a number of procedures and arrangements that might be adopted by a DLT MTF, in order to guarantee, for example, the integrity of issuances on the distributed ledger, the safekeeping of the DLT securities and the confirmation of transactions in DLT transferable securities[91].

Regarding the obligation of DLT MTFs to maintain the integrity of securities issues, the EC recognizes that the use of DLT and smart contracts could simplify some back-office processes, including the reconciliation of data and information[92]. In this context, when a DLT MTF take on the responsibility of

[88] Article 3(2) and 3(3) of the proposed pilot regime.
[89] Meaning that the number of DLT transferable securities recorded on the DLT MTF equals the total number of such DLT transferable securities in circulation on the digital ledger technology at any given time in accordance with Art. 4(2)(b).
[90] Meaning that that the DLT MTF keeps records which enable the investment firm or market operator operating the DLT MTF, without delay at any given time, to segregate the DLT transferable securities of a member, participant, issuer or client from those of any other member, participant, issuer or client.', in accordance with Art. 4(2)(c).
[91] Recital 15 of the proposed pilot regime
[92] Impact assessment of the proposed pilot regime.

recording DLT transferable securities on its own ledger, it must ensure that the number of DLT transferable securities recorded on the DLT MTF equals the total number of such DLT transferable securities in circulation on the digital ledger technology at any given time; and that the DLT MTF keeps records which enable the investment firm or market operator operating the DLT MTF, without delay at any given time, to segregate the DLT transferable securities of a member, participant, issuer or client from those of any other member, participant, issuer or client, according to Article 4(2).

In addition, where DLT MTFs are enabled to provide settlement of DLT transferable securities transactions, in accordance with the letters ‘d’ to ‘g’ of the referred Article 4, they must ensure the settlement finality of DLT transferable securities, along with the delivery versus payment and the prevention of settlement fails. Lastly, as per Article 4(4) the exemption requests to operate a DLT MTF must be proportionate and justified as well as limited to the DLT MTF.

As above mentioned, the operators of DLT MTFs should ensure the disclosure of information on settlement finality, the completion of near-real time settlement of transactions, delivery versus payment, and robust measures to prevent settlement fails. The pilot regime establishes that where an investment firm or a market operator operating a DLT MTF is granted one of the mentioned exemptions, such as from the intermediation by a CSD rule, they must ensure compliance with equivalent requirements to those applying to a CSD, including the disclosure of “*clear, accurate and timely information in relation to the settlement of transactions, including settlement finality, by defining the moment from which transfer orders or other pre-identified instructions may not be revoked by a member, participant, issuer or client*” (Art. 4(3)(c)); and that it “s*ettles transactions in DLT transferable securities close to real time or intraday, and in any case, no later than on the second business day after the conclusion of the trade, and that it ‘ensures delivery versus payment*” (Art. 4(3)(e)).

To ensure the settlement of DLT transferable securities, DvP can be carried out through central bank money where practicable and available or through commercial bank money, as it is in traditional settlement systems. This is also applied in case of DvP in DLT solutions, as confirmed by the pilot regime provisions.

Currently, there are a few projects of digital central bank money in place that might facilitate the possibility to settle the cash leg on the blockchain with central bank money (Euroclear, 2016). However, the Regulation on Markets in Crypto-Assets does not apply to crypto-assets issue by central banks acting in their monetary authority capacity or by other public authorities, neither to services related to such crypto-assets, according to Recital 7 of the proposed Regulation on Markets in Crypto-Assets.

Furthermore, for the purpose of promoting innovation and experimentation of the pilot regime, and to allow cash payments on a distributed ledger, as per Recital 16, the proposed regulation allows DLT MTFs to settle transactions trough commercial bank money in a token-based form, known as *stablecoins*, or in e-money tokens. Both categories of crypto-assets fall under the scope of the proposed Regulation on Markets in Crypto-Assets part of the Digital Finance Package and are defined by such as asset-referenced token[93] and electronic money token[94] respectively.

The challenges related to the potential benefits of DLT adoption in DvP settlement of securities transactions, and the necessity to achieve harmonization and interoperability among DLT solutions, seem to be recognized by the EC that, when considering the interoperability between market infrastructures, DLT MTFs or DLT SSSs, has proposed some flexibility for such activity in the sense that the pilot regime foresees the possibility of CSDs be exempted from the rule of access between CSDs through standard links[95] established by Art. 50 of CSDR, and the rule of access between a CSD and another market infrastructure (traditionally, a

[93] Proposal on a Regulation on Markets in Crypto-Assets, Article 3(3). 'asset-referenced token' means a type of crypto-asset that purports to maintain a stable value by referring to the value of several fiat currencies that are legal tender, one or several commodities or one or several crypto-assets, or a combination of such assets;

[94] Proposal on a Regulation on Markets in Crypto-Assets, Article 3(4). 'electronic money token' or 'e-money token' means a type of crypto-asset the main purpose of which is to be used as a means of exchange and that purports to maintain a stable value by referring to the value of a fiat currency that is legal tender'

[95] Art. 2(29) of the CSDR. 'CSD link' means an arrangement between CSDs whereby one CSD becomes a participant in the securities settlement system of another CSD in order to facilitate the transfer of securities from the participants of the latter CSD to the participants of the former CSD or an arrangement whereby a CSD accesses another CSD indirectly via an intermediary. CSD links include standard links, customised links, indirect links, and interoperable links.

CCP and trading venues) established by Art. 53 of the CSDR, according to Article 5(6), in case of incompatibility between CSDs systems or disproportionate costs.

In this regard, the proposed pilot regime establishes that DLT MTFs have the obligation to limit counterparty risk when using commercial bank money for cash payments (including *stablecoins* and e-money tokens) by ensuring adherence by the credit institutions used for the settlement to strict criteria such as their regulation and supervision, creditworthiness, capitalisation, access to liquidity and operational reliability[96]. And, as per Article 4(3)(g), a market operator or an investment firm operating a DLT MTF must ensure arrangements that either prevents or, if not possible, addresses settlement fails.

Where DLT transferable securities are neither recorded in book-entry in a CSD, nor on the distributed ledger of a DLT MTF, they should be recorded by a CSD operating a DLT SSS. While DLT SSS is defined in accordance with Article 2(4), as "*a securities settlement system, operated by a 'central securities depository', that settle transactions in DLT transferable securities against payment.*'

The definitions of CSD, settlement, business day and delivery versus payment, as per the proposed Regulation, refers to Regulation (EU) No 909/2014, the CSDR, in the proposed Articles 2(7), 2(9), 2(10) and 2(11). Regarding the authorization of a CSD operating a DLT SSS, the pilot regime also refers to the requirements established by the CSDR and its provisions regarding specific permissions, according to the proposed Article 5. However, the proposed Regulation allows NCAs to grant exemptions in the case of SSS as well.

The proposed Article 5, in the same context of before mentioned Article 4, lists the exemptions that might be granted by the NCA on a temporary basis if the conditions of Article 5, paragraphs 2 to 7 are met, and those additional requirements of Article 6 are fulfilled, in order to eliminate regulatory obstacles[97].

According to Article 5(2) and Recital 20, CSDs operating a DLT SSS might be exempted from some definitions of the CSDR, such as the notion of 'dematerialised form', 'transfer orders', and 'security account', including provisions that refer to the latter such as the rules on the recording of securities,

[96] Recital 16 of the proposed pilot regime.
[97] Recital 19 of the proposed pilot regime.

integrity of issue or segregation of accounts, when necessary to record DLT transferable securities on a distributed ledger and when there are regulatory obstacles. In the same context, they should also be exempted from the rules related to the notion of 'securities account' or 'book-entry form'. However, for such exemption the CSD must fulfil the requirements set by letters 'a' to 'e' of the same Article, including the demonstration of incompatibility with the use of the DLT with the use of book-entry form or the use of a securities account, the proposition of compensatory measures to meet the objectives pursued by the provisions from which an exemption is requested, such as the recording of the DLT transferable securities on the distributed ledger, the integrity of the issuance of the DLT transferable securities, and the segregation of such assets.

The following paragraph 3 establishes the possibility of exemption from the outsourcing requirements under Articles 19 and 30 of the CSDR in order to allow CSDs operating a DLT SSS to develop a business plan of shared responsibility of "*running its distributed ledger on which the transferable securities are recorded with other entities, including with its participants*"[98], if demonstrated that the referred provisions are incompatible with such activity and that the minimum requirements on outsourcing are complied with. When this exemption is granted, the paragraph 8 rules that "*the requirement in Article 39(1) of Regulation (EU) No 909/2014/EU for Member States to designate and notify the securities settlement system operated by the CSD in accordance with Directive 98/26/EC shall not apply to the DLT securities settlement system*.".

In paragraph 4, the proposed pilot regime describes the exemption from the obligation of intermediation under Article 2(19) of the CSDR as well as from the notion of participant, opening the permission to admit as participants natural and legal persons other than those referred in that Article, when such persons "*are of sufficient good repute and are fit and proper"*[99], and "*have sufficient level of ability, competence, experience and knowledge of the post-trading and the functioning of DLT"*[100].

[98] Recital 21 of the proposed pilot regime.
[99] Article 5(4)(a), of the proposed pilot regime.
[100] Article 5(4)(b), of the proposed pilot regime.

Pursuant to paragraph 5, a CSD operating a DLT SSS might be exempted from the application of Article 40 of the CSDR on cash settlement, if delivery versus payment is ensured, once it would be difficult for a CSD to operate movements in cash accounts and securities accounts on the DLT at the same time[101]. It allows the settlement of payment through central bank money or through commercial bank money (including those in a token-based form or in e-money tokens[102]), where the latter is not practicable and available.

The paragraph 6 foresees the exemption from Articles 50 and/or Article 53 of the CSDR on standard link access between a CSD/market infrastructure, when the use of DLT is incompatible with legacy systems of other CSDs, making it difficult an attempt of interoperability between them, or if such would be conditioned to disproportionate costs, considering the size of the DLT SSS. However, as per paragraph 7 "*where a CSD operating a DLT securities settlement system has requested an exemption in accordance with the first sub-paragraph, it shall give access to other CSDs operating a DLT securities settlement system or to DLT MTFs*.".

In regards of supervisory matters, the proposed Article 9 establishes measures of cooperation between market infrastructures, competent authorities and ESMA, which includes the obligation to share any information about the DLT business plan and practice, cyber threats or attacks, fraud or serious malpractice, changes in the information provided at the time of the initial exemption request, as well as of any technical difficulties, and in particular those linked to the use of DLT, and of any new risks to investor protection, market integrity and financial stability that was not envisaged at the time where the specific permission was granted. The competent authority might require a new application for permission or exemption or recommend corrective measures. Competent authorities and ESMA might request any relevant data. In addition, it is set the obligation of DLT market infrastructures to provide regular reports from DLT market infrastructures to their competent authorities and ESMA.

[101] Recital 24, of the proposed pilot regime

[102] In this case, "...*the investment firm or market operator operating the DLT MTF shall identify, measure, monitor, manage, and minimise any counterparty risk arising from the use of such money"*, as per Article 5(5) of the proposed pilot regime.

The pilot regime does not address internalised settlement, which does not take place in a securities settlement system, when performed through a systematic internaliser regime in OTC transactions. It does address the application of existing legislation for security tokens that qualify as financial instruments, but the expectation of clarification on the regulation of the use of blockchain in the internalized settlement is frustrated.

After the experimentation period of five years set by the EC for the pilot regime, ESMA shall report to the Commission with the assessment of the potential benefits of DLT, as well as of the risks and technical difficulties, according to Recital 40 and Article 10. The Commission will report to the Council and the European Parliament with its own assessment of the future possibilities of the proposed regulation, considering the extension for another period of time, as well as the extension to new categories of financial instruments, the possibility of amendment and making the regime permanent, target amendments to EU legislation, and the possible termination of the regime (Linklaters, 2020). Pursuant to Article 10(2), in such report the Commission might propose changes to the Union framework on financial services legislation when considered necessary to facilitate the use and implementation of DLT in the financial sector.

The Commission's objective is to have the Digital Finance Package and its three regulations in effect by 2024, after the legislative procedure is complete.

From the present assessment of the Commission's proposed pilot regime, it is reasonable to expect from such regulatory approach more legal clarity and harmonization of the European regulatory scenario in the securities tokens market, however, only with the results of the implementation of the pilot period it will be possible to confirm today's expectations.

VII. Conclusion

Beyond Bitcoin and cryptocurrencies, blockchain and DLT technologies implementation in financial services could, theoretically, disrupt the primary and secondary financial markets in a positive way, from issuance to trading, and settlement of assets digitally represented, or tokenized. More specifically, blockchain and the application of smart contracts built into it could have a relevant impact in post-trading of securities, including operational processes and

regulatory requirements. The referred technology is at an early stage of development and its limited application in the securities market infrastructure still does not provide firm evidence capable to support such speculations, what would be confirmed as we continuously surpass today's technological challenges in the near future and beyond.

With the wide adoption and interoperability of blockchain and DLT technologies, securities trading and settlement processes could be simpler, less costly, faster, more standardized and transparent, and less risky. Tokenization, in addition to the deployment of smart contracts, might have the power to streamline operations by merging trading, clearing and settlement in one single process through the upgrade of infrastructures. Trading of tokenized assets facilitated by blockchain networks could expand and include more market participants, including retail investors, that could result in the widespread trading of DLT transferable securities. Digitalization and automation would reduce the current workload with paper documentation and manual work. Also, the transparency of ownership that could reduce the need for collateral and free-up capital, corroborating the decrease in costs. In addition, tokenization could facilitate cross-border transactions and enable instant, or near-real time delivery versus payment settlement, with less intermediaries, overcoming interoperability issues, reducing the need for data reconciliation. While it can provide settlement flexibility with encoded schedules and permissions to netting and reverse transactions in the network. Thus, operational burdens and costs can be reduced and, consequently, increase market liquidity.

The use of blockchain could be particularly interesting in a market open to modernization, such as the European bonds market, characterized by the illiquidity and heterogeneity of the available financial products, in which there is a predominant lack of centralization and standardization, in comparison to equities markets. And, which after the 2008 financial crisis, has been presenting opportunities for infrastructural changes followed by adaptation efforts of market participants.

Take as an example the post-trading scenario in the European corporate bonds market which is limited in terms of transparency, efficiency and liquidity. Due to the reliance on highly manual-based labour to address the current workload in

this market, and also by the multitude of intermediaries and lack of integration between market participants, the clearing and settlement in such markets are negatively impacted by inefficiencies of data reconciliation, increased risks related to settlement failure and manual work, as well as increased operational costs, costly and lengthy settlement cycles. The possibility of optimization of post-trade processes, in addition to the prospect of the widespread trading of corporate bonds and increase of market liquidity, are key to support the believe that the development of blockchain or DLT-based market infrastructures to enable trading and settlement of blockchain-based bonds has considerable potential as a means to achieve greater market transparency, liquidity and overall efficiency. This might be true even when potential costs of the necessary investment in technology for blockchain implementation are considered, in a scenario where any marginal increase in the cost of the bond should be off-set by the increasing liquidity of the market.

Some pilot cases of blockchain-based bonds are being developed and implemented in limited amounts and/or within narrow scopes, as demonstrated and mentioned on this paper. However, until widespread implementation of these technologies in the corporate bonds market, we will likely not be able to identify and measure the potential benefits to the market as described in the preceding paragraph.

Today, the limited use of DLT-based systems in trading and settlement in the European regulated financial markets, other than technological and operational limitations, is most likely due to inadequate regulation. Considering blockchain-based bonds may qualify as transferable securities under MiFID II, the application of key existing European securities legislation (e.g., concerning trading and settlement, such as the MiFID II/MiFIR regime, the SFD and the CSDR) is not suitable for the particularities of the crypto-assets market, thus constraining the adoption and development of potential post-trading innovative solutions. At the same time, the lack of a proper regulation framework leaves investor and market participants vulnerable to the novel and increased risks related to securities tokens trading. Therefore, as long as confidence in the crypto-assets market is not generated by measures of consumer and investors protection applied at the

same level as traditional markets, the development of the crypto-secondary market will remain limited.

In this context, the Digital Finance Package adopted by the European Commission, in September 2020, represents a necessary and important regulatory step towards an innovative market in balance with investor protection and financial stability. More specifically, the Commission's proposal for a regulation on a pilot regime for market infrastructures based on distributed ledger, established as DLT MTFs and SSSs operated by CSDs, not only validates the relevance of the use of DLT technologies, including blockchain, for trading and settlement of DLT transferable securities, but also, addresses important existing gaps and issues in the application of existing securities rules, allowing derogations from certain provisions of MiFID II and CSDR that impede the development of DLT market infrastructures solutions, in addition to the implementation of additional requirements, in view of its operational peculiarities and associated risks.

Under the exceptions that might be granted in accordance with the pilot regime, DLT Multilateral Trading Facilities, operated by market operators or investment firms, will be able to admit to trading DLT transferable securities that are not recorded in a CSD, ensuring their initial recording on the DLT MTF distributed ledger, providing custody and settlement arrangements. In such case, the merger of trading and settlement activities enabled by DLT solutions will enable such trading platforms to integrate the role of a CSD, being subject to requirements similar to those applied to traditional market infrastructures in accordance with the CSDR. For example, assuming the obligation to ensure the integrity of the issues on the distributed ledger and the segregation of client's accounts, and settlement arrangements, including settlement finality, near-real time delivery versus payment settlement of transactions, as well as adequate measures to prevent settlement failures. In addition to the Commission's proposal to amend certain MiFID II provisions, DLT MTFs will be allowed to grant direct access to retail investors, conditioned to arrangements of investor protection and KYC and AML/CTF safeguards.

The Commission's proposal also gives the option to market infrastructures to assume the status of DLT SSS operated by CSDs, to record and settle DLT

transferable securities against payment, where they are not recorded in a CSD, nor in a DLT MTF distributed ledger. CSD operating a DLT SSS might perform the validation of new transactions and accounts updates, and depending on its business plan, might even outsource part of such settlement services to third parties, maybe by authorized participants in an DLT SSS. The exemption from intermediation is also applied in this case and they are allowed to admit individual participants in a settlement system. Also, a CSD might be allowed to provide cash settlement through central bank money or through commercial *stablecoins* or e-money tokens, that will be subject to the other proposed Markets in Crypto-Assets Regulation. Lastly, CSDs should allow access to other CSDs operating a DLT SSS or to DLT MTFs, and should be exempted from link obligations when it demonstrates incompatibility with other legacy systems or when an eventual attempt of interoperability would require disproportionate costs.

The referred exemptions that might be granted to DLT market infrastructures are conditioned to the compliance of specific additional requirements embedded in the pilot regime in order to cover novel risks related to privacy, cyber-security and custody arrangements. In addition, the Commission has also proposed a Regulation on Operational Resilience that will be applied to investment firms and market infrastructures.

It should be taken into consideration that we are dealing with an ideal hypothesis of transactions executed and settled through a single ledger, a single source of truth, maintained through the cooperation of the relevant network participants. Thus, it should be noted that the potential and relevant risks addressed in this work must not be ignored, including the need for interoperability of systems in the settlement process. In accordance with the Commission's proposal, the operators of DLT market infrastructures should establish and maintain the necessary arrangements to prevent, or resolve, risks related to their custody and settlement services. It should also be considered that additional specific measures may be necessary to cover the operational risks associated with a scenario in which cross-ledger settlement prevails, as mentioned throughout this paper.

The eligible DLT transferable securities that may be admitted to trading on a DLT MTF and recorded on a DLT SSS operated by a CSD, under the proposed

regime, will be restricted, in case of corporate bonds, to an issuance size of less than EUR 500 million, and sovereign bonds will not be permitted.

Although it is too soon to assert what will be the real benefits and costs of such regulatory approach, the Commission's proposed pilot regime might radically transform the current securities tokens market by contributing to the education and gain of experience of the industry, and the society, and by promoting the legal certainty and harmonization across jurisdictions, and specially by helping to encourage as well as to build confidence of investors to participate in trading, increasing the secondary market liquidity.

In the corporate bonds market, the impact of a regulated security tokens market might be significant. Regarding market infrastructures, breaking regulatory barriers to the development of trading and post-trading DLT solutions can contribute to the modernization, standardization, and integration of the market structure, bringing all those benefits mentioned. In this case, especially the benefits related to the opening of the market to a broader range of investors, including retail investors, who might take the opportunity to diversify their investments through innovative instruments supported by the potential for automation and streamlining of transaction and settlement processes, with possible reduced costs, and reduced risks (e.g., reduced counterparty risk and mitigated cyber-risks). More participation in a resilient and safe secondary market would bring more liquidity and efficiency gains that could positively reflect in the expansion of the primary market in a sustainable way. Also, beneficiating European companies with the opportunity of access to an innovative source of financing. Not to mention more experience and competitiveness for European financial services.

Although the pilot regime's scope includes, specifically, DLT market infrastructures defined as DLT MTFs and DLT SSS operated by CSDs, financial market infrastructures not qualified under such statuses should also be motivated to develop innovative DLT solutions for security tokens qualified as financial instruments, under the existing legislation. In the case of OTC market infrastructures, and systematic internalisers, that strongly supports corporate bonds transactions, the Commission's Digital Finance Package might also impact post-trading, considering that a regulated blockchain or DLT structure for trading

and settlement of securities tokens could serve as a foundation for off-exchange alternative practices, which will then likely evolve in novel ways in such a less regulated market. Also, although there is no expectation of a bespoke regulation in this area, it would be reasonable to expect guidance from the competent and relevant regulatory authorities focused, for example, on a blockchain internalised settlement, in accordance with MiFID II and the CSDR.

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SFD: Directive 98/26/EC of the European Parliament and of the Council of 19 May 1998 on settlement finality in payment and securities settlement systems.

Annex 1

Between 2017 and 2018, the first tests and prototypes of blockchain technologies for the issuance of bonds on the primary market have taken place across the world by the work of research and development of private companies, investment banks, FinTechs and governments. For example, government bonds have been issued directly on permissioned blockchain platforms as the case of the Austrian government which has assigned the bank OeKB to notarize the auction of a sovereign bond[103]. Most recently, the Bank of Thailand has launched a government bond infrastructure using blockchain, the DLT Scripless Bond Project[104]. In 2018, the World Bank in partnership with the Commonwealth Bank of Australia (CBA), the RBC Capital Markets (RBC) and TD Securities (TD) have issued 110 million Australian Dollars in bonds on a blockchain platform built and developed on a private version of Ethereum by the CBA Blockchain Centre of Excellence, housed in the Sydney Innovation Lab., the *bond-i*[105]. In May 2019, the bank has enabled the secondary market trading of *bond-i*, representing its first digital bond issued and traded on blockchain[106]. Also in 2019, the Bank of China has issued a 20-billion-yuan bond on BoC's own blockchain platform[107], targeting small and medium enterprises, having achieved the milestone of being the first blockchain-based bond in China. Societé Generale has issued a 112 million dollars covered bond on the public Ethereum by its technology provider SG Forge[108]. The bank was the sole investor as the issuance involved no outside investors. The Singapore Exchange – SGX has also issued a bond on

[103] https://www.coindesk.com/austrian-government-to-notarize-1-3-billion-bond-auction-using-ethereum .
[104] https://fintechnews.sg/43727/thailand/thailands-central-bank-issues-government-bonds-on-blockchain/ .
[105]https://www.worldbank.org/en/news/press-release/2018/08/09/world-bank-mandates-commonwealth-bank-of-australia-for-worlds-first-blockchain-bond .
[106] https://www.worldbank.org/en/news/press-release/2019/08/16/world-bank-issues-second-tranche-of-blockchain-bond-via-bond-i and https://www.worldbank.org/en/news/press-release/2019/05/15/world-bank-and-cba-partner-to-enable-secondary-bond-trading-recorded-on-blockchain.
[107] https://www.coindesk.com/bank-of-china-issues-2-8b-in-bonds-for-small-businesses-using-blockchain-tech .
[108] https://www.coindesk.com/french-lender-societe-generale-issues-112-million-bond-on-ethereum.

blockchain[109]. Amongst such examples, the Banco Santander (2019) case[110] deserves attention. The Spanish bank has issued a plain vanilla bond worth 20 million euros on the Ethereum public blockchain with the assistance of the FinTech Nivaura to digitalize the issuance of the bond using a smart contract. There were no outside investors involved, as the target was the bank itself. Banco Santander (2020) was the first bank to use a public blockchain to issue, manage and settle a bond on both sides using blockchain for the delivery of securities and the cash payment. This was possible through the tokenization of both cash and bonds. In fact, as it will be further discussed, such crypto-assets are financial instruments similar to bonds issued in the form of security tokens.

[109] https://cointelegraph.com/news/singapore-exchange-uses-blockchain-to-issue-300m-digital-bond.
[110] https://www.santander.com/en/press-room/press-releases/santander-launches-the-first-end-to-end-blockchain-bond.

Annex 2

Countries like Germany, France, Luxembourg, Lithuania, Switzerland, Liechtenstein and Malta have taken relevant regulatory steps towards an adequate regulation. In 2017, France has adopted the Blockchain Ordinances n. 2017-1674 du 8 décembre 2017 and the Sapin II Law n. 2016.1691 du 9 décembre 2016, to enable the registration and transfer of unlisted blockchain securities[111]. In 2019, France has introduced the PACTE law[112] that establishes a regime for ICOs and crypto-assets service providers, limited to crypto-assets that do not qualify as financial instruments under the EU law. Germany has implemented a crypto-assets and crypto-custody legislation in addition to a proposal for a bill on electronic securities[113]. Luxembourg has enacted the Bill of Law 7637 amending the legal framework for dematerialised securities, including DLT technologies[114]. Switzerland presented its Blockchain Law in 2020 legitimizing securities tokens as a new class of asset[115]. Lithuania has established guidelines on ICOs and STOs clarifying that digital tokens understood as financial instruments shall fall under national and the EU regulatory framework[116]. Liechtenstein has adopted the Blockchain Act, a framework that covers all applications of the token economy[117]. Malta has formulated a specific regulatory framework with three legal acts: The Malta Digital Innovation Act, the Innovative Technology Arrangements and Services Act and the Virtual Financial Assets Act.

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[111] https://www.linklaters.com/-/media/files/insights/2017/december/2017_december_18_blockchain_france.ashx?rev=9bd9f4b2-96e7-4209-aec0-18fd75390107&la=en&hash=9286966EB64C49FD52FAD29D7836452A51E446E8 .

[112] https://www.dlapiper.com/en/us/insights/publications/2020/04/finance-and-markets-global-insight-issue-18/france-introduces-an-innovative-legal-framework-for-digital-assets/ .

[113] https://www.linklaters.com/pt-pt/insights/publications/2020/august/draft-electronic-securities-act-paves-the-way-for-dlt-based-securities-in-germany .

[114] https://www.allenovery.com/en-gb/global/news-and-insights/publications/luxembourgs-legal-framework-has-just-been-amended-to-recognise-the-use-of-dlt-for-issuing-and-settling-dematerialised-securities .

[115] https://www.coindesk.com/switzerland-tokenized-securities-law-new-chapter-seba-sygnum-six-sdx .

[116] https://www.lb.lt/en/news/bank-of-lithuania-provides-recommendations-on-raising-capital-through-stos .

[117] https://ico.li/liechtenstein-adopts-blockchain-act/ .