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THE LAW OF ALGORITHMIC STABLECOINS IN THE EU

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The Law of Algorithmic Stablecoins in the EU

Edoardo D Martino[*] and Yannick Roos LLM[†]

ABSTRACT

Algorithmic stablecoins are a specific subset of stablecoins employing algorithmic adjustments of supply and demand as the key stabilization mechanism. In the pursuit towards a fully decentralised means of payment, detached from collateral and solely stabilised by smart contracts and algorithms, algorithmic stablecoins pose unique risks and challenges due to their complex construction.

This contribution explores the approach that is currently taken by regulators through exposing the unique risks posed by algorithmic stablecoins and arguing that these risks require a supplementary regulatory approach alongside existing proposals for regulation. We justify this by showing the complexity and diversity of fully algorithmic protocols and reveal where the dangers of these protocols originate.

The article reviews the European Union's Markets in Crypto-Assets Regulation (MiCAR) and determines its limited applicability to algorithmic stablecoins through general provision and crypto asset service providers. It briefly considers an international comparison by exploring different regulatory proposals from outside the EU with the aim to draw lessons to better assess MiCAR effectiveness.

We conclude that MiCAR, despite being the most advanced and encompassing legislation in the area of crypto activities, does not target the specific risks of algorithmic stablecoins. Moreover, it creates a complex and ambiguous system with regards to the provisions applicable to algorithmic stablecoins and puts forward rules that are difficult to adapt or update via secondary legislation leaving room for further exploration of the regulatory framework to ensure safety and stability.

Key words: Algorithmic stablecoins, MiCAR, financial stability, digital currency, crypto asset

JEL Classification: G23; G28; K23

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1. Introduction

Stablecoins are crypto assets that purport to maintain a stable value.[1] These are gaining more and more centrality in the crypto ecosystem providing stability, liquidity and accessibility.[2] In turn, it is essential that the risks stemming from them are addressed by regulation.[3]

Stablecoins have received a great deal of regulatory attention in the past years. However, as we will show, the regulatory discourse has revolved around collateralised stablecoins, i.e.: stablecoins whose stabilization mechanism relies on the quality and quantity of collateral assets. Yet, these are not the only form of stablecoins devised by the market. In fact, another potential stabilization mechanism is represented by an algorithm altering the supply of stablecoins in response to changes in demand. These are called algorithmic stablecoins.[4]

Algorithmic stablecoins are, for now, less accepted by the market and characterised by distinctive features and a particular design which requires a distinctive analytical and regulatory approach. On the contrary, the current regulation or regulatory proposals almost exclusively address collateralised stablecoins. This being the case, the article investigates the law applicable to algorithmic stablecoins, mainly considering the most advanced crypto legislation worldwide – the European Union's (EU) Market in Crypto Asset Regulation (MiCAR).[5]

Stablecoins, 'that gain widespread acceptance,' have been labelled as 'the holy grail of crypto.'[6] In turn, algorithmic stablecoins take the ideology of decentralisation a step further and could therefore be considered even more divine and pure in the view of crypto proponents.[7] Due to their characteristics, algorithmic stablecoins — should such technology become scalable — have the potential to bring forth unique risks that could become a serious hazard to financial stability,

[1] Financial Stability Board, Regulation, *Supervision and Oversight of "Global Stablecoin" Arrangements - Final Report and High-Level Recommendations* (2020), 5.

[2] Craig Calcaterra, Wulf A. Kaal, & Vadhindran Rao "Stable cryptocurrencies: First order principles" (2020) *Stan. J. Blockchain L. & Pol'y*, *3* at 62-64.

[3] On the necessity of public regulation to unleash the potential of blockchain applications, see Edoardo D. Martino, W. Georg Ringe. "The Social Cost of Blockchain: Externalities, Allocation of Property Rights, and the Role of the Law" (2024) ILE Working Paper 80 at 21.

[4] In short, algorithmic stablecoins are programmed with open-source code and mechanisms which are transparent and fully auditable, offering the prospect of decentralisation, while alleviating the need for them to be backed by tangible assets which need to be audited (as is needed with their counterpart, the collateralised stablecoin) which in theory would allow them to be fully decentralised.

[5] Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets. OJ L 150, 40.

[6] Richard Senner & Didier Sornette, "The holy grail of crypto currencies: ready to replace fiat money?" (2019) *53*:4 *Journal of Economic Issues* 966 at 11.

[7] *Ibid*.

investor protection and market efficiency. We intend to investigate such risk and assess if the current regulatory approaches are apt to the challenge.

This article proceeds as follows. Section 2 starts by elucidating what algorithmic stablecoins are, in which ways they are different from other types of stablecoins and explores the unique risks posed by algorithmic stablecoins. Section 3 looks at the recently approved, and currently most advanced regulation of crypto assets, the EU's MiCAR, assessing the applicable regulatory regime to algorithmic stablecoins. Section 4 provides a brief comparative overview, looking at the regulatory approaches in the United States (US) and the United Kingdom (UK) and shows that no specific regulatory approach to algorithmic stablecoins is designed in these jurisdictions, perpetrating the problems highlighted for MiCAR. Section 5 discusses the findings and proposes some possible ways forward. Section 6 concludes.

2. Characteristics and Aspirations of Algorithmic Stablecoins in the Crypto Market

This section explains how algorithmic stablecoins function differently from collateralised stablecoins and the risks that are a result of this difference. It shows that the development of algorithmic stablecoins, supported by the underlying technology, has the potential to become a source of vulnerability in the financial ecosystem that is serious enough to require a specific body of regulation to be developed. Fully understanding the mechanisms governing the algorithmic stablecoin protocol is a necessary precondition to designing an appropriate and effective regulatory framework.[8] [9]

(a) From Cryptocurrencies to Collateralised Stablecoins

The origins of stablecoins can be found in a currently fast-growing movement started with the Bitcoin White paper — and the subsequent advancements in decentralised technologies afterwards.[10] This movement considers a decentralised design of the monetary system as more desirable than the current — highly centralised — design.[11] The Bitcoin protocol introduced the concept of a decentralised, peer-to-peer digital currency, in principle free from the control of

[8] A protocol is a set of rules that help define how users send and receive information on a specific network and can refer to a specific project on the blockchain. It is the foundational layer of code that sets up the framework for all activity in said protocol.

[9] Gordon Y. Liao & John Caramichael, "Stablecoins: Growth potential and impact on banking" (2022) International Finance Discussion Papers 1334. Washington: Board of Governors of the Federal Reserve System.

[10] Satoshi Nakamoto, "Bitcoin: A peer-to-peer electronic cash system" (2008), online (pdf): *Bitcoin:<https://bitcoin. org/bitcoin. pdf>*, 4(2) at 15.

[11] For a critique on financial decentralisation, see Aramonte, S., Huang, W., & Schrimpf, A., "DeFi risks and the decentralisation illusion." (2021) BIS Quarterly Review 21.

central authorities. Its underlying blockchain technology enabled transparent and secure transactions, inspiring a wave of innovation. However, Bitcoin faced a critical challenge: price volatility. This is where stablecoins, or algorithmic stablecoins, would enter the picture.

A stablecoin can be defined as a "digital unit of value that is not a form of any specific currency (or basket thereof) but is rather relying on a set of stabilisation tools, trying to minimise fluctuations in the price of the currency."[12]

This definition allows the distinction between different types of stablecoins to be dependent on different factors such as tools used for stabilisation, issuance/redeemability mechanisms, transparency, reliability and volatility.[13] The following paragraphs focus on the differences between algorithmic stablecoins and collateralised stablecoins.[14]

The most prominent distinction between an algorithmic stablecoin and a collateralised stablecoin is the stabilization mechanism. Looking at which stablecoins are more generally accepted by the market, for instance in terms of market capitalisation, it becomes clear that collateralised stablecoin protocols currently dominate the market. In these protocols, users deposit funds and in return they get the stablecoins for an equivalent value. Short of specific regulatory requirements for the use of reserves, the stablecoin issuer can invest, lend or pledge such funds which represent the collateral stabilizing the value of the stablecoin

Stablecoins can be collateralised either by on-chain or off-chain assets. Off-chain collateralised stablecoins offer a relatively high degree of certainty given that they are often collateralised with bank deposits or other cash-like assets.[15] The fact that these assets are not kept 'on the blockchain' makes them less susceptible to on-chain market movements and thus more certain. These benefits however are arguably achieved at a 'cost.' The dependency on centralised (fiat) collateral and the centralised nature of the dominant issuers (e.g.: USD Coin and USD Tether) appears antithetical to the belief in full decentralisation that is claimed to be inherent to crypto. These 'centralised' assets or currencies are mainly subject to

[12] Dirk Bullmann, Jonas Klemm, & Andrea Pinna, "In search for stability in crypto-assets: are stablecoins the solution?" (2019) ECB Occasional Paper Series No. 230 at 3. Four types of stablecoins are defined using this definition. A tokenised fund stablecoin, an on-chain collateralised stablecoins, an off-chain collateralised stablecoins and algorithmic stablecoins.

[13] Issuance and redemption in the case of collateralized stablecoins refers to the process of receiving a stablecoin as an investor in exchange for funds transferred to the issuer and vice versa in terms of redemption.

[14] A collateralized stablecoin is a type of cryptocurrency designed to maintain a stable value by being backed by (or possibly referencing the value of) reserve assets that can vary between fiat currencies or other types of cryptocurrencies.

[15] Baughman, G. et al., "The stable in stablecoins" (2022), online: <https://www.federalreserve.gov/econres/notes/feds-notes/the-stable-in-stablecoins-20221216.html>.

volatility in value themselves and a level of trust in the custodian of these assets or currency is an innate part of this design.[16]

On-chain over-collateralised stablecoins are closer to the 'holy grail' pursued by crypto proponents, as it gives a form of certainty and transparency regarding the amount of collateral and the type of collateral. In turn, this should make the protocol more trustworthy without the need of any centralised actor. However, the same dependency on possibly volatile assets can be identified along with a lack of transparency with regards to off-chain collateralised stablecoins. None of the other types of stablecoin are thus able to provide a means of exchange conformant to the crypto ideology. This is the point where the quest for the holy grail of crypto comes in.

(b) Algorithmic Stablecoins

Algorithmic stablecoins are intuitively even closer to the 'holy grail of crypto' in terms of independence from centralised authorities. In theory, algorithmic stablecoins should not need collateral for their stabilisation mechanisms to function,[17] and are therefore not subject to its (price) volatility and the custodial risk of central authorities.

Algorithmic stablecoin protocols receive funds that are used for other purposes but are not of primary importance for the functioning of the protocol.[18] This implies that the stabilization mechanism does not rely on a specific centralised authority or an authority external to the protocol, but on the decentralised expectations of the future purchasing power of the stablecoin.

By way of comparison, collateralised stablecoins depend on either a 1:1 collateralization with off-chain assets or an over-collateralised design with on-chain tokens. On the contrary, an algorithmic stablecoin solely relies on a set of automated smart contracts adjusting demand and supply complemented by a less than 1:1 — i.e.: fractional — backing to maintain a peg. [19] [20] [21]

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[16] Maxwell Murialdo & Jonathan L. Belof, "Can a Stablecoin Be Collateralised by a Fully Decentralised, Physical Asset?" (2022) 2:1 Cryptoeconomic Systems at 4-5.

[17] Hanna Kołodziejczyk & Klaudia Jarno, "Stablecoin–the stable cryptocurrency" (2020), online (pdf): *Regional Excellence Initiative 2019–2022* <https://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.ojs-doi-10_31268_StudiaBAS_2020_26/c/articles-2895475.pdf.pdf> at 161.

[18] Received funds or assets can be maintained as reserves to be used as a possible secondary stabilization mechanism but are not representing the value of the issued stablecoins (which is the case with tokenized and collateralized stablecoins).

[19] In an overcollateralized design the amount of collateral kept by the issuer exceeds the amount of outstanding stablecoin.

[20] A peg is linking the value of a digital asset to the value of another asset or currency in the aim to stabilise the first assets value.

[21] Morris, D. Z., "Paying the iron price: Fractional Reserve banking on a blockchain." Coindesk (14 September 2021), online: *CoinDesk Latest Headlines RSS*

Going back to the definition for stablecoins given by D. Bullmann et al, we can look specifically at their definition of algorithmic stablecoins: “a stablecoin being backed by users’ expectations about the future purchasing power of their holdings, which does not need the custody of any underlying asset, and whose operation is totally decentralised.”[22]

As again highlighted by this definition, algorithmic stablecoins do not need to be collateralised by an asset. Conversely, the stabilisation mechanism of algorithmic stablecoins is more like that of a central bank which is characterised by using an elastic supply of currency. In the ability to (algorithmically) alter the quantity of the coin’s supply proportionately to changes in coin market value, there seems to be at least a theoretical basis on which an algorithmic stablecoin could operate.[23]

It is however important to keep in mind that — at this stage of the technology — no existing protocol has been able to successfully run on solely algorithmic stabilisation mechanisms, without the use of other stabilisation techniques, which often include a type of collateralisation. This describes the phenomenon of fractional stablecoins. A fractional stablecoin is at least partly backed by collateral and stabilised by an algorithm.[24] [25] Given the ideology from which the idea of algorithmic stablecoins is stemming — i.e.: becoming fully decentralised and disintermediated — we focus on the algorithmic component of the stabilization mechanism,[26] looking at the risks stemming from algorithmic stablecoins and identifying possible methods of regulation for fully algorithmic stablecoins.[27]

<https://www.coindesk.com/policy/2021/06/17/paying-the-iron-price-fractional-reserve-banking-on-a-blockchain/>.

[22] Bullmann et al., *supra* note 12 at 3.

[23] Robert Sams, “A note on cryptocurrency stabilisation: Seigniorage shares” (2015) *Brave New Coin* at 1-8.

[24] For an interesting example of a moderately stable fractional stablecoin see the FRAX protocol: Kazemian, S., Huan, J., Shomroni, J., & Iyer, K., “Frax: A Fractional-Algorithmic Stablecoin Protocol” (2022), online: *2022 IEEE International Conference on Blockchain (Blockchain)* <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9881815> at 406-411..

[25] It would be very intriguing to research the applicability of regulation that is aimed for collateralized stablecoins to fractional stablecoins. Given the scope and purpose of this contribution, this will have to be left to further research.

[26] For the risk specifically related to collateralised stablecoins, see Gary B Gorton and Jeffrey Y. Zhang, “Taming wildcat stablecoins” (2023) U. Chi. L. Rev., 90, 909. With specific reference to the EU MiCAR proposal, see Edoardo D. Martino, "Regulating Stablecoins as Private Money. A Critical Take on the EU Proposal between Liquidity and Safety." (2022) Amsterdam Center for Law & Economics Working Paper No 7.

[27] This however does not exclude the analysis of other possible secondary stabilization mechanisms that are currently necessary to make algorithmic stablecoin protocols functional. See for more profundity on secondary stabilization mechanisms (or the wider term ‘tokenomics’) Bullmann, D., Klemm, J., & Pinna, A. (2019), Cho, J., “A Token Economics Explanation for the De-Pegging of the Algorithmic Stablecoin: Analysis of the Case of Terra. *Ledger"* (2023) 8 Ledger Journal at 8; and Zhang, L., & Liu, Y., “Optimal algorithmic monetary policy” (2021). *arXiv preprint arXiv:2104.07888.*

[27] *Ibid*.

There exist two types of algorithmic stablecoins' stabilisation mechanisms, the rebase-style mechanism and the seigniorage or two-token mechanism. A rebase style stabilisation mechanism, used by stablecoins such as Ampleforth, closely linked to the quantitative theory of money, utilise an elastic token supply to maintain stability by adjusting supply based on the token's value relative to its peg.[28] This system adjusts the token supply through rebasing or debasing, aiming to stabilise the unit of account but not the store-of-value, resulting in fluctuating purchasing power for wallet holders. In the debasing phase, this is mainly achieved through the destruction of excess tokens or fee/penalty mechanisms to achieve an equivalent result. This results in a wallet whose purchasing power is volatile.

The seigniorage (two-token) mechanism is the other algorithmic mechanism to stabilise the coins' value. It is currently more common in the market and does not suffer from volatile purchasing power as it does not rely on the elasticity of the supply as much. The seigniorage system aims to incentivize holders of the token to act in a specific way to stabilise the token. It uses two tokens one of which tries to maintain a stable peg, while the secondary (balancer or share) token is used to absorb the market volatility. For instance, if the stablecoin's price climbs, the holder of the balancer can exchange it for the stablecoin, thus making the profit while increasing the monetary supply, driving the price back to the unit of account. Conversely, when the stablecoin's price goes down, its holders can exchange it for the balancer at par, shrinking monetary supply and again driving the price back to the unit of account. During normal operation, this mechanism is incentive compatible, as arbitrageurs make a profit by either increasing or shrinking the money supply. For a seigniorage-style stablecoin to work, the incentives for token holders to act in the way they should, have to be effective. This last comment refers to the definition of algorithmic stablecoins given earlier. The premise on which this mechanism is built assumes that holders, speculators, or arbitrageurs will be incentivised and will trust in the working of the mechanism to reap the benefits of their actions. This requires these market participants to believe in the future growth of the protocol.

The description of these mechanisms is complex and may appear counterintuitive. To illustrate the technical and practical aspects of algorithmic stablecoins, we consider the examples of DAI and FRAX. These are two of the largest (partially) algorithmic stablecoins based on different stabilization mechanisms. Both are factional algorithmic stablecoins, meaning they are stabilized by collateral and by an algorithm. Before illustrating these stabilization mechanisms, it is necessary to

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[28] The quantitative theory of money posits that the total amount of money in circulation directly influences the price level in an economy, assuming other factors remain constant.

point out that this is by no means an in-depth analysis of these stablecoins, but more intended to give practical examples of the theory explained.[29]

The practical application of the stabilization mechanism of the DAI stablecoin consists of a number of components, including a rebase system. First of all, DAI is over-collateralized by a number of different cryptocurrencies. This means that the assets backing DAI exceed the worth of the number of DAI in circulation. In practice, this is achieved by so-called Collateralized Debt Positions (CDPs). When a DAI stablecoin is minted (created), users lock up crypto assets as collateral in a CDP smart contract on the Ethereum blockchain. Part of the CDP is a stabilization fee which is an annualized percentage rate charged on the outstanding DAI debt borrowed through CDPs. When the price of DAI falls below $1, indicating a deviation from its peg, the Stability Fee is increased. This policy aims to discourage excessive borrowing of DAI and incentivize users to convert DAI back to its pegged value. Conversely, if the price of DAI exceeds $1, the Stability Fee is reduced. This reduction lowers the cost of borrowing DAI, potentially leading to increased borrowing and the minting of new DAI, thereby bringing the price back down towards the $1 target. In addition, the stability mechanism functions with an oracle network that provides real-time price data and a Target Rate Feedback Mechanism (TRFM).[30] Should DAI's price deviate from its $1 peg, penalty fees or stability fees are imposed to correct the discrepancy. This should incentivise (arbitrage) traders to purchase DAI at a discount and subsequently burn it in exchange for its collateral value. This process adjusts the supply and demand dynamics, thereby stabilizing the price.

The FRAX stabilisation mechanism works somewhat differently, through a seignories mechanism. The Frax protocol works with the abovementioned two token system (seigniorage) that consists of a stablecoin, Frax (FRAX), and a governance token, Frax Shares (FXS). The protocol works with a collateralisation ratio (CR) which represents the percentage of FRAX tokens that are backed by collateral assets such as USDC (a stablecoin pegged to the US dollar) and other approved cryptocurrencies. This ratio is not fixed and can be changed over time in

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[29] See for more in-depth reviews of these stablecoin, Oefele, N., Baur, D. G., Smales, L. A., & Viswanath-Natraj, G., "Decoding DAI: Exploring Collateral Evolution and Price Dynamics" (2024) at 8; van der Merwe, A., "A Taxonomy of Cryptocurrencies and Other Digital Assets" (2021) Review of Business, 41(1) at 37; and Kazemian, S., Huan, J., Shomroni, J., & Iyer, K., "Frax: A Fractional-Algorithmic Stablecoin Protocol" (August 2022) In 2022 IEEE International Conference on Blockchain (Blockchain) at 406-411.

[30] The Target Rate Feedback Mechanism (TRFM) is integral to maintaining DAI's peg to the US dollar by adjusting supply and demand in response to price fluctuations (detected by the Oracle). During severe instability, it activates and modifies the Target Rate to influence the Target Price, making DAI generation more or less expensive and thereby pushing its market price back towards $1. The TRFM also adjusts the Stability Fee, increasing it when DAI is above $1 to discourage borrowing and decreasing it when DAI is below $1 to encourage borrowing, creating a negative feedback loop to stabilize DAI's value. This mechanism provides liquidity and reduces volatility without relying on centralized reserves or fiat backing.

accordance with improving or deteriorating market conditions. While being collateralised, FRAX is algorithmically stabilised using the secondary token FXS. Users can create (mint) new FRAX by depositing collateral and Frax Shares (FXS), the governance token of the protocol. The amount of collateral and FXS required is determined by the current CR. Similarly, users redeem (burn) FRAX to withdraw the underlying collateral and FXS. These processes of minting and burning reduces the supply of FRAX and help restore the peg if the price of FRAX falls below $1. For example, if FRAX trades at $0.98, (arbitrage) traders can buy FRAX on the open market and redeem it for $1 worth of collateral and FXS, profiting from the difference and reducing the supply of FRAX.

These two mechanisms seem quite clear in their operation and have been running largely successful, despite the relatively small market capitalization.[31] The question however remains what happens when protocols emerge whose mechanisms seek to push the boundaries of what is considered possible when looking at the current market and what risks are posed by these protocols. The following section tries to answer this question with the aim to expose the specific risks formed by fully algorithmic protocols.

(c) Algorithmic Stablecoins: Specific Risks

We now come to the specific risk potentially brought about by algorithmic stablecoins. An algorithmic stablecoin protocol is often compared to a (central) bank making use of monetary policy to minimise price fluctuations. One of the most prominent vulnerabilities of a (central) bank with no fiscal backstop is the occurrence of a bank run.[32] As evidenced by past crashes of algorithmic stablecoins projects such as TITAN or TERRA-LUNA, a certain level of trust and demand is required. Loss of either of these two in the stablecoin or the secondary token can be detrimental to the survival of the token. If the coin's volatility increases exactly when a stablecoin needs them the most to meet redemptions and restore the peg, the incentives for market participants deteriorate and again start to show cracks in the effectiveness stabilisation mechanism.[33] This fragility is in its turn inherently paired with a 'death spiral'.[34] The troubling characteristic of the death spiral is the

[31] DAI and FRAX are capitalized, respectively, at around 648 million $ and 5,350 billion $ on CoinMarketCap. See respectively CoinMarketCap (2024), online: <https://coinmarketcap.com/currencies/multi-collateral-dai/> and CoinMarketCap (2024), online: <https://coinmarketcap.com/currencies/frax/>.

[32] See Frost, J., Hyung, S. S. & Wierts, P. "An Early Stablecoin? The Bank of Amsterdam and the Governance of Money" (2020) De Nederlandsche Bank Working Paper No. 696, for an example of a central bank being a target of a bank run.

[33] See Catalini, C., & de Gortari, A., "On the economic design of stablecoins" (2021) Social Science Research Network and Clements, R., "Built to fail: The inherent fragility of algorithmic stablecoins" (2021) 11 *Wake Forest L. Rev. Online* 133.

[34] See the following paper for the practical example of a death spiral created by the loss of confidence combined with failing arbitrage mechanisms: Lyons, R. K., & Viswanath-Natraj, G., "What keeps stablecoins stable?" (2023) *Journal of International Money and Finance 131* at 18.

fact that there does not need to be an actual reason to expect downward movement. The mere fear of downward movements or a run on one of the tokens can result in a self-fulfilling downward spiral just because the market knows a death spiral is possible.

An example of this is the algorithmic stablecoin UST which functioned with a two-token (seigniorage) system using a secondary token called Luna. (Arbitrage) traders are incentivised to burn or mint UST for $1 worth of Luna when UST is de-pegged downward or upward. One major cause of the collapse of UST was a borrowing and lending protocol (within the UST protocol) called Anchor. To incentivize the adoption of UST, the Anchor protocol offered a very high yield of 19.5% to depositors minting UST leading to a large increase in UST issuance. The newly issued UST were used to pay the interest on Anchor deposits and fund other activities. The volume of deposits skyrocketed and the level of subsidies required became increasingly unsustainable. On May 7, 2022, two large withdrawals of 375 million UST from Anchor marked the beginning of the run, with wealthier and more sophisticated investors exiting first and incurring smaller losses compared to poorer, less informed individuals who acted later and suffered greater losses.[35] This resulted in a shock, being exacerbated by market sentiments, which led traders to panic and sell their UST holdings. This brought down the price of UST to $0.91, from $1. As a result, traders started to change 90 cents worth of UST for $1 of Luna. This continuous minting of new Luna resulted in the price of LUNA falling and leading to increasing dilution which then further depressed the price of LUNA resulting in a dramatic "death spiral." In the next three days, the LUNA supply increased from 1 billion to 6 trillion and the LUNA price decreased from $80 to almost zero.

Furthermore, this level of incentive is very much correlated with the level of stability the protocol is able to achieve.[36] Given the (almost inherent) susceptibility to a run this stability is not guaranteed. On top of that, when looking at the demand, one could say (at least for now) that the demand within the ecosystem is fairly fluctuating. The market is extremely exposed to price swings with the consequence of big supply and demand movements (bitcoin crashing or rising). This can lead to sudden peaks in demand or supply for an algorithmic stablecoin that can lead to cracks in the effectiveness of the protocol's stabilisation mechanism.[37]

A same kind of impediment can exist, according to A. Avernas et. al., when one is (again) considering the situation where the price of an algorithmic stablecoin falls

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[35] Liu, J., Makarov, I & Schoar, A., "Anatomy of a run: The Terra Luna Crash" (2023) NBER *Working Paper 31160* at 4.
[36] Adrien d'Avernas, Vincent Maurin & Quentin Vandeweyer, "Are stablecoins stable?" 2021 *Working Paper* at 4-5.
[37] This risk is exacerbated by the constant need for symmetry in information (using oracles) to have accurate pricing.

below its peg. In this situation a stablecoin is sold and burned while a secondary token is given in return. The (future) value of this token is the seigniorage from which the system gets its name.[38] In a technical analysis combined with a comparison with banking, the paper argues that there is a limit to a protocol's ability to burn stablecoins and 'issue' secondary tokens.[39] Due to this limit, in order for the system to retain its ability to remove quantities (of stablecoins for secondary tokens) when needed and stabilise prices, it needs to keep growing its stablecoin demand at an exponential rate.[40] The exponential growth is only achieved by a constant (growing) level of demand which can thus be viewed as a condition needed to be present for the functioning of this seigniorage system. This seems to make algorithmic stablecoins highly procyclical. The downward risk is reinforced when we couple this observation with the rigid implementation of the protocol, which is difficult to adjust ex-post to extreme scenarios.

Another important issue is the matter of governance. This until now unelucidated topic can be considered to play a crucial role in the stability design. This applies because the way of decision-making (decentralised), the speed of decisions and the transparency with which decisions are made, can be crucial in the functioning of a project in order to be responsive to market movements. This topic is another prime example of interaction between external factors and internal mechanisms needed to be apt.[41]

In decentralised decision-making, it is important to investigate the likely strategic outcome of such decision. Game theory has long shown that the cooperative Nash equilibrium becomes more likely as the number of repetitions increase — this is called the Folk Theorem. This not only relates back to the vulnerability in arbitrage trading and the susceptibility to a run that can be ignited by a change in market sentiment or a larger sell-off, but also to the use of secondary stabilisation mechanisms and internal governance procedures (and the previously mentioned necessity to be responsive). The Folk Theorem proves that it is impossible to create protocols, no matter how complex or well-engineered, which can eliminate corruption — in the sense of independent decision-making of each player. After a certain number of repetitions, players will start converging towards a cooperative equilibrium, even if it is a low-income equilibrium, such as a death spiral run.[42] A set of rules, or in the case of an algorithmic stablecoin protocol a set of smart contracts, that is too static will not be able to prevent this. By contrast, a changing

[38] Klein, M., & Neumann, M. J., "Seigniorage: What is it and who gets it?" (1990) *126*:2 *Weltwirtschaftliches Archiv* 205.
[39] This limit is determined by the protocols so-called 'Franchise Value' which is reflecting the discounted future seigniorage revenues stemming from the secondary tokens that are on the market.
[40] d'Avernas, A., *supra* note 36 at 24.
[41] A more detailed treatment of these points can be found here: Calcaterra, C., *supra* note 2; Stable cryptocurrencies: First order principles. *Stan. J. Blockchain L. & Pol'y*, *3* at 77-80.
[42] Calcaterra, C., *supra* note 2 at 81.

set of rules and an agile governance design can react to and prevent this abuse if it devotes enough resources to reward such efforts. When looking at common practices of algorithmic stablecoin protocols and their desire to become fully decentralised, the governance mechanism will have to be fully decentralised as well. In practice this will most often boil down to a system where the approval of the majority of the holders of a token/coin is needed before a proposal can be authorised and implemented. Although this system provides the much-appreciated transparency and accountability, it is less nimble in its application than what might be necessary.[43] This might imply the need for an external — centralised — authority provided with some level of discretion in governance decisions in extreme conditions.

Before moving to the applicable regulatory framework for algorithmic stablecoins, it is important to discuss a common preliminary critique: is there a need for regulation at all? When one compares the total market capitalisation, algorithmic stablecoins do not seem to have a substantial share (approximately 1.8% of the total stablecoin market capitalisation consists of algorithmic stablecoins).[44] This raises the question why regulators should spend their time and money on regulating this niche section of the crypto market. The answer to this question can mostly be found in the interconnectedness of the cryptocurrency market. A more specific illustration of this can be found in the Terra-LUNA crash in May 2022. This crash showed that algorithmic stablecoin protocols and the risks they pose can be of influence in the entire crypto ecosystem.[45] Despite their relatively small market share, it seems clear that algorithmic stablecoin protocols can have far-reaching consequences, posing systemic risks and highlighting the need for regulatory oversight.[46] The following section will look at MiCAR, the most promising regulatory instrument for crypto-assets to-date. [47]

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[43] See for more depth on the use and design of governance within crypto: Goldsby, C., & Hanisch, M. "The boon and bane of blockchain: getting the governance right." (2022) *California Management Review*, *64*(3) at 141-168.

[44] Lee, S. P. "Stablecoins Statistics: 2023 report" (13 July 2023), online: *CoinGecko* <https://www.coingecko.com/research/publications/stablecoins-statistics#:~:text=As%20of%20January%2031%2C%202023,market%20cap%20is%20%24138.4%20billion>; "Top algorithmic stablecoins tokens by market capitalization" online: *crypto.com. (n.d.).* <https://crypto.com/price/categories/algorithmic-stablecoins>.

[45] See Seungju Lee, Jaewook Lee, & Yunyoung Lee, "Dissecting the Terra-LUNA crash: Evidence from the spillover effect and information flow" (2023) 53 Finance Research Letters 103590; Anton Badev & Cy Watsky "Interconnected DeFi: Ripple Effects from the Terra Collapse" (2023) Finance and Economics Discussion Series 2023-044.

[46] This also seems to be recognised by the EU on a more generic level in MiCAR recital 5.

[47] Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-asset [2023] OJ L 150/40 [MiCAR].

3. MICAR and Algorithmic Stablecoins

(a) Regulatory Scope and Applicable Provisions

The MiCAR represents the EU's attempt to lead the regulatory debates and practice on DLT-based financial services. In the recitals, the regulation explicitly states that its aim is not only to address risks (i.e., for retail holders of crypto assets) pertaining to market integrity, possible market abuse and financial crime. It also tries to aid user confidence (with legal certainty) and avoid hindering innovation of digital services, alternative payment instruments or new funding sources.[48]

The impact of the newly approved MiCAR regulation on the crypto economy is still to be seen, as we are in the first phases of its official implementation and application. However, for the purpose of this study, the question again remains what effect the implementation will have on the operations of algorithmic stablecoins. Specifically, how are algorithmic stablecoins treated? What are the applicable provisions?

Unfortunately, there are no clear-cut and satisfactory answers when reading the regulation. Therefore, an interpretative analysis of the MiCAR provisions is necessary to construct the body of provisions that are applicable to algorithmic stablecoins. In this endeavour, it is crucial to closely consider MiCAR recitals as these are the only elements explicitly referring to algorithmic stablecoins. However, it is important to remind the reader that, under EU law, recitals do not constitute a legal rule and cannot be binding as such. Yet, they can be used as an interpretative tool as is customary in EU law and can be used to define the purpose and scope of certain provisions. [49]

The regulation lays down uniform requirements for the offer and admission to trading of three categories of crypto assets.[50] First, asset-referenced tokens (ART); second, e-Money tokens (EMT); third, as a residual category, crypto assets that are not ARTs or EMTs.[51] ARTs and EMTs are the categories of crypto assets

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[48] *Ibid.,* recitals 4-6.

[49] On the legal status of recitals under EU law, see Casa Fleischhandels, Case 215/88 [1989] ECR 2789 at para. 31; Commission v Italy Case C-110/05 [2009] ECR I-519, Advocate General Léger Opinion at para. 64-65 and Moskof, Case C-244/95 [1997] ECR I-6441 at paras. 44-45, BECTU, Case C-173/99 [2001] ECR I-4881 at paras. 37-39, Case C-435/06, C [2007] ECR I-10141 at paras. 51-52.

[50] Zetzsche, D. A. et al., "The Markets in Crypto-Assets Regulation (MiCAR) and the EU digital finance strategy" (2021) 16:2 *Capital Markets Law Journal* 203.

[51] MiCAR, *supra* note 47 at Article 3(1) under 5, 6 and 7.

(5) Crypto asset means a digital representation of a value or of a right that is able to be transferred and stored electronically using distributed ledger technology or similar technology.

(6) Asset-referenced token (ART) *means a type of crypto-asset that is not an electronic money token and that purports to maintain a stable value by referencing another value or right or a combination thereof, including one or more official currencies.*

representing stablecoins. The differences between the two lies in the 'unit of account' used as stable value. In the case of EMTs, it must be on single official currency, such as the US Dollar or the Euro. On the other hand, in the case of ARTs, the stable value can be referenced to a wider basket of assets.[52] Crucially, those who wish to issue ARTs or EMTs need to be specifically authorised. These issuers are, required to guarantee safety and liquidity to the largest extent possible, providing the EMT holders with the right to withdraw at par upon request of the holder, as prescribed in Article 29 MiCAR. In turn, ART issuers thcan guarantee safety and liquidity to a more limited extent, following the specific rules on reserve assets and redemption, as prescribed - respectively - in Articles 36 and 39 MiCAR. Finally, the issuer of crypto assets other than ART and EMT cannot guarantee safety and liquidity.[53]

ARTs and EMTs cover collateralised stablecoins (either on-chain or off-chain). The regulatory framework is clearly thought to capture this type of issuers, detailing the obligations on reserves and the redemption rights. It is debatable whether and to what extent these also cover algorithmic stablecoins. As anticipated, to answer this question one needs to look at the recitals. Specifically, Recital 41 states that:

> "*Where a crypto-asset falls within the definition of an asset-referenced token or e-money token, Title III or IV of this Regulation should apply, irrespective of how the issuer intends to design the crypto-asset, including the mechanism for maintaining a stable value of the crypto-asset. The same applies to so-called algorithmic 'stable coins' that aim to maintain a stable value in relation to an official currency, or in relation to one or several assets, via protocols, that provide for the increase or decrease in the supply of such crypto-assets in response to changes in demand. Offerors or persons seeking admission to trading of algorithmic crypto-assets that do not aim to stabilise the value of the crypto-assets by referencing one or several assets should in any event comply with Title II of this Regulation.*"

Therefore, in its final version, MiCAR aims to include algorithmic stablecoins as long as the issuer aims to maintain a stable value referencing to one or several assets (ART – Title III) or one single official currency (EMT – Title IV).

(7) E-money token (EMT) *means a type of crypto-asset that purports to maintain a stable value by referencing the value of one official currency.*

[52] It is important to underline that ARTs can reference one single currency but can also reference more than one currency or a combination of currencies or rights, whereas EMTs must reference a single currency.

[53] For the legal analysis see Filippo Annunziata, "An Overview of the Markets in Crypto-Assets Regulation (MiCAR)." (2023) European Banking Institute Working Paper Series no. 158 at 46-56. For a functional analysis, see Martino, *supra* note 26 at 36-45.

Furthermore, Recital 19 states that the definition of EMTs should be '*as wide as possible*'.[54] While this remark aims to limit possible regulatory arbitrage and circumvention of the eMoney Directive,[55] it signals a certain *vis attractiva* of this regulatory regime whenever a crypto asset references one single currency.

Before drawing conclusions, it is important to observe that the final version of MiCA adopted a radically different solution compared to the initial MiCAR proposal. Indeed, the proposal explicitly excluded algorithmic stablecoins from application of Title III and Title IV.[56] This solution was more pragmatic, as it acknowledged the radical difference between collateralised and algorithmic stablecoins, recognizing that a regulatory framework thought for collateralised stablecoins would be difficult to apply to algorithmic ones.

Therefore, it can be concluded that, according to the final version of MiCAR, algorithmic stablecoins shall be considered ARTs or EMTs if the issuer '*purports to maintain a stable value of the crypto-asset by referencing another value or right or combination thereof or one official currency.*' Should this not be the case, algorithmic stablecoins would be considered simply as crypto assets governed by Title II.

Title II lays down general requirements related to the offer to the public or admission to trading of crypto assets which mostly regard whitepaper and disclosure requirements. These resemble an area of regulation that is not unlike securities regulation.[57] It outlines the required contents of a whitepaper for crypto assets which must include general information about the issuer, offeror or person seeking trading admission, as well as details about the crypto asset, the associated project and the risks involved.[58] Moreover, the information provided by the whitepaper should be fair, clear, and not misleading, providing all material information. The title continues by laying down disclosure requirements that include market communications that must be clearly identifiable as such and have to be fair, clear and not misleading.[59] Both whitepaper and disclosure requirements need to be communicated with competent authorities who are instructed to oversee

[54] MiCAR, *supra* note 47 recital 19.

[55] Directive 2009/110/EC of the European Parliament and of the Council of 16 September 2009 on the taking up, pursuit and prudential supervision of the business of electronic money institutions. OJ L 267, p. 7.

[56] Recital 26 of the Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Markets in Crypto-Assets, and amending Directive (EU) 2019/1937, COM/2020/593 final (MiCAR Proposal). For an analysis of the implications of the MiCAR proposal for algorithmic stablecoins, see Martino, *supra* note 26 at 35.

[57] See for elaboration Annunziata, F., "The Licensing Rules in MiCAR. Fintech Regulation and the Licensing Principle" (2023), Dário Moura Vicente Diogo Pereira Duarte Catarina Granadeiro (eds), Centro de Investigaçao de direito privado, European Banking Institute, Frankfurt.

[58] MiCAR, *supra* note 47 article 6. This includes a statement regarding the fact that the whitepaper is not approved by any competent authority in any Member State of the European Union.

[59] *Ibid.* at article 7.

these changes.[60] Further parts of Title II regard the granting to retail holders the right of withdrawal and establishes obligations for offerors and those seeking trading admission, emphasising honesty, fairness, conflict of interest management and secure systems. In addition, it addresses liabilities related to white papers, holding administrative body members accountable for infringements, leading to potential civil liability for losses incurred by crypto asset holders.[61]

When analysing MiCAR, it is apparent that the regulation of algorithmic stablecoins has not been the main objective and focus of the regulators. It is noticeable that some large parts of the regulation have in mind collateralised stablecoins. This will create interpretative issues and may crowd out algorithmic stablecoins from the European market, stifling innovation in the area — contrarily to the stated aim of the regulation. At first sight, while waiting for clearer guidelines from the European Banking Authority, it appears that rebase-style algorithmic stablecoins should be considered '*crypto-assets that do not aim to stabilise the value of the crypto-assets by referencing one or several assets'* and therefore be categorised as ARTs or EMTs. This also implies that fractional algorithmic stablecoins using a rebase-style stabilization mechanism should be considered not allowed in the EU, as stablecoin issuers shall maintain at all times reserves whose value is at least that of the claims of token holders.[62] On the other hand, the seigniorage-style stablecoin may be exempted, depending on its setting.

However, it is not clear that the current formulation of MiCAR helps to address the specific risks brought about by algorithmic stablecoins and discussed in Section 2.c. In fact, the lack of specific regulation makes it impossible to tackle those risks and leaves ample room for arbitrage. In the upcoming section we look at a specific arbitrage possibility related to the requirements to be considered as 'issuer' of cryptocurrencies, including ARTs and EMTs.

(b) Legal Person(ality) and Fully Decentralised Applications

MiCAR requires 'issuers' of crypto assets, including ARTs and EMTs, to be legal or natural persons or other forms of undertakings (e.g. commercial partnership).[63] In the regulation of traditional financial services, this may look little more than a tautology. However, in blockchain-based application, this becomes a troublesome requirement, especially when read in combination with Recital 22. This Recital exempts crypto assets provided in a fully decentralised manner. The meaning and the scope of this exemption is unclear for two orders of reasons. First, as noted above, Recitals have no binding normativity. Second, the concept of 'fully

[60] *Ibid.* at article 8.
[61] *Ibid.* at article 13, 14 and 15.
[62] *Ibid.* at Article 36(7).
[63] *Ibid.* at Article 3 at para. 1 under 12. See also Article 4 and 5 in relation to general crypto-assets; Article 18 for ARTs; and Article 48 for EMTs.

decentralised' is factually ambiguous so that it will depend on what the competent authority considers to be 'fully decentralised'. Following Articles 140 and 142 MiCAR, the commission, having consulted the EBA and ESMA, shall present a report on this topic, among others.

The exclusion of fully decentralised issuers is likely to be more consequential than it may look at first sight, especially when it comes to the law applicable to algorithmic stablecoins insofar as the rational non-negligible number of projects may be to qualify as 'completely decentralised' crypto assets, especially if MiCAR would ban or significantly curb their business model and technological setup. Although it might, at this point, be unclear when an algorithmic stablecoin project can be considered as 'fully decentralised' and 'has no identifiable issuer,' the situation can be imaginable where there exists a fully decentralised algorithmic stablecoin project.[64]

Going back to the examples discussed in Section 2b, both DAI and FRAX self-define themselves as 'fully decentralised stablecoins'. While this is not legally necessary nor sufficient to be considered as 'fully decentralised' for the purpose of MiCAR, it is indicative of the industry line of reasoning. Looking closer at the organizational structure of the two projects, the DAI seem to be attributable to the 'Maker foundation' or the 'DAI foundation', two off-chain foundations with legal personality.[65] It is reasonable to think that, beyond the various decentralised protocol and governance arrangements of the DAI, the Maker foundation can be considered the entity that provides '*the crypto-asset services and activities performed, provided or controlled, directly or indirectly.*'[66] On the other hand, it seems much harder to identify a legal or natural person to whom the FRAX project is attributable. This does not necessarily mean that FRAX will be considered as 'fully decentralised' under MiCAR, but at least identifying the legal issuer can be a complex exercise.

(c) Crypto Asset Service Providers as Gatekeepers

Determining the applicable law for algorithmic stablecoins under MiCAR is, to say the least, troublesome and even when the applicable law is clear, monitoring and enforcing its application is costly and cumbersome for the competent authority. To partially cope with these inherent regulatory issues, the European legislation assigned the role of gatekeeper to Crypto Asset Service Providers (CASPs).

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[64] For a detailed analysis of the various 'centralisation vectors' characterising Decentralised Finance applications, see Katrin Schuler, Ann Sofie Cloots, and Fabian Schär. "On DeFi and On-Chain CeFi: How (Not) to Regulate Decentralized Finance." (2024) Journal of Financial Regulation (advanced article).
[65] MakerDAO (2024), online: <https://makerdao.com/en/whitepaper#abstract>.
[66] MiCAR, *supra* note 47 at Recital 22.

This is even more relevant for crypto activities which will be considered as fully decentralised. In fact, the last part of Recital 22 specifies that '*crypto-asset service providers providing services in respect of crypto-assets*' that have no identifiable issuers and are completely decentralized are still within the scope of MiCAR. This results in a situation where — in the case of fully decentralised algorithmic stablecoins — only the parts of MiCAR regarding CASPs will have a significant influence on algorithmic stablecoin protocols.

Given this preamble, it is useful to introduce the key provisions related to CASPs. Title V sets out the authorisation requirements and operating conditions for a ' *legal person or other undertakings whose occupation or business is the provision of one or more crypto-asset services to clients on a professional basis, and that is allowed to provide crypto-asset services in accordance with Article 59 of Title V.*'[67] It stipulates the prerequisites for authorisation, disclosure requirements and operating parameters contingent upon the nature of services rendered, akin to regulatory frameworks such as MiFID II. The remainder of this title seems, not unlike Title II, to consist of a fairly straightforward adaptation of securities regulation.[68]

However, MiCAR set forth additional rules for specific CASPs, partially deviating from traditional securities regulation, adding further gatekeeping responsibilities.[69] For the purpose of this study, the specific rules on trading platforms are particularly relevant. Article 76 of MiCAR states that trading platform shall set approval processes to decide on the admission of any crypto asset to trading. Such process should include the publication of a crypto asset white paper.[70] Moreover, the CASP operating the trading platform 'shall ensure that the crypto-asset complies with the operating rules of the trading platform and shall assess the suitability of the crypto-asset concerned.'[71] Finally, irrespective of the specific arrangement and procedures of the individual platform, any CASP operating an authorised trading platform 'shall prevent the admission to trading of crypto-assets that have an inbuilt anonymisation function.'[72]

All these provisions put CASPs in the spotlight when it comes to implementing MiCAR principle on crypto assets and specifically on algorithmic stablecoins. It can be expected that trading platforms will have incentives to protect the market

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[67] *Ibid.* at Article 3 at para. 1 under 15.

[68] It focusses on outlining authorisation criteria and operational guidelines for entities offering crypto-asset services, including disclosure requirements and regulatory oversight. It mandates comprehensive applications to competent authorities, prudential safeguards and client fund protection measures, emphasising transparency and client interest.

[69] Annunziata, *supra* note 52 at 61-62.

[70] MiCAR, *supra* note 47 at Article 76(1)(a).

[71] *Ibid.* at Article 76(2).

[72] *Ibid.* at Article 76(3).

by filtering out algorithmic stablecoins that, for example, do not comply — at least formally — with Title II MiCAR requirements.

A final interesting point here will be the distinction between two types of exchanges —centralised and decentralised.[73] The latter, in line with Recital 22 would be excluded from the application of MiCAR, including the corresponding gatekeeping responsibilities.

4. A Brief Comparative Overview

Before the final assessment of MiCAR, it is useful to have a brief comparative overview of other regulatory approaches to algorithmic stablecoins. The overview will mainly consider the US and the UK regulatory regimes. This choice is justified by the relevance of these jurisdictions in the global financial market. The UK and the US are not the only jurisdictions other than the EU that are currently engaging in the regulation of crypto assets; perhaps, they are not even the most interesting. However, they are instructive for the assessment of MiCAR. Other jurisdictions might include Singapore or Hong Kong.[74]

As with the analysis of MiCAR, this section focuses on the law applicable to algorithmic stablecoins, largely disregarding the specifics of the regulation applicable to collateralised stablecoins. The goal of this analysis is to learn from the effects the regulations might have on algorithmic stablecoins and to figure out if the uncovered risks specific to these protocols would be effectively regulated.[75]

(a) US Lummis-Gillibrand' Payment Stablecoins Act

On 17 April 2024, after a long and cumbersome legislative process, the new 'Payment Stablecoins Act' sponsored by senators Lummis and Gillibrand was introduced in the Senate.[76] The bill is the result of political compromises and has a

[73] A centralised crypto exchange is operated by a single entity, typically a company, which acts as an intermediary to facilitate trading, holds custody of user funds and exercises control over the platform. In contrast, a decentralised crypto exchange operates on a peer-to-peer network, allowing users to trade directly with each other without relying on a central authority, offering greater user control over funds and potentially higher privacy, but with potentially lower liquidity and limited features.

[74] The legislative experimentations in Singapore and Hong Kong are particularly relevant. Even though their analysis is beyond the scope of this article, they are worth mentioning. For the Singapore approach, see Rachel Phang "Singapore's Emerging Regulatory Approach to Stablecoins" Banking & Finance Law Review (2024) 40:1, 67. For Hong Kong, see Xiyuan Li, "Stablecoin Regulation in Hong Kong: Recent Developments and Critical Evaluations" (2024), online: <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4870280> at 15.

[75] For a more evaluative contribution regarding the discussed regulatory approaches (however not specified to algorithmic stablecoin protocols), see Martino, E. D., "Comparative Cryptocurrencies and Stablecoins Regulation. A framework for a functional comparative analysis" (2023) EBI Working Paper Series No. 145.

[76] S.4155, *Lummis-Gillibrand Payment Stablecoin Act,* 118th Congress, 2023-2024.

much more limited scope compared to the initial-Lummis-Gillibrand 'Responsible Financial Innovation Act'. [77] This proposal is more comprehensive than the proposed 'Payment Stablecoins Act' and — at least in its scope — mimics MiCAR. This encompassing proposal has currently been deferred until further notice.[78]

Before looking at a few details of the proposal, it is important to highlight that — in line with the political stance of the sponsors and the previous Responsible Financial Innovation Act proposal — the 'Payment Stablecoins Act' is mainly an investor and consumer protection bill.[79] This specific and narrow policy goal contrasts with the broad and overlapping MiCAR policy goals and shapes the approach to algorithmic stablecoins.

Accordingly, the scope of the regulation is narrow and applies only to crypto assets (A) that are, or are designed to be, used a means of payment or settlement; and (B) the issuer of which — (i) is obligated to convert, redeem, or repurchase for a fixed amount of United States dollars; or (ii) represents, or creates the reason able expectation, "that the crypto asset will maintain a stable value relative to the value of a fixed amount of United States dollars."[80]

Unlike the previous proposal on 'Responsible Financial Innovation', the proposed 'Payment Stablecoins Act' specifically defines algorithmic stablecoins. These are defined as crypto assets represented by the issuer, or otherwise designed to create the reasonable expectation, that the crypto asset will maintain a stable value relative to the value of a fixed amount of United States dollars; and (B) relies on the use of an algorithm that adjusts the supply of the crypto asset in response to changes in market demand for the crypto asset to maintain the expectation that the crypto asset will maintain a stable value.[81]

Under the 'Payment Stablecoins Act', issuers of algorithmic stablecoins that provide payment services must be a chartered bank (depository institutions) or, for smaller issuers, also an authorised non-depository institution.[82] Natural persons or

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[77] See "Lummis, Gillibrand Introduce Landmark Legislation to Create Regulatory Framework for Digital Assets", (7 June 2022), online: *KRISTEN GILLIBRAND* <https://www.gillibrand.senate.gov/news/press/release/-lummis-gillibrand-introducelandmark-legislation-to-create-regulatory-framework-for-digital-assets/> [<https://perma.cc/L4HJ-98LK>] and <https://www.gillibrand.senate.gov/wp-content/uploads/imo/media/doc/Lummis-Gillibrand%20Responsible%20Financial%20Innovation%20Act%20%5bFinal%5d.pdf>

[78] See Brian Quarmby, "*Lummis-Gillibrand crypto bill likely deferred to next year*" (20 July 2022), online: *Cointelegraph* <https://cointelegraph.com/news/lummis-gillibrand-crypto-bill-likely-deferred-to-next-year>.

[79] Sean G. D'Arcy et al., "Bipartisan Legislation Introduced in the Senate to Establish a Regulatory Framework for Stablecoins" (2024), online: *Akin* <https://www.akingump.com/en/insights/alerts/bipartisan-legislation-introduced-in-the-senate-to-establish-a-regulatory-framework-for-stablecoins>.

[80] 'Payment Stablecoins Act', *supra* note 76 at Section 2 (13).

[81] *Ibid.* at Section 2 (1).

[82] *Ibid.* at Section 6 and 7.

other undertakings, unlike under MiCAR, cannot issue payment stablecoins.[83] The specific requirement on reserves and — even more specifically — dollar reserves *de facto* bans uncollateralized algorithmic stablecoins from the market for payments.

(b) UK's Financial Services and Markets Bill (FSMB)

The regulation of Stablecoins in the UK was finally passed on 29 June 2023 and is part of the Financial Services and Market Bill (FSMB).[84] The bill is a post-Brexit regulation that regards a wide range of financial services and aims to bolster the competitiveness of the UK as a global financial centre.[85]

The bill provides a legal basis and general legal principles upon which specified parties, such as the Financial Conduct Authority (FCA) and the HM Treasury, can draft and implement regulation to bring stablecoin-based arrangements in the framework of existing electronic money and payments regulatory regimes. This enables regulators to flexibly implement crypto assets into existing regulation according to market developments and corresponding risks.

With regard to stablecoin regulation, the key regulatory concept is that of 'Digital Settlement Asset' (DSA). Amending the Banking Act of 2009, the FSMB includes DSA among the means of payments that can be overseen by the Bank of England.[86] DSA are defined as: "a digital representation of value or rights, whether or not cryptographically secured, that — (a) can be used for the settlement of payment obligations, (b) can be transferred, stored or traded electronically, and (c) uses technology supporting the recording or storage of data (which may include distributed ledger technology)."[87]

When looking at the influence the FSMB might have on algorithmic stablecoin protocols, the Treasury's 'Response to the Consultation and Call for Evidence' of 2021 is very informative. The HM Treasury explicitly excludes algorithmic stablecoins (and stablecoins backed by other assets than fiat currency) from the scope of the FSMB.[88] The Treasury has made known that there is an ongoing risk that models evolve beyond the bounds of the existing frameworks. Powers to make amendments are therefore given to the Treasury to ensure that there are no regulatory gaps in terms of consumer protection and financial stability. Broadening

[83] *Ibid.* at Section 3(3).
[84] "Rocket boost for UK economy as Financial Services and Markets Bill receives Royal Assent", His Majesty's Treasury, press release (29 June 2023), online: <https://www.gov.uk/government/news/rocket-boost-for-uk-economy-as-financial-services-and-markets-bill-receives-royal-assent>.
[85] The process was initiated with a public consultation in 2021. See Treasury, H. M. (2021). UK regulatory approach to crypto assets and stablecoins: consultation and call for evidence (2021).
[86] Banking Act 2009, § 180.
[87] *Ibid.*, § 182 under 4a.
[88] Treasury, H. M. (2021), 2.46 at 16.

the scope of the definition of DSA remains within the powers of the Treasury, as circumstances and technology might evolve into a situation which would require a broadening of the regulatory scope.

Like in the US, the focus of the FSMB is on stablecoins used as a means of payments. Unlike the US, the focus is to harmonize the regime applicable to other means of payments to that applicable to stablecoins, so to foster the competitiveness of the UK as a hub for crypto activities. The exclusion of algorithmic stablecoins should be read in this context.

The approach taken by the UK presently thus results in a situation where algorithmic stablecoins are left out of scope of the digital settlement assets definition. This means that no specific imminent regulation can be expected to address specific risks stemming from algorithmic stablecoin protocols. Additionally, there is currently no tangible proposition for regulation to be expected which could have an indirect effect on algorithmic stablecoin protocols.

5. Effective Regulation of Algorithmic Stablecoins: MICAR And Beyond

It is now time to try and assess the effectiveness of the applicable EU regime for algorithmic stablecoins. We do so in two steps. First, looking exclusively at MiCAR, subsequently looking at the broader lessons that can be derived from our brief comparative exercise.

(a) MiCAR and algorithmic stablecoins: analytical conclusions

Based on the analysis carried out in Section 3, it appears from the applicable parts of MiCAR that the specific regulation of algorithmic stablecoins was not the primary objective of the regulator. No specific risks, as laid down in Section 2, seem to have been taken into account or assessed when looking at ART and EMT provisions as well as to the provisions on general crypto assets.

We showed that it is possible to determine the applicable regime to algorithmic stablecoins by interpreting MiCAR rules and recitals — not without uncertainties and ambiguities. However, this does not mean that the applicable provisions effectively tackle the specific risks algorithmic stablecoins bring about. It even seems to infer that MICAR provisions might not apply to specific forms of (algorithmic) stablecoins.

To say the very least, thanks to the disclosure requirements of the whitepaper regarding the underlying the protocols, market participants could become more aware of associated risks and become more informed on the issuer of the crypto assets. The disclosure and transparency requirements could have an interesting application in practice by making protocols more understandable, trustable and perhaps even contributing to information symmetry. Regrettably, this is where the promising applications of MiCAR to algorithmic stablecoins stop. Incidentally, one could even doubt of this promising effect, making the parallel between the prospectus regulation for traditional securities and the whitepaper regulation for crypto assets.[89]

Departing from these general principles, we can make some more specific observations. While the discussion of Section 2 raised several concerns, it is possible to identify a common thread between all of them: legislating via Recitals. As discussed, the MiCAR text has no norm directly targeted at algorithmic stablecoins. However, based on Recitals — especially Recitals 19, 22 and 41 — it is possible to interpret the applicable regime for algorithmic stablecoins under MiCAR. This situation is most likely the result of political compromises in the legislative procedure. Such an impression is reinforced by the radical change between the proposal and the final version of MiCAR. The former explicitly excludes algorithmic stablecoins. The latter explicitly includes them. This construction can imply technical limitations.

First and foremost, the applicable legal regime is ambiguous. Recital 41 states that, if the algorithmic stablecoin aims at stabilizing its value by referencing one or several assets, the regime for ARTs or EMTs should apply. Otherwise, the regulation for generic crypto assets applies. Different technological designs, such as rebase- or seigniorage -style algorithms, can be categorised differently. Beyond that, all regulatory requirements both for ARTs, EMTs or other crypto assets are not thought to fit algorithmic stablecoins, so that their application to protocols running the stablecoin is complex and, more importantly, does not capture the specificities of algorithmic stablecoins. For instance, in line with Article 47(5) MiCAR, the EBA has recently launched a consultation as to this process and its guidelines in order to orderly redeem tokens.[90] As mentioned by the consultation, "having a redemption plan is crucial to ensure an orderly approach to redemption and to ensure an equitable and orderly redemption of all entitled token holders in a timely manner."[91] Due to the fact that under MiCAR's current form the redemption processes of algorithmic stablecoins will not be regulated, there exist the chance that these processes could be damaging to holders, deteriorate transparency and harm financial stability, as we argued in section 2c.

[89] On the ineffectiveness of the prospectus regulation to safeguard retail investors, see Luca Enriques and Sergio Gilotta, "Disclosure and Financial Market Regulation." in N. Moloney, E. Ferran and J. Payne, eds, *The Oxford Handbook of Financial Regulation* (Oxford University Press, 2015) at 511-536.

[90] EBA, Consultation Paper Draft Guidelines on redemption plans under Articles 47 and 55 of Regulation (EU) 2023/1114 (8 March 2024), online (pdf): <https://www.eba.europa.eu/sites/default/files/2024-03/3bbdd074-e69e-40de-916d-463a56e2eb66/Consultation%20paper%20on%20draft%20GL%20on%20redemption%20plans.pdf>.

[91] *Ibid.* at 35.

These problems are exacerbated by the fact that MiCAR is mostly rule-based. This means that the regulatory delegations to secondary level regulators, usually the European Banking Authority, are specific and with low discretion. This will impede also these regulators to update the framework to fit algorithmic stablecoins and their peculiar risks.

Finally, and relatedly, the exclusion of crypto asset services that are fully decentralised and of crypto assets with no identifiable issuer increases the ambiguity and complexity of the system.[92] This issue is not specific to only algorithmic stablecoins. However, it is particularly problematic for algorithmic stablecoins. As discussed above, algorithmic stablecoins are ambiguously included in the scope of MiCAR through a Recital. At the same time, another ambiguous Recital trimmed the scope of application of the same body of rules to fully decentralised stablecoins. Incidentally, as discussed in Section 2, algorithmic stablecoins are designed to stretch the decentralised features of their protocols, in the pursuit of the 'crypto holy grail'.

What exactly means being fully decentralised? MiCAR does not define this concept, using once again a Recital to shape its scope of application. What is even more troublesome is that there is no definitive consensus on what the term entails.[93] Regardless of the fact that there does not seem to be a conclusive definition of the term, it is a fairly well-established actuality that as a part of their ideology stablecoins will aim to become decentralised. Despite the fact we might not know what this exactly entails, we can know what this will imply. Protocols will aim to become decentral regardless of the fact what this necessitates. Whatever definition might originate in the future, protocols will do their best to match this definition, increasing complexity while reducing accountability and transparency. The conclusion that can be drawn at the very least, is that the framework provided by MiCAR can be considered obscure in its application to 'decentralised' activities or services which brings with it a dose of uncertainty.

A further point with regards to full decentralisation is worth noting: if crypto asset services are provided by 'fully decentralised' providers, those are also excluded by MiCAR. This means that a fully decentralised exchange, such as Uniswap, may not be subject to MiCAR.[94] This would erase even the gatekeeping role of crypto asset service providers discussed in Section 3c.

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[92] MiCAR, *supra* note 48 at Recital 22.

[93] See Aramonte et al., *supra* note 11.

[94] For a clear comparison between the two see Jackob, A., "*Comparing centralized and decentralised crypto exchanges in 2023[updated]"* Medium (13 June 2023), online: <https://blog.cryptostars.is/comparing-centralized-and-decentralised-crypto-exchanges-in-2023-updated-d69dfb05c639>.

(b) Beyond MiCAR: divergent regulatory approaches and regulatory effectiveness

Beyond the specific assessment of the MiCAR text, it is useful to broaden the view and consider the differences between the regulatory approaches adopted by the EU Regulator and those of the US and UK counterparties. The discussion carried out in Sections 3 and 4 evidence that MiCAR is the most advanced and ambitious project for regulating crypto activities. However, it is also important to highlight that the US proposal on 'Payment Stablecoins Act' and the UK FSMB have a narrower scope and more pragmatic approach. With specific reference to algorithmic stablecoins such a narrow and pragmatic attitude may have regulatory advantages considering the highly technical and complex nature of algorithmic stablecoins.

When comparing the three examined regulatory frameworks further, one should first consider the regulatory approaches that can or should be taken. MiCAR is implementing a new and independent regulatory framework, the FSMB is trying to place digital assets within existing regulation. The US is striving to pass any sort of legislation on crypto activities. In this endeavour, the US legislator seems to switch from encompassing and ambitious bills towards narrower interventions. Without commenting on the specific advantages and disadvantages of these approaches, it is meaningful to recognise these differences in light of the analysis of the effectiveness and adaptability of the regulation.[95]

Second, there are fundamental choices to be made with regards to the goals that the regulation wants to achieve. In financial regulation, some traditional goals of financial regulation are investor/consumer protection, financial stability, market efficiency, competition, the prevention of financial crime and fairness which will have to be considered in a trade-off when designing regulation.[96] From this perspective, a narrow scope and well identified goals favours a more effective regulation of algorithmic stablecoins.

For instance, the ultimate goal of the UK FSMB is to foster innovation and bolster the competitiveness of the UK crypto industry. The exclusion of algorithmic stablecoins from the definition of Digital Settlement Asset follows consequentially. While this approach is not conducive to address the specific risks, the resulting framework is clear and the primary legislation largely empowers secondary regulators to amend and update the framework should it be deemed necessary. The approach US proposal on 'Payment Stablecoins Act' is at once antithetical and similar to the UK one. Antithetical insofar as the goals pursued by the two regulations sharply differ. Similar insofar as the policy goal is narrow and well-

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[95] Whitehead, C. K., "The Goldilocks Approach: Financial Risk and Staged Regulation" (2011) 97 *Cornell L. Rev.* 1267.

[96] Armour, J. et al., "*Principles of financial regulation"* (Oxford University Press) at ch.3.

identified: consumer/investor protection. From this choice the stringent regulation on algorithmic stablecoins that are used as payment method follows naturally. In contrast, MiCAR purports to pursue wide and diversified policy goals, including safeguarding financial stability, protecting investors and fostering innovation.[97] This results in a comprehensive and ambitious framework which is — however — prone to excessive complexities and ambiguities. This is particularly relevant for algorithmic stablecoins as MiCAR does not directly consider those in the primary legislative text, but only indirectly in Recitals, increasing the complexity and ambiguity in the regulatory scope and legal application.

6. Concluding Remarks

This article delves into the characteristics, aspirations and risks of algorithmic stablecoins within the cryptocurrency market. We highlight their distinct features and the risks associated with their unique stabilisation mechanisms and clarify the fundamental differences between algorithmic stablecoins and collateralised stablecoins. Additionally, we highlight that developing a fully algorithmic stablecoin protocol brings about numerous hurdles that might not be easily overcome. It has underscored the importance of understanding the different technological developments driving algorithmic stablecoins and their potential implications for the goals of financial regulation, including financial stability, due to recent examples having market-wide effects.

We carry out an in-depth analysis of the EU MiCAR, showing that algorithmic stablecoins are not specifically targeted by the regulation. The regulation's applicability to algorithmic stablecoins remains limited, as it primarily targets collateralised ARTs and EMTs. Despite some provisions indirectly affecting algorithmic stablecoins, such as those related to crypto asset service providers, MiCAR lacks specific regulations tailored to the risks associated with algorithmic stablecoins, as addressed in Section 2. It is possible to derive the applicable regime to algorithmic stablecoins interpreting MiCAR text together with its Recitals. However, the result is complex and ambiguous. MiCAR falls short in addressing the distinct challenges posed by algorithmic stablecoin protocols, leaving room for further exploration of regulatory frameworks to ensure safety and stability within these protocols.

Looking at other regulatory developments — specifically in the US and UK, we show that EU MiCAR is the most ambitious and advanced piece of crypto regulation. However, its overarching nature and the composite policy goals it pursues risk undermining the effectiveness of the regulatory regime applicable to algorithmic stablecoins.

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[97] See, *supra* note 46.

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