CONFRONTING THE DEFI REVOLUTION: A COMPARATIVE ANALYSIS OF THE APPLICATION OF NEW ZEALAND'S PERSONAL PROPERTY SECURITIES ACT 1999 TO CRYPTOASSETS

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The financial sector in the 21st century is experiencing a revolution. The major disruptor is decentralised finance (DeFi) which leverages emerging blockchain technology to eliminate the need for centralised financial institutions and empowers individuals with peer-to-peer digital exchanges. DeFi is underpinned by cryptoassets such as bitcoin, ether, and non-fungible tokens (NFTs). As DeFi offerings have become increasingly sophisticated, important legal issues have arisen. One such issue is whether the law is appropriately positioned to recognise and give effect to the use of cryptoassets as collateral in lending arrangements. The lack of legal certainty at present poses a substantial risk to market participants who are, for the most part, transacting blindly. This article, therefore, addresses the applicability and comparative suitability of New Zealand's Personal Property Securities Act 1999 (PPSA) to cryptoasset collateral, using the recent Singaporean case of Chefpierre *as a test case. It argues that the PPSA is generally better positioned than English (Singaporean) secured credit law to respond to the emerging use of cryptoassets as collateral. Nevertheless, the challenges posed by cryptoasset collateral necessitate legislative change; in particular, change to the PPSA's perfection requirements and priority rules. After reviewing and analysing recent legal developments in the United Kingdom and the United States, this article proposes that a number of bespoke rules and concepts designed to respond to cryptoassets be introduced into the PPSA.*

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I INTRODUCTION

The world is experiencing a financial "revolution".[1] The major disruptor is decentralised finance (DeFi) which aims to eliminate reliance on centralised intermediaries[2] and thus the need for trust in such entities.[3] By leveraging emerging distributed ledger technology like blockchain,[4] DeFi enables peer-to-peer financial transactions,[5] thereby offering greater accessibility, efficiency and transparency than the traditional centralised financial system.[6] Anyone with an internet connection can trade, borrow, lend and manage assets using software that records and validates transactions in secure, decentralised databases which may be distributed across an entire network of participants.[7] DeFi has experienced "rapid growth and development" in recent years[8] and, with increasing adoption by institutional investors, "the linkages with traditional financial institutions are growing".[9] DeFi's proliferation may also accelerate the ongoing trend toward the "cryptoization" of the global economy.[10]

At the core of the DeFi revolution are cryptoassets. The Bank for International Settlements defines cryptoassets as "private digital assets that depend primarily on cryptography and distributed ledger or similar technology".[11] Familiar cryptoassets include cryptocurrencies such as bitcoin and ether, as well as non-fungible tokens (NFTs).[12] The size of the global cryptocurrency market has grown and

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1 Peter Gomber and others "On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption and Transformation in Financial Services" (2018) 35 Journal of Management Information Systems 220 at 221.

2 Christoph Wronka "Financial crime in the decentralized finance ecosystem: new challenges for compliance" (2023) 30 JFC 97 at 97.

3 Primavera De Filippi, Morshed Mannan and Wessel Reijers "Blockchain as a confidence machine: The problem of trust & challenges of governance" (2020) 62 Technology in Society 101284 at 1.

4 Gomber and others, above n 1, at 237.

5 Wronka, above n 2, at 105.

6 At 97.

7 Kaihua Qin and others "CeFi vs. DeFi – Comparing Centralized to Decentralized Finance" (16 June 2021) arXiv <www.arxiv.org>.

8 Wronka, above n 2, at 103.

9 International Monetary Fund, Monetary and Capital Markets Department *Global Financial Stability Report: Shockwaves from the War in Ukraine Test the Financial System's Resilience* (International Monetary Fund, 19 April 2022) at 66.

10 At 66.

11 Basel Committee on Banking Supervision *Prudential treatment of cryptoasset exposures* (Bank for International Settlements, December 2022) at 32. Digital assets are, in turn, defined as "a digital representation in value which can be used for payment or investment purposes or to access a good or service": at 32.

12 Bitcoin and ether are examples of coins (also known as native tokens). They exist only on their own blockchain; for instance, ether is the native coin of the Ethereum network/blockchain. Coins are issued on

fluctuated dramatically, peaking at approximately USD 3 trillion in November 2021, before crashing to, and plateauing at, around USD 1 trillion in mid-2022.[13] But despite the notorious scams, frauds[14] and crises which partly drive cryptoassets' price fluctuations, and notwithstanding the widespread perception that global uptake of cryptoassets is merely an economic bubble buttressed by "speculative" investing,[15] cryptoassets are likely here to stay.[16]

As DeFi offerings have become increasingly sophisticated, important legal issues have arisen. One such issue is whether the law is appropriately positioned to recognise and give effect to the use of cryptoassets as collateral in lending arrangements. The lack of legal certainty at present poses a substantial risk to market participants. That risk is exacerbated by two aspects of DeFi. First, DeFi arrangements tend to be highly leveraged, with some platforms allowing traders up to 125-times leverage on some assets.[17] Secondly, DeFi generally operates under a narrow banking model,[18] with most lending platforms requiring overcollateralisation to mitigate the risk created by price volatility.[19] Therefore, to fund their highly risky trading, participants will borrow cryptoassets and, in return, post

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their native blockchain through the process of validating transactions (which also creates new blocks in the blockchain). This process is regulated by a consensus algorithm, which in the case of Ethereum is "proof-of-stake". Tokens (or non-native tokens) are cryptoassets without their own blockchain. They are additional assets created on top of other (native) assets' blockchains and can be issued on multiple blockchains. Tokens are created by smart contracts, rather than by the process of validating transactions. There are a multitude of tokens that serve a variety of purposes. Stablecoins are tokens whose prices are pegged to traditional assets like the US Dollar. The benefit of adding such additional assets on-chain is that, whilst it would be possible to use native coins, "many financial contracts require a low-volatility asset, [and tokenisation] enables the creation of [such] assets": Fabian Schär "Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Markets" (2021) 103 Federal Reserve Bank of St Louis Review 153 at 158. Another distinct category of token is non-fungible tokens (NFTs): at 160.

13 CoinGecko "Global Cryptocurrency Market Cap Charts" (11 September 2023) <www.coingecko.com>.

14 See for example Natalie Sherman and Joe Tidy "Crypto giant FTX collapses into bankruptcy" (12 November 2022) BBC <www.bbc.com>.

15 Wronka, above n 2, at 105.

16 Campbell Pentney, Zac Kedgley-Foot and Sebastien Aymeric "The Big Picture: Blockchain and Cryptocurrency" (12 December 2022) Bell Gully <www.bellgully.com>.

17 International Monetary Fund, Monetary and Capital Markets Department *Global Financial Stability Report: COVID-19, Crypto, and Climate: Navigating Challenging Transitions* (International Monetary Fund, October 2021) at 45.

18 Igor Makarov and Antoinette Schoar *Cryptocurrencies and Decentralized Finance* (Bank for International Settlements, BIS Working Paper 1061, December 2022) at 3.

19 International Monetary Fund, above n 9, at 66. Overcollateralisation is the posting of collateral which has a value in excess of the loan amount. It is accomplished by setting discount factors for different (types of) cryptoassets. For example, if the discount factor for a particular cryptoasset is 0.4, borrowers can borrow up to 40 per cent of the value of the cryptoasset collateral posted.

a significantly greater value of cryptoassets as collateral.[20] In a market where leverage and collateral are so important, it is crucial that parties have certainty as to the legal nature and enforceability of their arrangements.

In light of the significant global consideration and implementation of law reform in this area, this article explores and analyses how the Personal Property Securities Act 1999 (PPSA) applies to cryptoasset-collateralised lending arrangements, using *Janesh s/o Rajkumar v Unknown Person ("CHEFPIERRE")* (*Chefpierre*) as a test case.[21] Part II deals with questions of legal taxonomy, concluding that cryptoassets constitute personal property and thus can be subject to the PPSA. Part III outlines *Chefpierre* and the nature of lending arrangements on NFTfi. Part IV appraises the English (Singaporean) approach to secured credit law, arguing that its granularity and formalism render it inadequate for the purposes of creating security interests in cryptoassets. Part V applies the PPSA to *Chefpierre*, canvassing statutory provisions relating to the creation, attachment, perfection and enforcement of security interests in doing so. I posit that, as regards upholding DeFi parties' intentions by providing legal recognition to their arrangements, the PPSA is preferable to English secured credit law. Nevertheless, the novel challenges posed by cryptoasset collateral arrangements demand legislative reform. Part VI, therefore, reviews recent developments in the United Kingdom and the United States and proposes the incorporation of two bespoke rules into the PPSA: (i) a new method for the perfection of security interests in cryptoassets; and (ii) the granting of super-priority to secured parties who perfect their security interests in cryptoassets by that method. Part VII concludes.[22]

II CRYPTOASSETS AS PROPERTY

When parties enter into a secured lending transaction, they want to be certain that the law will give effect to the rights and obligations they intend to create in relation to the purported collateral. For transactions involving cryptoasset collateral to achieve appropriate legal recognition and certainty in New Zealand, they must fall under the scope of the PPSA. This will be the case only if cryptoassets constitute personal property.

Under the PPSA, "personal property includes chattel paper, documents of title, goods, intangibles, investment securities, money, and negotiable instruments".[23] The definition of "personal property" does not identify any essential characteristics of personal property nor elucidate when a thing is capable of being personal property.[24] Instead, a thing is first deemed to be personal property at

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20 At 75.

21 *Janesh s/o Rajkumar v Unknown Person ("CHEFPIERRE")* [2022] SGHC 264 [*Chefpierre*].

22 Key terms in this article are defined in a glossary in Part VIII.

23 Personal Property Securities Act 1999 [PPSA], s 16 definition of "personal property".

24 Linda Widdup *Personal Property Securities Act: Concepts in Practice* (4th ed, LexisNexis, Wellington, 2016) at [5.1].

common law and then, for the purposes of the Act, categorised within one of the seven enumerated components of personal property. Therefore, one must turn to the common law to determine whether cryptoassets constitute personal property.

A Personal Property at Common Law

The common law recognises only two categories of personal property: choses in possession and choses in action.[25] Choses in possession refer to moveable, "tangible things of which physical possession can be taken and rights in relation to which can be asserted by use and enjoyment".[26] Choses in action refer to intangible things which have no independent form and exist only insofar as they are recognised by law;[27] rights in such things can only be obtained or enforced by legal action, and not by taking physical possession.[28]

Rights to cryptoassets can be asserted by use and enjoyment.[29] A person who has knowledge of, or access to, the relevant private key[30] can spend, transfer, or otherwise use a cryptoasset.[31] However, they are simply strings of data and thus intangible things that are incapable of being possessed.[32] Therefore, cryptoassets are not choses in possession.[33]

A quintessential chose in action is a bank deposit.[34] Since deposited money is the bank's and not the customer's, there is nothing in the bank's hands which belongs to the customer that the latter can enforce their rights in by taking physical possession.[35] Consequently, a bank deposit is simply a legal claim by the customer (the creditor) against the bank (the debtor) for the amount held (the debt).[36]

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25 *Colonial Bank v Whinney* [1885] 30 Ch D 261 (CA) per Fry LJ.

26 Matteo Solinas "Pushing the Boundaries: A Tentative Taxonomy of Money in New Zealand Private Law" (2021) 52 VUWLR 607 at 617.

27 Law Commission of England and Wales *Digital Assets: Final report* (Law Com No 412, June 2023) at [3.19].

28 Solinas, above n 26, at 617.

29 Law Commission of England and Wales, above n 27, at [3.32].

30 A private key is a string of alphanumeric characters – similar to a password – which is used to authorise a cryptoasset transaction. Access to the private key therefore allows for control of the cryptoassets associated with the corresponding public key: see HM Treasury *Future financial services regulatory regime for cryptoassets: Consultation and call for evidence* (February 2023) at 49.

31 Satoshi Nakamoto *Bitcoin: A Peer-to-Peer Electronic Cash System* (2008) at 1–2.

32 Solinas, above n 26, at 617.

33 At 617.

34 *Foley v Hill* (1848) 2 HLC 28, 9 ER 1002 (HL).

35 *Foley v Hill*, above n 34.

36 *Foley v Hill*, above n 34.

But the "chain of digitised information" that comprises a cryptoasset "is not a legal claim for the payment of money".[37] Although a participant can view their total cryptocurrency balance by using software, giving the impression that it is similar to a bank account/deposit, at no point in the blockchain's protocol is a central intermediary involved who records participants' accounts and validates transfers.[38] Consequently, "it is impossible to identify a person against whom action could be taken to vindicate those proprietary rights".[39] In short, there is "no individual counterparty"[40] to the cryptoasset holder's right and thus "no one to take on the role of a debtor" within the network.[41] Accordingly, cryptoassets "cannot be conceived of as rights or claims in themselves";[42] they are, instead, "things to which rights can relate".[43] Furthermore, unlike the creditor's right to be repaid by the bank, cryptoassets exist independently of the legal system and "can be used and enjoyed independently of whether any rights or claims in relation to them are enforceable by action".[44] Therefore, cryptoassets – although intangible things – are not, in the orthodox, narrow sense, choses in action.[45]

Cryptoassets exhibit elements of each category of personal property, but do not fit neatly into either.[46] It is therefore difficult to reconcile the legal nature of cryptoassets with the common law's chose in action/chose in possession dichotomy. Despite this, the view that cryptoassets are personal property is the consensus amongst most legal scholars[47] and the conclusion that the common law has quite firmly reached in recent years.[48] This view was endorsed in New Zealand by the High Court in *Ruscoe v Cryptopia Ltd (in liq)*.[49] In *Cryptopia*, the High Court did not treat the common law's

37 Solinas, above n 26, at 617.

38 At 617.

39 At 617.

40 *ByBit Fintech Ltd v Ho Kai Xin* [2023] SGHC 199 at [34].

41 Solinas, above n 26, at 617.

42 Law Commission of England and Wales, above n 27, at [3.32].

43 At [3.52].

44 At [3.32].

45 Solinas, above n 26, at 617.

46 At 616.

47 At 619. See also David Fox "Cryptocurrencies in the Common Law of Property" in David Fox and Sarah Green (eds) *Cryptocurrencies in Public and Private Law* (Oxford University Press, Oxford, 2019) 153; and Kelvin FK Low and Ernie GS Teo "Bitcoins and other cryptocurrencies as property?" (2017) 9 Law Innov Technol 235 at 249–252.

48 Law Commission of England and Wales, above n 27, at [2.50].

49 *Ruscoe v Cryptopia Ltd (in liq)* [2020] NZHC 728, [2020] 2 NZLR 809.

categories of personal property as the starting point.[50] Instead, the Court's approach was to first determine if a thing is property; from there, since all personal property must necessarily be either a chose in action or a chose in possession, that thing is exclusively categorised within the binary.[51] In this way, the two recognised categories of personal property were not intended to force a "narrow view of what can be classified as property, but rather [to] simply … push all examples of property into one of two categories".[52] To determine whether cryptocurrencies were capable of being property,[53] Glendall J applied Lord Wilberforce's oft-cited statement of the characteristics of property in *National Provincial Bank v Ainsworth*.[54] Glendall J held that cryptocurrencies satisfy the *Ainsworth* criteria in that they are definable, identifiable by third parties, capable in their nature of assumption by third parties and have some degree of permanence and stability.[55] Having established that cryptocurrencies are property, to accord with the dictum that all personal property must be of one of two kinds, his Honour determined that "the most that could be said is that cryptocoins might have to be classified as choses in action" given that they are incapable of being possessed.[56] This notion, which has been independently recognised and approved in Singapore,[57] provides for choses in action to be treated as a wide, residual category of things that "captures any object of personal property rights that is not a [chose] in possession".[58] As such, a broader and more flexible conceptualisation of personal property which captures cryptoassets is possible at common law.[59]

However, relying on a residual, catch-all category of choses in action to recognise cryptoassets as property is not a universally accepted proposition. The Law Commission of England and Wales proposes an alternative approach: that the law unequivocally recognises that a thing will not be deprived of legal status as personal property merely because it is neither a chose in possession nor a (true) chose in action.[60] Such recognition is accomplished by the creation of a new, third category of

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50 At [123].

51 At [124].

52 At [124].

53 At [102].

54 *National Provincial Bank v Ainsworth* [1965] AC 1175 (HL).

55 *Cryptopia*, above n 49, at [116].

56 At [124].

57 See *ByBit Fintech*, above n 40.

58 Law Commission of England and Wales, above n 27, at [2.49].

59 Solinas, above n 26, at 617.

60 Law Commission of England and Wales, above n 27, at [3.68].

personal property.[61] "Third category things"[62] would explicitly include cryptoassets.[63] The thrust and merits of the Law Commission's approach are not within the scope of this article.

B Categorisation Under the PPSA

This article proceeds on the assumption that cryptoassets are personal property and thus can be subject to the PPSA when purportedly used as collateral. A further consideration is exactly how the PPSA would apply. As noted above, the PPSA's definition of "personal property" is more akin to a description, simply identifying seven categories of collateral which are "defined so that every conceivable type of personal property falls within only one of the categories".[64] Although the PPSA generally applies uniformly to all personal property, certain provisions only apply, or apply differently, depending on the category of collateral into which the personal property in question falls. Of the prescribed categories, only two – intangibles and money – could capture cryptoassets. Notably, these are mutually exclusive categories: if a cryptoasset constitutes "money", it cannot also be an "intangible".[65]

"Intangible" is defined as "personal property other than chattel paper, a document of title, goods, an investment security, money, or a negotiable instrument".[66] It is a residual category, meaning that a thing which is personal property, but which does not fall within any of the six other prescribed categories, is an "intangible" for the purposes of the Act.[67] Although such treatment as a residual category seems rather inclusive, "the other categories are intended to be defined so precisely that only intangible personal property will fall within the intangible category".[68] Generally, all cryptoassets will be treated as intangibles. The only exception is if certain cryptoassets, specifically cryptocurrencies such as bitcoin, are instead deemed to constitute money. "Money" means "currency authorised as a medium of exchange by the law of New Zealand or of any other country".[69] Until recently, there was no question as to whether cryptocurrencies constituted money under the PPSA or equivalent overseas legislation. But that is no longer the case: the government of El Salvador authorised bitcoin as legal

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61 At [3.65].

62 As they are termed by the Law Commission of England and Wales, above n 27, at [2.46].

63 At [3.68].

64 Widdup, above n 24, at [5.1].

65 PPSA, s 16 definition of "intangible".

66 Section 16 definition of "intangible".

67 Widdup, above n 24, at [5.26].

68 At [5.26].

69 PPSA, s 16 definition of "money".

tender, and thus a medium of exchange, in 2021.[70] On a plain reading of the PPSA, it follows that at least bitcoin is caught by the definition of "money" and is therefore expressly excluded from constituting an intangible.[71] However, such a reading, absent further statutory interpretation, is incomplete. Under the Act, "money" is restricted to tangible, physical legal tender; that is, notes and coins.[72] This interpretation is supported by the fact that other things which could reasonably be considered money in the colloquial sense are instead captured by different categories of collateral. For instance, bank deposits, which are private money and a medium of exchange, are instead captured by a distinct defined term, "account receivable", a subcategory of "intangible".[73] Likewise, cheques fall under the definition of "negotiable instrument", a distinct category of collateral.[74] The definition of "cash proceeds" also distinguishes "money" from "deposit accounts", "cheques", and "drafts".[75] Furthermore, the definition of "intangible" expressly excludes "money", suggesting that "money" is intended to capture only physical/tangible things.[76] Therefore, bitcoin and other cryptocurrencies would not be categorised as "money" under the PPSA.

It follows that cryptoassets will be subject to the PPSA's intangible-specific rules in addition to its general provisions. I recommend that cryptoassets be explicitly included as a defined term in the PPSA – like "account receivable" – so that they are identified as a specific subcategory of the residual "intangible" category of personal property. This would allow for the drafting of rules which apply specifically to cryptoassets on account of their unique nature, thereby providing for cryptoassets to be treated differently, where necessary, from intangibles generally.

III CHEFPIERRE

The 2022 Singaporean case of *Chefpierre* concerned a borrower who regularly entered into lending arrangements on NFTfi, a peer-to-peer NFT-collateralised cryptocurrency lending platform.[77]

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70 Oscar Lopez and Ephrat Livni "In Global First, El Salvador Adopts Bitcoin as Currency" *The New York Times* (online ed, New York City, 7 September 2021).

71 Sam Babe, Tamie Dolny and Angela Oh "Virtual Collateral 101: How to Take and Enforce Security Over Cryptocurrencies, Crypto-Assets and Central Bank Digital Currencies" (19 April 2023) Aird Berlis <www.airdberlis.com>.

72 Widdup, above n 24, at [14.13].

73 See PPSA, s 16 definition of "account receivable".

74 Section 16 definition of "negotiable instrument".

75 Section 16 definition of "cash proceeds".

76 Section 16 definition of "intangible".

77 NFTfi has reportedly facilitated more than 65,000 loans with an aggregate loan volume of approximately USD 600 million: see NFTfi "Home" (6 October 2024) <www.nftfi.com>.

NFTfi lending arrangements are facilitated by smart contracts.[78] NFTfi's user interface allows parties to negotiate key terms: the quantum, interest rate and duration.[79] If they indicate their mutual agreement on the platform, two transactions are automatically executed.[80] First, the NFT offered as collateral by the borrower is immobilised and held in escrow, though without a third party (like NFTfi) acting as custodian or escrow agent.[81] Instead, the NFT is transferred to NFTfi's "escrow smart contract", an "automated quasi-escrow agent".[82] Throughout the duration of the loan, "the de facto owner of the NFT … is the smart contract. No one (also not the NFTfi team) can access the NFT during that time".[83] Secondly, the lender's funds are transferred into the borrower's account. The NFT can only be withdrawn upon full repayment of the loan, at which point it is automatically transferred back to the borrower.[84] The smart contract provides the lender with a unilateral "foreclosure" option, exercisable only in the event of default.[85] Upon default, the loan can no longer be repaid, even if the lender has not yet foreclosed.[86] If the lender forecloses, it becomes the sole owner of that NFT[87] and waives its claim for the outstanding amount.[88] These, per NFTfi's Terms & Conditions, are "predefined rules which apply to every loan".[89]

On 19 March 2022, the borrower entered into a loan agreement with a user whom he knew only by the pseudonym "chefpierre.eth" ("Chefpierre") for 150,000 DAI (equivalent at the time to USD 150,000).[90] The borrower offered a particularly rare and valuable NFT as collateral.[91] Because the NFT was immensely precious to him,[92] his loan agreement with Chefpierre contained a number of

78 NFTfi "How NFT lending works" <www.nftfi.com>. Refer to Part VIII for a definition of "smart contract".

79 Timothy Chan and Kelvin FK Low "DeFi Common Sense: Crypto-backed Lending in *Janesh s/o Rajkumar v Unknown Person ('CHEFPIERRE')*" (2023) 86 MLR 1278 at 1280.

80 NFTfi, above n 78.

81 NFTfi "Terms & Conditions" (25 May 2023) <www.nftfi.com>.

82 Chan and Low, above n 79, at 1281.

83 NFTfi, above n 78.

84 NFTfi, above n 78.

85 NFTfi, above n 78.

86 NFTfi, above n 78.

87 NFTfi, above n 78.

88 Chan and Low, above n 79, at 1280.

89 NFTfi, above n 81.

90 *Chefpierre*, above n 21, at [17].

91 At [10].

92 At [11].

additional terms which attempted to vary or otherwise set aside the standard terms on which NFTfi invites parties to contract.[93] For instance, at no point was the lender to use the foreclosure option within the smart contract without first granting the borrower reasonable opportunities to make full repayment of the loan.[94] And, notwithstanding the existence of the option:[95]

> At no point would the lender obtain ownership, nor any right to sell or dispose of the Bored Ape NFT. The lender could only, at best, hold on to the Bored Ape NFT, pending repayment of the loan.

The borrower was unable to repay the loan by the due date.[96] After negotiations for an extension of time failed, Chefpierre exercised the "foreclosure" option, transferring the NFT from NFTfi's escrow smart contract into his cryptocurrency wallet.[97]

Notwithstanding that the decentralised nature of blockchain posed difficulties vis-à-vis establishing jurisdiction, Lee Seiu Kin J held that there must be a court which had jurisdiction and could serve as an appropriate forum to hear the dispute.[98] Since the claimant was located in Singapore and carried on his business there, "that court was the Singapore court".[99]

The High Court of Singapore then affirmed that a court can grant an injunction against a person unknown so long as that person is sufficiently described.[100] The description of the defendant as (i) the "user behind the account 'chefpierre.eth' on Twitter and Discord as of the date of filing of this Application"[101] and (ii) the "person to whom the Bored Ape NFT had been transferred"[102] was sufficiently certain to identify both those who were included and those who were not.[103] Thus, the pseudonymous nature of the transaction did not preclude the claimant from seeking relief.[104] Additionally, it was held to be acceptable, given practical limitations, for the claimant to serve court

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93 At [11].

94 At [11].

95 At [11].

96 At [20].

97 At [21].

98 At [30].

99 At [30].

100 At [41].

101 At [40].

102 At [40].

103 At [41].

104 At [42].

papers on Chefpierre through online chat platforms and the messaging function of the latter's cryptocurrency wallet.[105]

Because Lee Seiu Kin J dealt with an interlocutory, ex parte application for a proprietary injunction, *Chefpierre* does not offer a meaningful discussion of the potential personal property security issues given rise to. Hence, these issues will be discussed first in relation to English law (which is aligned fully with the Singaporean approach). Then, I will explore how the PPSA would likely apply had the facts arisen in New Zealand.

IV THE ENGLISH APPROACH

The English approach to secured credit law can be described as "formalistic" because it recognises and differentiates between four types of security interests in personal property, the applicability of which depends on the nature of the property in question.[106] Security interests are either possessory – (contractual) liens and pledges – or nonpossessory – (equitable) charges and mortgages. Possessory security interests apply only to tangible property; nonpossessory security interests can be created in both tangible and intangible property.[107] Even setting aside the additional terms bargained for in *Chefpierre* – which only add to the uncertainty – the arrangement illustrates the difficulties of unequivocally ascertaining and characterising the secured party's interest under English law.[108] Plainly, the lender's interest in the collateral cannot be a pledge or a lien because the borrower cannot deliver physical possession of the intangible NFT to the lender.[109] Although non-possessory security interests can theoretically be granted in cryptoassets, characterising the lender's interest in the NFT as either a mortgage or a charge is implausible.[110]

The arrangement contained a right of "foreclosure" on the lender's part and a coded right of redemption on the borrower's part; features consistent with a mortgage. Furthermore, the smart contract's "foreclosure" option appears to be consistent with the legal power to foreclose vested in a mortgagee, since its exercise extinguishes the borrower's proprietary interest in the NFT and imposes no obligation on the lender to account to the borrower for any surplus value.[111] Nevertheless, it is unlikely that the arrangement created a mortgage.[112] A legal mortgage over personal property requires

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105 At [91].

106 Roy Goode and Louise Gullifer *Goode and Gullifer on Legal Problems of Credit and Security* (6th ed, Sweet & Maxwell, London, 2017) at 5.

107 At 6.

108 Chan and Low, above n 79, at 1289.

109 Goode and Gullifer, above n 106, at 6.

110 Chan and Low, above n 79, at 1290.

111 At 1289.

112 At 1289.

title in the collateral to be transferred to the mortgagee at inception (on the condition that it will be re-transferred on the discharge of the secured obligations).[113] This is inconsistent with standard NFTfi loan agreements, under which legal ownership of an NFT is transferred only upon exercise of the foreclosure option in the event of a debtor's default.[114] Moreover, as Chan and Low, in an article analysing *Chefpierre*, observed:[115]

> … insofar as the code purports to grant the lender the option of foreclosing as a self-help remedy, this is fundamentally incompatible with the principle that foreclosure must always be an act of the court.

The lender's interest is also unlikely to constitute a charge because foreclosure is unavailable to chargees.[116] Furthermore, the existence of a charge is inconsistent with the notion that the lender, upon foreclosure, becomes the owner of the NFT. A charge only allows the chargee, upon default, to have the collateral and its proceeds of sale appropriated to the discharge of the debt in question;[117] it does not vest in the chargee the right to own or possess the collateral.[118] But when a lender enforces their rights via the "foreclosure" option, they are not obliged to sell the NFT and can instead retain it as their property. In any case, the fact that enforcing a charge necessarily involves selling the collateral[119] raises practical difficulties in a market where price volatility and uncertain liquidity "may render the sale of collateral difficult or ineffective as a mechanism for realising its full market value".[120] Therefore, even if it can be validly granted, a charge is not particularly suitable for cryptoassets.

The limitations of the English (Singaporean) model are readily apparent: although participants of NFTfi and similar platforms clearly intend to create legal rights and obligations commensurate with security being taken in the cryptoassets offered as collateral, it is unclear what security interest is actually created.[121] In particular, the requirements pertaining to the creation of nonpossessory security interests and the rules governing their enforcement are granular and formalistic – perhaps to the extent that such security interests are either inapplicable because of how cryptoasset-collateralised

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113 Michael Bridge *Personal Property Law* (4th ed, Oxford University Press, Oxford) at 281.

114 NFTfi, above n 78.

115 Chan and Low, above n 79, at 1289.

116 At 1290.

117 Goode and Gullifer, above n 106, at 37.

118 Bridge, above n 113, at 284.

119 Law Commission of England and Wales *Digital Assets: Consultation paper* (Law Com No 256, July 2022) at [18.22].

120 At [18.14(3)].

121 Chan and Low, above n 79, at 1289.

arrangements are commonly structured, or practically unsuitable because of the novel qualities of cryptoassets and the cryptoasset market.

A more suitable approach is one sufficiently broad and flexible to circumvent the challenges created by legal granularity and formalism. The PPSA, if amended to integrate bespoke principles which can address the idiosyncratic features of cryptoassets, would provide a superior framework.

V THE PPSA

The structural and functional basis of the PPSA is founded on Canadian legislation, which is itself modelled on art 9 of the American Uniform Commercial Code.[122] The PPSA was born from calls for reform in the late 20th century, with the most important initiatives coming from the New Zealand Law Commission in 1988 and 1989.[123] New Zealand's secured credit law at the time, which shared many similarities with present-day English law, was considered to be in an unsatisfactory state, being "overly complex, inconsistent and inaccessible".[124] In response, the PPSA offered a substance-over-form approach which sought to ensure that the law applied consistently to all transactions that were "functionally equivalent" and essentially served the same purpose.[125]

A Creation

Unlike English law, the PPSA does not recognise nor provide for different security interests;[126] its statutory "security interest" is a broad, catch-all concept which can be granted in all personal property, including intangibles.[127] A security interest is created without regard to the form of the transaction[128] which creates or provides for the interest and the identity of the person who has title to the collateral.[129]

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122 Richard North "The New Zealand Personal Property Securities Act: Growing Pains" (2005) 11 Canta LR 123 at 123.

123 Anthony Duggan and Michael Gedye "Personal Property Security Law Reform in Australia and New Zealand: The Impetus for Change" (2009) 27 Penn St Intl L Rev 655 at 659.

124 Widdup, above n 24, at [1.1].

125 At [1.2].

126 At 5. However, there are some exceptions to this general rule. The PPSA applies to the various security interests that can be created at common law – charges, mortgages and pledges – all of which are treated as statutory security interests: see s 17(3). The PPSA also provides limited recognition to common law liens and s 93 provides that a common law lien has priority over a statutory security interest in certain circumstances.

127 At 6.

128 PPSA, s 17(1)(a)(i).

129 Section 17(1)(a)(ii).

Subject to the limited exceptions in s 23, an interest in personal property constitutes a "security interest" under the PPSA if:

(i) it falls within the general definition of "security interest" under s 17(1)(a) as an "interest in personal property created or provided for by a transaction that in substance secures payment or performance of an obligation"; or

(ii) it is a deemed security interest – an interest identified in s 17(1)(b) – even if it does not fall within the above definition.

Section 17(1)(b) provides for three deemed security interests: transfers of accounts receivable or chattel papers, leases for a term of more than one year, and commercial consignments. Although these transactions do not secure payment or performance of an obligation,[130] they are deemed to be security interests in accordance with the PPSA's substance-over-form approach to secured credit law.[131] However, none of the deemed security interests are applicable to cryptoasset collateral. If a security interest in cryptoassets exists, it will be by virtue of s 17(1)(a).

In *Chefpierre*, the lender's interest in the NFT was created by a transaction that in substance secured payment by the borrower of the loan amount. But it will only be a security interest for the purposes of s 17(1)(a) if "it reveals that the debtor encumbered the property by granting real rights in it to the creditor".[132] To ascertain whether the parties intended to create "real" rights in the borrower's asset(s) in favour of the lender, courts will look to the language used when creating their contractual relationship.[133]

Whilst the arrangement certainly encumbered the borrower's rights in the NFT by restricting his ability to deal with (ie control) it as if he were its absolute owner, it is unclear whether any "real" rights in the NFT were intended to be granted to Chefpierre. Even though after foreclosure the NFT would be stored in Chefpierre's cryptocurrency wallet, the additional terms provided that the only right he gained in the NFT – even after default – was merely the right to hold it for an indeterminate period, until full repayment of the loan was effected. This suggests that Chefpierre could not look to the NFT to discharge the borrower's obligation. In that case, he is unlikely to have gained proprietary rights in the collateral, and characterising Chefpierre's interest as a PPSA security interest is an uncertain proposition. However, the additional terms directly contradicted the standard, predefined

130 Widdup, above n 24, at [3.1].

131 At [3.2]. A lease for a term of more than one year, for instance, constitutes a security interest because the PPSA recognises that such leases "generally serve as devices for financing acquisition of effective ownership of an asset": see New Zealand Law Commission *A Personal Property Securities Act for New Zealand* (NZLC R8, 1989) at 90.

132 Widdup, above n 24, at [2.31].

133 At [2.33].

terms on which NFTfi invites parties to contract. It is unclear whether the additional terms are effective – that is, if they successfully vary or invalidate the rights and obligations concerning the collateral contemplated by boilerplate NFTfi lending arrangements.

Setting aside then the additional terms, what rights were granted to the lender? Plainly, the borrower encumbered the collateral by granting the lender the right to take control of (ie transfer to his cryptocurrency wallet) the NFT in the event of default. At this point, the lender gained "real" proprietary rights in the collateral and was entitled to look to it to satisfy the borrower's obligation – he could sell or keep it as he pleased. But there is an important caveat: a PPSA security interest is "a mere encumbrance on the property and does not transfer any 'ownership' interest to the secured party".[134] So, does the notion of the lender acquiring ownership of the NFT upon foreclosure[135] invalidate the existence of a security interest? I suggest it does not. NFTfi lending arrangements do not transfer an ownership "interest" in the NFT to the lender for the period of the loan. They instead provide for ownership of the NFT to be transferred to the lender following default, at which point the loan period has expired. In other words, "foreclosure" is simply how a lender enforces their security interest in an NFT. The effect of foreclosure on ownership is therefore better understood as the result of a security interest being enforced. Similarly, the transfer of ownership of collateral from a borrower to a secured party is a result consistent with the valid enforcement of a PPSA security interest.[136]

Therefore, regardless of whether the particular transaction in *Chefpierre* created a security interest, there are no difficulties in categorising a lender's interest that is created by a standard NFTfi transaction as falling within s 17(1)(a) of the PPSA and so constituting a statutory security interest.

The lender in a boilerplate NFTfi arrangement can be more confident that the arrangement creates a PPSA security interest in the lender's favour than whether it creates a valid mortgage or charge under English law. Indeed, most cryptoasset-collateralised lending arrangements, regardless of their form, are likely caught under s 17(1)(a) and thus subject to the PPSA. The PPSA's comparative lack of granularity and formalism means it is better suited than English law to recognise security interests in cryptoassets and, in so doing, give legal effect to the rights and obligations DeFi parties intend to create.

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134 At [2.6].

135 NFTfi, above n 81.

136 PPSA, s 123.

B Enforcement

In contrast to English law, where the manner of enforcement available to secured parties depends on the type of security interest created,[137] enforcing a PPSA security interest is comparatively more straightforward.

Secured parties must comply with pt 9 of the PPSA except to the extent that the enforcement provisions have been contracted out of by the parties under s 107.[138] Once a debtor has defaulted, a secured party generally has the option of either selling the collateral or retaining it. If there are multiple secured parties, any one of them, no matter their priority, can seize and sell the collateral.[139] If a secured party opts to sell the seized collateral, it must provide notice to the debtor and any higher-priority secured parties.[140] A court may make an order directing the manner in which any notice is to be given or dispensing with the giving of the notice.[141] New Zealand courts – like the High Court of Singapore in *Chefpierre* – may consider notice by way of digital messaging platforms to be satisfactory given the pseudonymous nature of cryptoasset transactions. The sale extinguishes all security interests in the collateral.[142] The sale amount goes to the secured parties in order of priority up to the amount they are owed. Any surplus amount goes to the debtor.[143] An alternative to selling the collateral is to retain it.[144] Retention transfers ownership of the collateral to the secured party and all security interests in it are extinguished.[145] However, this option is available only to the party with the first-priority security interest and in the absence of objection by other secured parties.[146]

In *Chefpierre*, the lender was the only secured party and so, by default, the highest-ranking secured party. Therefore, how he enforced his security interest – whether by selling or retaining the NFT – would be at his discretion. For instance, if he was unlikely to realise the full market value of the NFT at the time of default, he could opt to retain or hold it awaiting more favourable conditions. For reasons already discussed, with respect to cryptoassets, such flexibility is practically advantageous. But supposing there was another secured party who had a higher-ranking security

137 Refer to the discussion in Part IV about the enforcement of charges under English law.

138 Widdup, above n 24, at [31.1].

139 PPSA, s 109.

140 Section 114(1).

141 Section 186.

142 Section 115.

143 Sections 116A–117.

144 Section 120.

145 Section 123.

146 Sections 120–122.

interest in the collateral, Chefpierre would have been unable to retain the NFT. This outcome undermines the comparative practical benefits of enforcement under the PPSA. However, the law reform I propose here[147] would lead to secured parties in Chefpierre's position always having the highest-ranking security interest in the cryptoasset collateral and thus the option to retain it upon default, assuming all perfection requirements are satisfied.

C Attachment

For a security interest to become effective and legally enforceable, it must attach to the collateral.[148] Such attachment is also a prerequisite for the perfection of a security interest.[149] The following analysis assumes that Chefpierre's interest in the NFT constitutes a PPSA security interest.

The PPSA provides for two levels of attachment: one for enforcing a security interest against a party to the security agreement (the debtor), and the other for enforcing a security interest against a third party (such as a competing secured creditor).[150] Both levels of attachment require that: (i) value is given by the secured party; and (ii) the debtor has rights in the collateral. [151] Where the security interest is enforced against the debtor, only these requirements must be satisfied for valid attachment. Where a security interest is enforced against a third party, in addition to these requirements, the requirements specified in s 36 must be satisfied.[152] Since Chefpierre's security interest would be enforced against only the borrower, only the first two requirements apply. Chefpierre gave value for the collateral in the form of the cryptocurrency lent to the borrower, and the borrower, who owned the NFT, had rights in the collateral. Thus, both requirements would have been satisfied and Chefpierre's security interest would have attached to the NFT.

Although there were no competing secured creditors, it is worthwhile determining whether s 36 would have been complied with. Section 36 is satisfied either if the collateral is in the possession of the secured party or if a security agreement containing an adequate description of the collateral is signed by, or otherwise assented to, by the debtor.[153] Because one cannot "possess" intangible cryptoassets, s 36 cannot be satisfied by taking possession of an NFT.[154] In any case, s 36 is more

147 Refer to the discussion about priority in Part VI.

148 Widdup, above n 24, at [8.1].

149 PPSA, s 41(1)(a).

150 Section 40.

151 Section 40(1).

152 Section 40(1).

153 Section 36.

154 This is subject to s 18 of the PPSA, which provides for an extended definition of "possession" in certain cases, including in relation to intangible investment securities. Section 18 is discussed in Part V(D).

usually satisfied by means of a security agreement.[155] In *Chefpierre*, the loan agreement assented to by the debtor described the collateral as a particular Bored Ape Yacht Club NFT with the ID #2162.[156] Since each NFT ID is unique to a specific non-fungible token,[157] this description allows the NFT used as collateral to be identified and is thus an "adequate description".[158] On that basis, s 36 is satisfied.

D Perfection

Perfection refers to steps required by statute to give "publicity"[159] to security interests and thus minimise the risk of:[160]

> … third-party transacting decisions and claims being undermined by an 'invisibility of security interests', and of the value realisable by third parties being compromised by the existence of undisclosed priority security interests.

Separately, but of equal importance, perfection enables secured parties to protect their interests in collateral by ensuring the effectiveness of those interests against the (potential) interests of competing third parties, including transferees and other secured parties.[161]

A common statutory formality requirement to achieve perfection is registration. A PPSA security interest is perfected when a financing statement relating to the collateral is registered on the Personal Property Securities Register (PPSR),[162] a publicly available online database.[163]

As regards cryptoasset collateral, perfection by registration creates three main difficulties. First, the additional cost and administrative burden[164] imposed on parties by registration runs counter to the "underlying philosophy" of DeFi arrangements, which are designed to be more expedient and less regulated than the traditional financial system.[165] Another core tenet of DeFi is that it purports to be

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155 Widdup, above n 24, at [8.18].

156 *Chefpierre*, above n 21, at [2].

157 Schär, above n 12, at 160.

158 PPSA, s 36(1)(b)(i).

159 Louise Gullifer "What Should We Do about Financial Collateral?" (2012) 65 CLP 377 at 386.

160 Law Commission of England and Wales, above n 119, at [18.99].

161 Widdup, above n 24, at [9.1]; and Law Commission of England and Wales, above n 27, at 190.

162 PPSA, s 41(1)(b)(i).

163 Personal Property Securities Register "What is the PPSR?" (5 March 2018) <www.ppsr.companies office.govt.nz>.

164 Law Commission of England and Wales, above n 27, at [8.49].

165 Matteo Aquilina, Jon Frost and Andreas Schrimpf "Decentralized Finance (DeFi): A Functional Approach" (2024) 10 Journal of Financial Regulation 1 at 2.

"trustless".[166] Of course, that is not entirely true – participants must still trust the protocol and overall system[167] – but, in principle, it means that they can transact only on the faith of the immutable blockchain. Such an ostensibly "trustless" model is difficult to reconcile with requiring participants to register, check and otherwise rely on an external register maintained by a third party who exists off-chain.[168]

Moreover, relying on an external register to determine priority and thus the available method(s) of enforcement, as well as the order of distribution in the case of a sale, will lead to slower enforcement of security interests.[169] This is disadvantageous in the context of cryptoasset markets where, for reasons already discussed, time is often of the essence when a debtor defaults. Maintaining a registration requirement would also hamper the liquidity and efficiency of cryptoasset markets.[170] Additionally, since built-in pseudonymity is one of the attractions of DeFi lending, maintaining that is generally considerably important to participants.[171] But registration requires public disclosure of parties' personal information. For example, to register a financing statement on the PPSR where the debtor is an individual, the secured party must provide the debtor's name, date of birth and address.[172] Requiring the secured party to acquire the debtor's personal information is also difficult to square with the widespread preference for pseudonymity of DeFi participants.[173]

Secondly, DeFi arrangements are intrinsically global and decentralised. On which jurisdiction's register should financing statements therefore be registered? The likely answer is the jurisdiction in which the collateral is situated, which in the case of cryptoassets – seeing as they are intangibles and have no physical location – refers to the jurisdiction where the debtor is located.[174] But because of the pseudonymous nature of DeFi arrangements, it may be practically impossible for system

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166 De Filippi, Mannan and Reijers, above n 3, at 1.

167 At 7.

168 "Off-chain" means external to the distributed ledger/blockchain system in which the cryptoasset exists: see Law Commission of England and Wales, above n 27, at xii.

169 At [8.49].

170 Financial Markets Law Committee *Response to Law Commission: Consultation on Digital Assets* (November 2022) at 15. These "market-based reasons" – improved liquidity and efficiency – were also part of the justification for exempting "financial collateral" from registration requirements under the United Kingdom's Financial Collateral Arrangements (No 2) Regulations 2003. Similar concerns arguably arise in the cryptoasset context.

171 Megan McDermott "The Crypto Quandary: Is Bankruptcy Ready?" (2021) 115 Nw UL Rev 1921 at 1933.

172 PPSA, s 142(1).

173 Kelvin FK Low and Ernie GS Teo "Bitcoins and other cryptocurrencies as property?" (2017) 9 Law, Innovation and Technology 235 at 238.

174 PPSA, s 30(a).

participants to ascertain where a person is situated and, thus, the jurisdiction in which a possible security interest in the relevant cryptoassets has been registered. Although these challenges can be circumvented by creating a borderless, cryptoasset-specific register, there is no "central authority" within a permissionless blockchain upon whom the obligation of maintaining a register could be imposed.[175] Under the PPSA, subject to limited exceptions, a third party who acquires property that is subject to a registered security interest, and then suffers loss because of the enforcement of that security interest, cannot claim as a defence that it lacked actual knowledge of the security interest.[176] Such an approach is effective when it is clear what the relevant register is, since searching on that register is an imperative element of due diligence. However, when the relevant register could be any one of the many global personal property registers, it is commercially unacceptable to, in effect, require persons to investigate each one. Therefore, in the context of cryptoassets, registration fails to offer sufficient protection to third parties.[177]

Thirdly, perfection by registration fails to offer sufficient protection to secured parties. Registration does not prevent the debtor from selling the secured property or reusing it as collateral in another transaction. Although this is generally a nonissue for other types of collateral, the absence of protection against "illegitimate transfers" is problematic in the context of cryptoassets.[178] At the point the collateral has been disposed of, a lender's security interest is effective only if they are able to "trace"[179] the transfer in the blockchain ledger and identify the transferee from the ledger.[180] But, as Mann notes:[181]

> … the inherently pseudonymous nature of blockchain transfers … make[s] it trivially easy for a borrower to transfer assets to an entity that is difficult, if not practically impossible, for the lender to identify or locate.

A lender advancing funds against cryptoasset collateral would "hardly be satisfied by knowing that its security interest [is] perfected under applicable law" if there is uncertainty as to whether the collateral will be available as a source of repayment if the borrower fails to satisfy its repayment

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175 Riaan Bezuidenhout, Wynand Nel and Jacques M Maritz "Defining Decentralisation in Permissionless Blockchain Systems" (2022) 29 AJIC 1 at 5–6.

176 Widdup, above n 24, at [11.1].

177 Law Commission of England and Wales, above n 27, at [8.30].

178 Xavier Foccroulle Ménard "Cryptocurrency: Collateral for Secured Transactions?" (2019) 34 BFLR 347 at 382–383.

179 Sharon E Foster "Virtual Currency as Crypto Collateral Under Article 9 of the UCC: Trying to Fit a Square Peg in a Round Hole" (2020) 73 Ark L Rev 263 at 293.

180 Ronald J Mann "Reliable Perfection of Security Interests in Crypto-Currency" (2019) 21 SMU Sci & Tech L Rev 159 at 165.

181 At 165.

obligations.[182] Thus, if the borrower can freely dispose of the cryptoasset collateral, the lender's security interest, even if it has satisfied the necessary statutory formalities and is validly perfected by registration, will be of "little practical value".[183]

Therefore, perfection by registration, while offering a relatively straightforward method of technical legal protection, affords "little in the way of reliable potential for enforcement".[184] What is needed, then, is a mechanism by which parties can both perfect and practically protect a security interest in cryptoassets.[185] It follows that, in respect of cryptoasset-collateralised lending arrangements, for statutory perfection requirements to achieve their intended aim, they must offer a method other than registration. An alternative method of perfection should be "technology-specific"[186] and utilise the "transactional design" of DeFi lending arrangements to improve the publicity of security interests and offer lenders more reliable access to their collateral.[187]

In addition to registration, the PPSA also provides that a secured party can perfect its security interest by taking possession of the collateral.[188] Although this method of perfection does not prima facie apply to intangibles, the PPSA allows for a broader meaning of possession in certain cases – including in relation to intangible investment securities.[189] Section 18 extends the definition of "possession" beyond its ordinary meaning of physical possession of a tangible thing. Consequently, s 18 also expands the scope of how perfection by taking "possession" can be achieved.[190]

VI LAW REFORM

There are at least two suggestions for law reform. Section 18 could be amended to allow "possession" of cryptoassets to be taken where certain requirements are satisfied – for example, if they are in a person's control. This would enable perfection by possession to apply to cryptoassets and so introduce a different means by which to perfect security interests in cryptoassets (albeit one that is functionally and statutorily equivalent to taking "possession"). However, such an approach would be unnecessarily complex and risk making the PPSA unclear and inaccessible. Alternatively, a new, third method of perfection, circumscribed to apply only to cryptoassets (as a defined term and a subset of

182 At 164.

183 At 164.

184 At 165.

185 Ménard, above n 178, at 382.

186 Financial Markets Law Committee, above n 170, at 16.

187 Mann, above n 180, at 165.

188 PPSA, s 41(1)(b)(ii).

189 Section 18.

190 Widdup, above n 24, at [9.7].

intangibles), could be introduced into the PPSA. The latter approach is preferable because it would be more conducive to drafting coherent, understandable rules and principles regarding cryptoassets.

A Perfection by Control

Perfection by control is the intangible analogue to perfection by taking possession of a tangible thing.[191] It is a viable alternative because control is an appropriate way to give publicity to security interests in cryptoassets. In the context of DeFi protocols on public (ie permissionless) networks,[192] the presence or absence of control is a defining, observable feature of "on-chain" collateral arrangements.[193] In such networks, "all transactions are publicly observable", including the presence and function of any smart contract, the code of which can be analysed on-chain: the "observability and deterministic execution allow – at least in theory – an unprecedented level of transparency".[194] Thus, where a cryptoasset is controlled by a party other than its apparent owner, or is subject to a holding arrangement governed by a smart contract, these features are visible to network participants and will send a clear, sufficiently public signal[195] to likely third parties as to the possible existence of a security interest in the cryptoasset.[196] Furthermore, if a secured party has control of the cryptoasset, it can prevent illegitimate transfers.

Additionally, unlike registration, control-based perfection neither relies on external intermediaries nor necessarily imposes an administrative burden and additional costs upon participants. However, difficulties arise because "control" can be conceptualised in various ways, and it is unclear what would, and should, constitute "control" for the purposes of perfecting a security interest in cryptoassets.[197]

B The FCARs

Under the United Kingdom's Financial Collateral Arrangements (No 2) Regulations 2003 (FCARs), perfection is achieved by the secured party taking "possession or … control" of the financial

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191 Xavier Foccroulle Ménard, Andrew Lom and Rachael Hashmall "Bringing the UCC into the digital age: Review of the 2022 UCC amendments and controllable electronic records" (1 November 2022) Norton Rose Fulbright <www.nortonrosefulbright.com>.

192 International Digital Assets Counsel Association and CryptoUK *A Joint Response to the Law Commission's Digital Assets Consultation Paper (Number 256)* (Law Commission, 4 November 2022) at 601.

193 Ménard, Lom and Hashmall, above n 191.

194 Schär, above n 12, at 169.

195 International Digital Assets Counsel Association and CryptoUK, above n 192, at 13.

196 Law Commission of England and Wales, above n 27, at [8.116].

197 At [8.93].

collateral.[198] "Possession" for the purposes of the FCARs is different to the common law concept of possession in that it is a "composite factual and legal construct".[199] "Control" similarly comprises a legal element.[200] This legal component is at the crux of determining whether financial collateral is in a person's "control".[201]

Although what is meant by "control" under the FCARs is not entirely settled, it likely refers to legal negative control,[202] the legally enforceable right to prevent the taking or disposing of the collateral, possibly in combination with some form of factual[203] control.[204] There is considerable uncertainty as to whether this conceptualisation can be satisfactorily applied to the various, complex control configurations present in cryptoasset collateral arrangements.[205]

First, assuming that some form of factual control is required, in many arrangements the cryptoasset will not practically be controllable by either the borrower or the lender, instead being subject solely to the operation of a "deterministic holding arrangement" such as an escrow smart contract.[206] Indeed, for the duration of the loan in *Chefpierre*, the NFT was practically controlled by the escrow smart contract, and Chefpierre only gained factual control following default upon exercising the foreclosure option.[207] Thus, the only point at which lenders in these "deterministic" escrow arrangements have practical control is after the expiry of the loan period, and the gaining of such control is conditional upon a repayment default. It also cannot be argued, since NFTfi itself was not a custodian, that another person or entity had practical control of the NFT on the lender's behalf.[208]

Secondly, as regards the "core test" under the FCARs of legal negative control, it is not entirely clear whether the "shared or conditional control arrangements" typical of cryptoasset-collateralised

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198 Financial Collateral Arrangements (No 2) Regulations 2003 (UK), reg 3(1).

199 Law Commission of England and Wales, above n 27, at [8.94(3)].

200 At [8.97].

201 At [8.94].

202 At [8.93].

203 Factual control is the practical ability to exercise positive and/or negative control: see [8.93(4)].

204 At [8.94(4)].

205 At [8.97].

206 At [8.96(1)].

207 Since the underlying escrow smart contract is coded to automatically execute a given set of instructions upon fulfilment of predetermined conditions, neither the lender nor the borrower has the practical power to effect outcomes other than those that are programmed to occur.

208 NFTfi, above n 78.

lending will satisfy the requirements of this type of control.[209] Duncan Sheehan argues that the collateral taker has "negative control in that he can legally prevent the provider from using the collateral; indeed the automaticity of smart contracts means this is simply done for him".[210] In this way, the automaticity of smart contracts does not pose an issue, and legal negative control is better understood not as the "positive ability to choose to act to prevent the provider doing x", but rather as the "provider being legally precluded from doing x and precluded from this for the taker's benefit".[211] However, the Law Commission of England and Wales remains less certain about whether legal negative control is satisfied in such arrangements.[212] For legal negative control to be acquired, the secured party must have a "contractual right to prevent the debtor from dealing with the charged assets".[213] But the contractual terms underpinning most escrow smart contract arrangements do not make clear whether the secured party acquires such a right. Indeed, whilst Chefpierre probably acquired legal positive control (the contractual, ie legally enforceable, right to take the NFT in the event of the debtor's default without further consent of the debtor), it is uncertain, given both NFTfi's standard terms and the parties' additional terms, whether he had legal negative control.[214]

Moreover, and regardless of whether legal negative control can, in practice, be acquired in conventional cryptoasset collateral arrangements, it is inappropriate that legal, as opposed to factual, control be the "core organising principle" of a perfection requirement.[215] As Gullifer observes, "if what we are interested in is the outward signs of an arrangement, one might have thought that operational [ie factual] control was more important than legal control".[216] Therefore, the FCARs' concept of "control" is unlikely to be an adequate, appropriate basis on which to build a perfection rule for cryptoassets.[217]

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209 Law Commission of England and Wales, above n 27, at [8.97].

210 Duncan Sheehan "Submission to the Law Commission of England and Wales' Digital Assets Consultation" (2022) at 7.

211 At 7.

212 Law Commission of England and Wales, above n 27, at [8.97].

213 Elena Christine Zaccaria "An inquiry into the meaning of possession and control over financial assets and the effects on third parties" (2018) 18 JCLS 217 at 222.

214 At 222.

215 Law Commission of England and Wales, above n 119, at [18.101].

216 Gullifer, above n 159, at 391–392.

217 Law Commission of England and Wales, above n 27, at [8.97].

C The UCC

A distinct conceptualisation of control is provided by amendments in 2022 to the American Uniform Commercial Code (UCC).[218]

The amendments introduce the new art 12, which recognises a new class of assets called "controllable electronic records" (CERs).[219] A CER is a "record stored in an electronic medium that can be subjected to control".[220] This definition is intended to capture, inter alia, all cryptoassets generally.[221] The amendments also modify the existing art 9 to clarify the perfection and priority of security interests in CERs.[222] The amended art 9 provides that security interests in CERs can be perfected by control.[223] A person has "control" under art 12 if they have:[224]

(i) The "power to avail [themselves] of substantially all the benefit from the [CER]";[225]
(ii) The exclusive power to "prevent others from availing themselves of substantially all the benefit from the [CER]";[226] and,
(iii) The exclusive power to "transfer control of the [CER] to another person or cause another person to obtain control of another [CER] as a result of the transfer".[227]

Additionally, a person must be able and willing to readily identify themselves to third parties as the person having these powers.[228] Identification can be made other than by name, such as by account number or cryptographic key.[229]

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218 Uniform Law Commission and the American Law Institute *Uniform Commercial Code Amendments (2022)* (Uniform Law Commission, 1 June 2023).

219 The amendments, adopted by the Uniform Law Commission in July 2022 as a model law, must be enacted by each individual state to be effective in such state.

220 Uniform Commercial Code [UCC], § 12-102(a)(1).

221 Ménard, Lom and Hashmall, above n 191.

222 Ménard, Lom and Hashmall, above n 191.

223 UCC, § 9-314.

224 Fulfilment of conditions (i) and (ii) creates a rebuttable presumption of control absent evidence to the contrary: see § 12-105(d).

225 Section 12-105(a)(1)(A).

226 Section 12-105(a)(1)(B)(i).

227 Section 12-105(a)(1)(B)(ii).

228 Section 12-105(a)(2).

229 Section 12-105(a)(2).

The art 12 concept of "control" is best understood as "the functional analogue of possession of tangible personal property".[230] The common law concept of possession is a factual matter.[231] It follows that, unlike the FCARs, the UCC defines "control" solely by reference to factual, not legal, control. Even so, as discussed above, requiring secured parties to have practical control of the cryptoasset collateral creates difficulties in practice. However, in contrast to the FCARs, "control" under art 12 is a bespoke concept applicable only to CERs.[232] As such, the requirements of "control" are, by design, flexible enough to accommodate the control configurations utilised in most cryptoasset collateral arrangements. For instance, the exclusivity requirement (and thus "control") will be satisfied even where the powers set out in art 12 are shared among multiple people.[233] A person can also obtain exclusive power (and thus "control" of the collateral) through another person.[234] These principles permit a secured party to take control of a CER held by a third-party custodian,[235] as well as where the collateral is held in a multi-signature wallet; that is, an intermediary (non-custodial) wallet that requires authorisation by two or more private keys to effect a transfer of collateral.[236] Most crucially, UCC § 12-105(b)(1) directly contemplates collateral arrangements involving smart contracts, and permits control to be taken by a secured party where:

> … a system in which the electronic record is recorded … has a protocol programmed to cause a change, including a transfer or loss of control or a modification of benefits afforded by the electronic record.

Conceptually, a lender can take "control" of cryptoasset collateral despite it being subject to the practical control of a "deterministic holding arrangement".[237] It follows that, under the art 12 model, Chefpierre could have perfected his security interest in the borrower's NFT by taking "control" of the NFT when it was transferred into NFTfi's escrow smart contract.

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230 Article 12, prefatory note.

231 Law Commission of England and Wales, above n 27, at [5.8].

232 UCC, § 12-105.

233 Section 12-105(b)(2).

234 Section 12-105(e).

235 Ryan Laity and Donald G Bird "UCC Article 12 – A sensible framework for secured transactions involving cryptocurrencies or other digital assets" (15 December 2022) Borden Ladner Gervais <www.blg.com>.

236 Christopher Keith Odinet, Andrea Tosato and Jordan Jenquin "How to Create a Floating Lien on Digital Assets" (14 June 2023) American Bar Association <www.americanbar.org>.

237 Law Commission of England and Wales, above n 27, at [8.96(1)]; and Laity and Bird, above n 235.

D Perfection by Provision

Another method of perfection, one based on "provision", is proposed by the Financial Law Committee of the City of London Law Society (CLLS-FLC).[238] The proposal aims to address extensive criticism of the "uncertainties, practical challenges and limitations arising from the interpretation" of the "control" test under the FCARs.[239] The notion of "provision", which refers to the collateral having been "provided to"[240] the collateral taker, is derived from the perfection requirement under the European Union's Financial Collateral Directive[241] (which was generally implemented in United Kingdom law by the FCARs).[242] The CLLS-FLC's proposal is a broader, more flexible concept of which factual control is only one constituent element;[243] for example, rights of withdrawal or substitution in favour of the borrower do not compromise the satisfactory provision of the collateral to the lender, notwithstanding any impact these rights may have on the lender's factual control over the financial collateral.[244]

The CLLS-FLC's proposal is framed only by reference to financial collateral and the FCARs.[245] It does not intend to deal with the specific issues posed by cryptoassets and cryptoasset collateral arrangements.[246] Nevertheless, "provision" is a useful concept in the cryptoasset context because it is sufficiently flexible to respond to a "diverse range of collateral holding arrangements and management techniques" for cryptoassets.[247] Whilst the starting point and overall framing of the method of perfection would be shared with the approach under the Directive,[248] its substantive content would be formulated specifically to accommodate cryptoasset collateral arrangements.[249]

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238 Financial Law Committee *Financial Collateral: A Proposal For its "Provision"* (The City of London Law Society, 4160-9532-2403/1/MRE/MRE, 4 November 2022) at [8].

239 Law Commission of England and Wales, above n 27, at [8.124].

240 At [8.134].

241 Directive 2002/47/EC on financial collateral arrangements [2002] OJ L168/43, art 2(2).

242 Financial Law Committee, above n 238, at [6].

243 Law Commission of England and Wales, above n 27, at [8.116].

244 At [8.118].

245 At [8.140].

246 At [8.125].

247 At [8.134].

248 At [8.121].

249 At [8.121].

Importantly, whilst "provision" is an alternative to the concept of "control" under the FCARs,[250] in relation to cryptoasset collateral, the substantive meaning of "provision" will likely mirror that of "control" under art 12 of the UCC. This is because "provision" is a similarly broad, flexible and bespoke concept which is not necessarily defined or restricted by a narrow conceptualisation of factual control.[251] For instance, a provision-based method of perfection could allow for the cryptoasset collateral to be "provided to" the collateral taker notwithstanding that the collateral is subject to the practical control of an escrow smart contract.[252] Likewise, collateral may be deemed as having been "provided" even where the lender shares practical control with other parties, or where the borrower retains the right to substitute the collateral or withdraw any excess collateral.[253] Consequently, both methods of perfection may, in practice, be largely similar.

Therefore, either a "provision"-based or a "control"-based method of perfection may be suitable. The more pertinent concern is how exactly "provision" (or "control") should be defined in the context of cryptoassets. The answer to this question would be best determined through an exhaustive multidisciplinary process combining technological and legal experts and market participants. However, art 12 provides an appropriate starting point for what should be adopted in New Zealand.

E Priority

Under the PPSA's general priority rules,[254] which apply to security interests in intangibles, it is possible for a party outside of a cryptoasset-collateralised lending arrangement to have a higher-ranking security interest than the lender who has perfected its security interest in a cryptoasset by taking "control" of, or having been "provided", it.[255] The outcome that the security interest of a party outside the cryptoasset lending arrangement takes priority would be problematic in that it would be contrary to the reasonable commercial expectations of both the lender and DeFi market participants at large.[256]

To illustrate the difficulties caused by the PPSA's existing priority rules, consider the following hypothetical case. Suppose a bank has a registered security interest in person A's present- and after-acquired property. Person A later enters into an NFTfi lending arrangement with person B and offers

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250 That is, "provision" in relation to financial collateral under the FCARs is distinct from, and broader than, the FCARs' conceptualisation of "control" as meaning legal negative control: see [8.134].

251 At [8.116].

252 At [8.134].

253 At [8.134].

254 PPSA, s 66.

255 Assuming a new means of perfection is implemented.

256 Mann, above n 180, at 164–165.

an NFT as collateral. B then perfects her security interest in the NFT by taking "control" of it.[257] Under the s 66 rules, the bank's prior-perfected security interest, which encompasses the NFT, has priority over B's security interest. However, since the registration of security interests is not an "on-chain" feature observable by system participants, registration fails to indicate to B the existence of a security interest in that cryptoasset. Moreover, for reasons already discussed, it would be practically impossible for B to even become aware of the bank's security interest and so look to protect her interests. B's decision to lend to A and her claim to the NFT both being undermined by a largely "invisible"[258] security interest would be an unfair outcome and one that would subvert B's legitimate expectation that she can look to the NFT in the event of A's default.[259] Such an outcome would also seriously impede the taking of security and thus the flow of credit in DeFi markets.[260] Therefore, law reform is necessary for both principled and practical reasons.

Since it is a defining, observable feature of collateral arrangements, a more suitable priority regime would look to utilise "control" (or "provision") as the means to perfect a first-rank security interest in cryptoassets. Such is the approach adopted by the 2022 amendments to the UCC. Under art 12, whilst security interests in a CER can still be perfected by registration,[261] security interests in a CER perfected by control will have priority.[262] In other words, a security interest in cryptoassets perfected by control will receive super-priority over other security interests in the same cryptoassets perfected only by registration.[263] In the above hypothetical case, even though the bank's security interest was perfected earlier, B's security interest in the NFT would take priority.

Registration may remain a useful option in various circumstances and so should be retained in the PPSA as a means to perfect security interests in cryptoassets.[264] Furthermore, regardless of how a new method of perfection is implemented in New Zealand (ie whether it is "control"- or "provision"-based), perfection of security interests in cryptoassets by that method should grant super-priority to secured parties. Such reform would be consistent with the PPSA's overarching approach to priority since there are already several exceptions to its general priority regime: purchase money security

257 As defined in art 12 of the UCC.

258 Law Commission of England and Wales, above n 119, at [18.99].

259 Notwithstanding that A's use of the NFT as collateral in his agreement with B would (likely) constitute a breach of his security agreement with the bank. But of course, the bank can look to protect its commercial interests by taking "control" of the NFT and thus receiving super-priority.

260 Law Commission of England and Wales, above n 27, at [8.30].

261 Section 9-312.

262 Section 9-326A.

263 Laity and Bird, above n 235.

264 Ménard, above n 178, at 352–353.

interests sit outside of the s 66 rules;[265] and the priority of security interests in accessions[266] and commingled goods[267] are governed by different, specialised rules.

VII CONCLUSION

Given DeFi's rapid growth and transformative potential, the legal issues to which it gives rise demand a commensurate response from the legal system. One such issue relates to the emerging use of cryptoassets as collateral. Presently, it is uncertain whether existing laws are sufficient to uphold the intentions of DeFi participants by giving due legal recognition and protection to their arrangements. Although New Zealand is not at the forefront of the DeFi revolution, it is crucial that New Zealand's laws remain responsive to what is a rapidly evolving trend in commercial practice.

To that end, this article applied the PPSA to cryptoasset-collateralised lending arrangements and assessed its comparative suitability. This article showed that the PPSA's relative absence of granularity and formalism makes it better positioned than English (Singaporean) secured credit law to recognise security interests in cryptoassets. However, the novel challenges presented by cryptoasset collateral arrangements still necessitate a degree of legislative reform. In particular, the only method of perfection applicable to cryptoassets – registration – fails to offer sufficient protection to third parties and secured parties alike. Additionally, the PPSA's general priority rules risk creating perverse outcomes which are contrary to the reasonable commercial expectations of DeFi participants. To address these concerns, bespoke rules and concepts designed to respond to cryptoassets must be introduced into the PPSA, with overseas legal developments offering a suitable basis for what should be adopted in New Zealand.

VIII GLOSSARY

Bitcoin

Bitcoin is the archetypal example of a public, permissionless crypto-token system and is a communications channel which creates a system for electronic transactions. The system allows individuals to communicate with one another without the need for a centralised intermediatory to authenticate the integrity of any communication or message.[268]

Bitcoin was the first example of a blockchain.

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265 PPSA, ss 73–77.

266 Sections 78–81.

267 Sections 82–86.

268 Law Commission of England and Wales, above n 27, at vii.

Blockchain

A method of recording data in a structured way. Data (which might be recorded on a distributed ledger or structured record) is usually grouped into timestamped 'blocks' which are mathematically linked or 'chained' to the preceding block, back to the original or 'genesis' block.[269]

There are hundreds of different blockchains. Blockchain is one of the many different types of distributed ledger technologies (DLTs).

Decentralised finance (DeFi)

A general term for automated and/or deterministic and decentralised and/or disintermediated applications providing financial services on a (generally decentralised and often blockchain-based) settlement layer, including payments, lending, trading, investments, insurance and asset management.[270]

Distributed ledger

A digital store of information or data. A distributed ledger is shared (that is, distributed) among a network of computers (known as nodes) and may be available to other participants. Participants approve and eventually synchronise additions to the ledger through an agreed consensus mechanism.[271]

Distributed ledgers preceded blockchain and other forms of DLT.

Distributed ledger technology (DLT)

Technology systems that enable the operation and use of a distributed ledger.[272]

A blockchain is one form of DLT.

Non-fungible token (NFT)

Typically, a cryptoasset which confers "digital ownership rights of a unique asset ([for example,] a piece of digital art), using a technology such as DLT to support the recording or storage of data".[273] Since NFTs are non-fungible, each NFT is unique, distinct and not interchangeable. However, NFTs are considerably broader than either the digital representation of a physical object or a digitally native unit of value with unique characteristics.[274] In addition, they can not only be used to enable unambiguous, decentralised ownership of non-physical assets, but also ownership-based access

269 At vii.

270 At ix.

271 At x.

272 At x.

273 HM Treasury, above n 30, at 16.

274 Schär, above n 12, at 160.

management.[275] Moreover, there may be future use cases where NFTs are used to enable digital identity, creating a fluid, established identity that can "move freely between immersive virtual worlds".[276]

Smart contract

Computer code that, upon the occurrence of a specified condition or conditions, is capable of running automatically or deterministically according to pre-specified functions.[277]

275 walt.id "Introduction to NFTs for Identity." (11 March 2022) <www.walt.id>.

276 Crypto.com "NFTs: Identity in the Metaverse" *Financial Times* (online ed, London, 24 November 2021) <www.ft.com>.

277 Law Commission of England and Wales, above n 27, at xiv.