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Applying Blockchain Technology to Cross-Border Tax Reporting

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Abstract

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1 Introduction

Blockchain is a revolutionary technology.[1] The anonymous Satoshi Nakamoto proposed their novel electronic cash system, and with it blockchain technology, as a solution to the trust issues seen within the current financial system: Nakamoto thought that placing reliance on third party institutions in order to validate transactions was in itself a bigger issue of trusting that institution. By distributing the records across many databases, trust is no longer placed with one sole entity.[2] As envisaged by the crypto-visionary, blockchains create resilient, tamper-proof, autonomously functioning, transparent databases which update in (almost[3]) real time. Thus, there are advantages to applying the technology to problems which lack transparency, privacy, and structure.[4]

Given blockchain's unique characteristics, this paper seeks to discuss a large problem in the international tax community relating to tax evasion, specifically within the framework of the Organisation for Economic Coordination and Development's (OECD) Common Reporting Standards (CRS). Further, this paper discusses the application of blockchain technology as a remedy or mitigation to the problem. Section 2 will identify problems within the CRS, along with some previously proposed solutions by the OECD. Section 2 will also examine the American reporting counterpart, the Foreign Account Tax Compliance Act (FATCA), in order to compare the regimes. FATCA must be examined for four reasons: firstly, the CRS was based off of FATCA;[5] secondly, the US is deemed to be one of the least transparent tax jurisdictions while not participating in the CRS, which is problematic for the

[1] Primavera De Filippi and Aaron Wright, Blockchain and the Law: The Rule of Code (Harvard University Press 2018): digital currencies (61-63), smart contracting (74-76), smart financing (89-104), data storage (117-127).
[2] Satoshi Nakamoto, 'Bitcoin: A Peer-to-Peer Electronic Cash System' (2008) <https://bitcoin.org/bitcoin.pdf> accessed 6 April 2020.
[3] The speed at which a blockchain network reaches "consensus" depends on many factors and will be discussed later on in this paper. Speeds can vary drastically. See De Filippi and Wright (n 1) 26-28.
[4] ibid 33-57.
[5] Noam Noked, 'Tax Evasion and Incomplete Tax Transparency' (2018) MDPI (2).

rest of the CRS countries;[6] thirdly, the US maintains the most substantial program of information reporting of any other OECD country;[7] and lastly, as the US is one of the largest economies in the OECD and the world, it would not be realistic to ignore their data.

In section 3, a brief overview of blockchain will be given. The issues relating to digitisation will be discussed: because blockchain is a digital platform and tax relies on the compliance of all taxpayers, it is logical that this blockchain solution will not be physically possible unless there is full compliance to digitalised methods of tax reporting. Section 4 will examine a proposed blockchain solution to VAT fraud (the 'VAT Blockchain Model'). In section 5, the tax reporting blockchain model will be extrapolated from the analysed VAT Blockchain Model in order to be applied as a solution to the problems found within the CRS. Section 6 will fully dissect this blockchain solution, discussing everything from practical matters like costs and technological issues to more theoretical matters like those of international comity and taxpayer equity. This blockchain solution could be the next step towards full tax compliance and transparency, but it will be up to each individual country whether or not such a solution is realised.

2 Problems in Cross-Border Tax Reporting

2.1 Current Tax Reporting Schemes

The Microsoft Whitepaper 'Blockchain for tax compliance' estimates that the global tax gap reaches $1.6 trillion after collection, with the European Union (EU) value added tax (VAT) and United States (US) Internal Revenue Service (IRS) gaps being substantial contributors. The whitepaper further estimates that global cost of collection may total almost $1.3 trillion.[8] The IRS estimates that the US national net tax compliance rate is almost 85%

[6] Noked (n 5) 6.
[7] Joel Slemrod 'Cheating Ourselves: The Economics of Tax Evasion' (2007) 21(1) Journal of Economic Perspectives 25 (33, 35).
[8] Kuralay Baisalbayeva et al. 'Blockchain for tax compliance' (Microsoft, PwC, and Vertex, 2019).

for the years 2011-2013, with a net tax gap estimate of $381 billion; this is a decrease in compliance from the previous years' estimates.[9] Similarly, Canada estimates a tax gap between CAD 21.8-26 billion for 2014;[10] the UK estimates £35 billion for 2017-2018;[11] and Australia estimates AUD 28 billion for 2015-2016.[12] Importantly, the US tax gap estimate does not include noncompliance figures based on foreign holdings, meaning that tax gap estimates would be greater had they included such estimates.[13] Moreover, this signals a lack of transparency in gathering and publishing this information. It has additionally been found that almost 40% of all foreign direct investment (about $12 trillion) is held artificially, passively passing through some sort of corporate shell.[14] One last thing to note is that tax gap figures are a highly theoretical, with each country estimating its own tax gap differently.[15] Therefore the measurement of tax compliance is imperfect.

However, these estimates signal a global lack of noncompliance within national tax regimes, which may be motivated by a range of personal circumstances including political leanings, investment strategies, risk aversion to turbulence at home, and, more simply, criminality. But whatever the motivations, taxes must be paid in order for a government to function properly, as they are a large portion of the government's operating budget. However,

[9] IRS, 'Tax Gap Estimates for Tax Years 2011-2013' (Publication 5365, Catalogue 73349K, Department of the Treasury, September 2019) <www.irs.gov/pub/irs-pdf/p5365.pdf> accessed 20 March 2020.
[10] Canada Revenue Agency, 'Tax Gap: A Brief Overview' (Government of Canada 2019) <www.canada.ca/en/revenue-agency/programs/about-canada-revenue-agency-cra/corporate-reports-information/tax-gap-overview.html> accessed 21 March 2020.
[11] HM Revenue & Customs, 'Measuring Tax Gaps 2019 Edition: Tax Gap Estimates for 2017-18' (United Kingdom 2019) <assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/820979/Measuring_tax_gaps_2019_edition.pdf> accessed 20 March 2020.
[12] Australian Taxation Office, 'The Performance of the Tax System' (Commonwealth of Australia 2020) <www.ato.gov.au/About-ATO/Research-and-statistics/In-detail/Tax-gap/Australian-tax-gaps-overview/?anchor=Whywemeasurethetaxgap#Whywemeasurethetaxgap> accessed 24 March 2020.
[13] Committee on Ways and Means US House of Representatives, 'Understanding the Tax Gap and Taxpayer Noncompliance', (Testimony of J Russell George, 2019).
[14] Jannick Damgaard and Thomas Elkjaer, 'The Global FDI Network: Searching for Ultimate Investors' (2017) IMF Working Paper 17/258 <www.imf.org/en/Publications/WP/Issues/2017/11/17/The-Global-FDI-Network-Searching-for-Ultimate-Investors-45414> accessed 31 March 2020.
[15] Slemrod (n 7) 33.

there is never going to be perfect compliance.[16] Slemrod asserts that the mere presence of tax evasion does not imply a failure of policy.[17] But surely, the more perfect the policy, the more perfect the compliance rates. Thus, this paper seeks to discuss a technological solution to a global trend in imperfect policy signalled by noncompliance and lack of oversight.

With the goals of heightened transparency, compliance, and international cooperation, the Organisation for Economic Coordination and Development (OECD) instituted a legal framework for the international exchange of financial information, known as the Common Reporting Standard (CRS) in 2014.[18] This followed the 2010 enactment of the US Foreign Account Tax Compliance Act (FATCA) for similar reporting purposes.[19] The CRS is designed to create a global standard for automatic exchange and mandates what information needs to be reported to any jurisdiction for tax purposes. This information, provided by financial institutions (FIs) or financial intermediaries, will be shared with the CRS signatory jurisdictions *annually* in order to create tax transparency and boost compliance, while preventing double taxation. It sets out the obligations, definitions, and procedures for exchange.[20] It should be noted that the US is the only OECD country, and western democracy, to not be a signatory of the CRS Multilateral Competent Authority Agreement, because they have their own reporting regime, FATCA.

FATCA relies on many intergovernmental agreements with other jurisdictions in order to create a reporting network. Even if there is no agreement with a foreign jurisdiction, FATCA still holds foreign FIs accountable for reporting on any US citizen or tax resident.[21] Once a foreign FI registers with the IRS, they may be instructed to withhold payments to any

[16] ibid 25.
[17] ibid 43.
[18] OECD, 'What is the CRS' (OECD 2018) <www.oecd.org/tax/automatic-exchange/common-reporting-standard/> accessed 30 March 2020.
[19] IRS, 'FATCA Information for Foreign Financial Institutions and Entities' (US Government, 31 January 2020) <www.irs.gov/businesses/corporations/information-for-foreign-financial-institutions> accessed 31 March 2020.
[20] OECD (n 18).
[21] IRS (n 19).

US citizen or tax resident who is noncompliant with FATCA measures. If these institutions are noncompliant, they will be subject to the 30% FATCA withholding tax if the payment is from a US source.[22]

Though the CRS and FATCA are a huge step towards greater tax compliance and transparency, facilitating the reporting and international exchange of financial information, there seems to still be problems within the regimes. Noked states that 2018 is too early to tell whether the CRS procedures will increase tax collection, as the first reports were only exchanged in 2017, but note that this is four years after implementation.[23] In fact, Byrnes states that most of the money recovered in the US from FATCA since 2016 has been from money laundering schemes and failure to file specific forms, not through noncompliance arrangements.[24] Interestingly, Casi, Spengel, and Stage found that the implementation of CRS induced an average reduction of 14% in cross-border deposits. However, this did come with a 9% rise in cross-border deposits held in the US, which they coined a "relocation effect."[25] This is because the US is deemed to be a good jurisdiction to evade in due to its low levels of transparency, even if it does not boast low tax rates.[26] These estimations are not insignificant, as well; 9% would roughly equate to $50 billion as the amount held by foreign individuals in the US in any given year.[27]

The relocation effect may be one of the biggest challenges to the CRS. If the US continues to allow foreign holdings without proper reporting or does not follow the CRS, there will not just be international comity problems. As the Casi, Spengel, and Stage study

[22] Deloitte, 'FATCA Frequently Asked Questions (FAQs)' (Deloitte 2018) <www2.deloitte.com/content/dam/Deloitte/il/Documents/financial-services/fatca_faqs_fsi_services.pdf> accessed 31 March 2020.
[23] Noked (n 5) 4.
[24] William Byrnes, 'Background and Current Status on FATCA and CRS' (2017) Legal Studies Research Paper Series, Research Paper No 17-75, Texas A&M University School of Law <papers.ssrn.com/sol3/papers.cfm?abstract_id=3045459> accessed 30 March 2020.
[25] Elisa Casi, Christoph Spengel, and Barbara Stage, 'Cross-Border Tax Evasion After the Common Reporting Standard: Game Over?' (University of Mannheim 2018) 2-4.
[26] Noked (n 5) 6.
[27] Casi, Spengel, and Stage (n 25) 20.

suggests, progress will be undermined when foreign holdings are relocated to opaquer jurisdiction like the US in order to evade home tax.[28]

Though it may be a bit premature to evaluate these reporting schemes fully, they still signal cooperation within the international tax community. These schemes are the foundation for which more oversight and enforcement can be built upon.

2.2 Opportunities for Tax Evasion

Taxpayers may take advantage of certain reporting loopholes within the CRS in order to escape or obscure tax liability. These loopholes are very similar to the ones found within FATCA and will be discussed in tandem.[29]

Noked outlines the areas that lead to opportunities for tax evasion.[30] They include ownership of non-financial assets held abroad such as real property, precious metals, cryptocurrencies, collectibles, or artwork. When such assets are held abroad in their own name, outright, there is no obligation to report.[31]

Offshore financial assets are more difficult to evade with because all FIs and account holders are legally required to report on financial assets held in a reporting jurisdiction. This type of tax evasion is usually done through purposeful non-reporting.[32] Firstly, owners of FIs may obscure the classification of their institution in order to meet an exempt status or to escape the oversight of the reporting jurisdiction. Secondly, account holders may just choose to hold their assets in exempt FIs. Thirdly, active non-financial entities (NFEs) have no obligation to report; the classification of NFEs is tricky and not within the scope of this

[28] ibid.
[29] Noked (n 5) 4-8.
[30] ibid.
[31] ibid 1.
[32] ibid 6.

paper. Furthermore, if there is a reporting obligation present for such an institution, there is no obligation to report *beneficial* ownership.[33]

There are also certain schemes designed to bring in foreign investment. Residency/citizenship-by-investment (RBI/CBI) schemes are valid for many uses, like visa-free travel, and can make tax regimes more competitive.[34] They can also bring in economic development and attract foreign capital.[35] However, these schemes can be abused by those who wish to circumvent the CRS. Knobel and Heitmüller explain that taxpayers can hide foreign bank accounts from local authorities by lying about their tax residency to their bank.[36] Documentary evidence is required, but as long as the compulsory minimal evidence is provided, banks will not question tax residency or report foreign holdings.[37] These schemes may also mandate only very low investment expenditure in a purely 'passive' nature, meaning that business creation may not be mandatory in order to gain citizenship/residency.[38] This type of scheme has been dubbed as high risk for tax evasion by the European Parliament. Other factors that increase risk of evasion include: little or no requirements for actual physical presence within the jurisdiction; no or low tax rates; being a non-reporting CRS jurisdiction; or having a special tax regime for foreign individuals.[39]

Lastly, it must be kept in mind that physical money (i.e. bank notes and coins) is hard to track. This is because money does not pass through an intermediary upon each

[33] ibid.
[34] Andreas Knobel and Frederik Heitmüller, 'Citizenship and Residency By Investment Schemes: Potential to Avoid the Common Reporting Standard for Automatic Exchange of Information' (Tax Justice Network, 12 March 2018) 2ff; Daniel Bunn and Elke Asen, 'International Tax Competitiveness Index 2019' (Tax Foundation 2020) <taxfoundation.org/publications/international-tax-competitiveness-index/> accessed 22 April 2020.
[35] ibid.
[36] ibid.
[37] Noked (n 5) 9.
[38] Knobel and Heitmüller (n 34) 4.
[39] Amandine Scherrer and Elodie Thirion, 'Citizenship by Investment (CBI) and Residency by Investment (RBI) Schemes in the EU: States of Play, Issues and Impacts' (European Parliamentary Research Service, October 2018).

transaction.[40] Further complicating this matter, money is a fungible commodity, making it hard to identify.[41] Technology not only allows (digital) currency to be anonymised through cryptography, but also simultaneously de-anonymised through code identifiers.[42] A discussion of the faults of fiat money is very much outside of the scope of this paper, however, the OECD should be aware of these faults when making new regulations. Reporting on *physical currency* held abroad is the same as reporting on any other good which is also held abroad outright. Having a transparent, secure, digital record of monies and goods transactions could not only mitigate tax evasion, but also the wider problem of financial fraud as well.

2.3 Mandatory Disclosure Rules

The OECD proposed Mandatory Disclosure Rules (MDR) in response to a call for greater transparency by the G7 Finance Ministers in the 2017 Bari Declaration.[43] These rules do not set a minimum standard for reporting but provide a framework for mandatory disclosure. These rules are designed to capture arrangements where it is reasonable to conclude that they have been designed to circumvent the CRS or are marketed as or have the effect of doing so. They are also designed to capture passive offshore vehicles that are held through an "opaque ownership structure."[44]

MDR call for more information to be disclosed than what is currently mandated by the CRS. Details of the foreign financial or investment schemes, their users (actual or potential),

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[40] Xunhua Wang, Brett Tjaden, and M Hossain Heydari, 'Bitcoin for E-Commerce: Principles and Applications' in Information Resource Management Association (ed), *Digital Currencies: Breakthroughs in Research and Practice* (IGI Global 2019) 42-43.
[41] Gideon Samid, *Tethered Money: Managing Digital Currency Transactions* (ProQuest Ebook Central, Elsevier Science & Technology 2015) 25ff.
[42] See discussion on zero knowledge proofs in section 6; ibid.
[43] OECD, 'Mandatory Disclosure Rules for Addressing CRS Avoidance Arrangements and Offshore Structures' (OECD, Public Discussion Draft, 11 December 2017 – 15 January 2018) 13 <www.oecd.org/tax/beps/Discussion-draft-mandatory-disclosure-rules-for-CRS-avoidance-arrangements-offshore-structures.pdf> accessed 7 April 2020.
[44] ibid 6.

and every entity involved in the supply of the scheme are mandated. The OECD states that MDR are designed to capture all information that is likely to be most relevant to tax administrations in their assessments of which jurisdictions they need to spontaneously exchange information with.[45]

For the purposes of this paper, the aforementioned CRS loopholes are only necessary to understand in outline. It is highly necessary, however, to know that these loopholes and vagaries exist, which allow for under-reporting and evasion. Knobel argues that the breadth of the mandatory rules allows for creativity in capturing fraudulent activity which may fall outside the scope of the CRS. National legislators may now be able to capture schemes which purposefully hide beneficial ownership or certain other types of accounts.[46] However, Knobel points out that MDR are not in fact mandatory.[47] Therefore, there is little incentive other than international comity for countries to implement these reporting rules. Knobel proposes that uncooperative jurisdictions should be labelled as such, with other countries taking "countermeasures against them," which should include preventing FIs and "resident taxpayers from engaging with service providers and financial institutions from those non-cooperative countries."[48]

I am inclined to disagree. Though mandatory reporting would increase compliance, there is evidence that tax havens indirectly stimulate the growth of non-haven countries in the region. [49] Moreover, eliminating access to tax havens has been shown to reduce investment and domestic employment for domestic multinational companies.[50] Strictly imposing

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[45] ibid.
[46] Andres Knobel, 'OECD Rules vs CRS Avoidance Strategies: Not Bad, but Short of Teeth and Too Dependent on Good Faith' (Tax Justice Network, 27 March 2018) <www.taxjustice.net/2018/03/27/oecd-rules-vs-crs-avoidance-strategies-not-bad-but-short-of-teeth-and-too-dependent-on-good-faith/> accessed 26 February 2020.
[47] ibid.
[48] ibid.
[49] Mihir A Desai, C Fritz Foley, and James R Hines Jr., 'Economic Effects of Regional Tax Havens' (2004) NBER Working Paper 10806 <www.nber.org/papers/w10806> accessed 6 April 2020.
[50] Juan Carlos Suárez Serrato, 'Unintended Consequences of Eliminating Tax Havens' (2019) NBER <www.nber.org/papers/w24850> accessed 6 April 2020.

mandatory rules should be weighed heavily with these economic disadvantages, never mind the sovereignty infringements. If the OECD and participating jurisdictions were to follow Knobel's suggestion, then the economic benefits that tax havens provide may be diminished. Thus, only once a country has chosen to participate in the CRS should the rules become mandatory, but not through any *legal* route. As will be discussed in the next section, the rules will have to be mandatory due to a realisation of a digital reporting scheme, which by nature necessitates compliance. Therefore, the CRS should not (and *cannot*) be mandated from the OECD by law, or through an international practice of targeting "non-cooperative" jurisdictions, but through the digital realities of the reporting system once a country has *chosen* to participate. This allows for countries to stay sovereign in deciding whether to adopt such measures without harsh international economic pressures, while still adding in fully mandatory rules on countries who do become signatories.

Furthermore, even if mandatory reporting is ratified by each participating country, there are still other problems within the tax reporting systems. Byrnes suggests that the problem with FATCA is that the US government has "little or no ability to establish, operate, and maintain the technology necessary" for the schemes function.[51] It can be argued that there is a similar problem with the CRS, given that they operate in almost identical manners and the CRS was created in FATCA's image. This suggests that tax reporting systems need a technological update which would allow them to operate in ways which are above their current capabilities. Blockchains may be the solution.

[51] Byrnes (n 24).

3 What is Blockchain?

3.1 Public vs Permissioned

Blockchain technology creates a distributed ledger (a shareable record) which can be accessed from anywher in the world, so long as there is an internet connection.[52] For the purposes of this paper, it is not necessary to know the minute details of blockchain technology; it is necessary, however, to understand its broad functions. The database that is created by blockchain technology can be accessed, read, shared, and added to by each member. As there is no organising or controlling party, the ledger cannot be modified or edited; it is 'append-only.'[53] The blockchain, once it has been dispersed into society, runs autonomously through its own code, meaning that the original programmer has all of the power in creating this program *ab initio*.[54] Furthermore, the actual blockchain becomes increasingly difficult to fix or alter with the addition of more members to the program because consensus is needed in order to alter the basic code underlying the blockchain.[55] Therefore, very little (if any) changes can be made to the underlying protocol of a blockchain *ex post facto*.[56] This creates a system of artificial trust between actors, where one only has to rely on the underlying protocols of the network, not the actors with whom they are transacting with.[57]

Ultimately, blockchain technology creates an immutable, resilient, autonomous, and tamper-proof database which can be used to store encrypted information across a highly

[52] De Filippi and Wright (n 1) ch 1.
[53] MIT Technology Review Editors, 'Explainer: What is a Blockchain?' (MIT Technology Review, 23 April 2018) <www.technologyreview.com/2018/04/23/143477/explainer-what-is-a-blockchain/> accessed 10 April 2020.
[54] De Filippi and Wright (n 1) ch 1.
[55] How blockchains function is quite interesting, though out of the scope of this paper. Errors in coding or malicious attacks can create 'forks' in the chain, which can have dire consequences. See: David Seigel, 'Understanding the DAO Attack' (CoinDesk 2016). <www.coindesk.com/understanding-dao-hack-journalists> accessed 27 February 2020.
[56] De Filippi and Wright (n 1) ch 1.
[57] Nakamoto (n 2).

sharable network.[58] For a visual representation, the information is stored in encrypted 'blocks.' The blocks are stacked on top of each other ensuring that each block's coding matches that of the one previous to it through encryption, therefore creating a chain-like structure. If one wanted to corrupt the chain, each encrypted block's coding would have to be changed sequentially, which is highly unlikely to happen.[59]

Public blockchains are open for anyone to take part in, under any name, so long as they create an account and download the program.[60] Bitcoin is a well-known example. However, for the purpose of implementing this technology to a tax system, a private or 'permissioned' blockchain would need to be used, as not every taxpayer should have access to the other's private tax information. Permissioned blockchains share roughly the same features, however, in these blockchains, an organising party must allocate permission rights to the other nodes.[61] As stated in the introduction, Nakamoto introduced blockchain as a way to take third parties and controlling institutions (i.e. banks and governments) out of certain transactions, creating a space where there is artificial trust based solely on code.[62] Permissioned blockchains, therefore, may be contrary to this vision, as it places a central organiser 'in charge' of regulating the blockchain. However, this trust issue can again be solved with an algorithmic function known as zero knowledge proofs which give computers on the permissioned blockchain their own private computing space, recreating again a system fully, but artificially, built on trust.[63] The combination of artificial trust and full transparency, in order to view the information encrypted onto the private blockchain, is the cornerstone of this tax reporting blockchain.

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[58] See Investopedia for a simple explanation of the technology: Christina Majanski, 'Distributed Ledgers' (Investopedia 2019) <www.investopedia.com/terms/d/distributed-ledgers.asp> accessed 27 February 2020.
[59] But not impossible: De Filippi and Wright (n 1) 113-114.
[60] ibid 33ff.
[61] ibid.
[62] Nakamoto (n 2).
[63] This is to be discussed further in section 6. PVIX Class, 'What are Zero Knowledge Proofs' (PVIX Class 2018) <www.youtube.com/watch?v=s6nYMJq3WA4> accessed 9 March 2020.

Permissioned blockchains, therefore, are the equivalent of a public blockchain (i.e. secure, immutable, autonomous) but with a unique feature: a controlling party can govern access to information based on what kind of encryption and passwords they allow. If a government is the proprietor of the code of such a database, they can grant and deny the access to the chain, therefore allowing and restricting access to information. Unauthorised agents who do not have the necessary decryption key will not be able to view the content of the data, even if it is housed on their servers.[64]

3.2 Digital Invoicing

The full realisation of a blockchain-facilitated tax regime will not happen until mandatory digital invoicing systems are entirely operational. These systems streamline all paper invoicing to real-time, digital transactions which can be saved on a digital database. Fiji has been one of the first to implement digital invoicing for their VAT regime. The GCC and the EU are moving towards the implementation of digital invoicing for taxation on the supranational level, however, their individual members are lagging.[65] As pointed out by Ainsworth, Alwohaibi, and Cheetham, "the movement to digital tax information reporting is widespread, slow moving, and irregular."[66] Until this necessary first step is completed, a blockchain system cannot be put into place, meaning that any community wide taxes (i.e. VAT) cannot be reported in real-time on a blockchain, until each country implements this technology.[67]

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[64] De Filippi and Wright (n 1) 14-16.
[65] Richard T Ainsworth, Musaad Alwohaibi, and Mike Cheetham, 'A High-Tech Proposal for the U.K. and Saudi VATs: Fighting Fraud with Mini-Blockchains and VATCoins' (2019) 96(6) Tax Notes International 511 (514); Richard T Ainsworth and Musaad Alwohaibi, 'The First Real-Time Blockchain VAT – GCC Solves MTIC Fraud' (Law and Economics No 17-23, Boston University School of Law, 24 July 2017) 8 <papers.ssrn.com/sol3/papers.cfm?abstract_id=3007753&download=yes> accessed 13 December 2019.
[66] Ainsworth, Alwohaibi, and Cheetham (n 65) 514.
[67] ibid 514ff.

The above point should be stressed: without mandatory digital reporting and higher cooperation, further technological advancements cannot be implemented. Without these further technological implementations, tax problems that struggle from lack of oversight and organisation, such as evasion and fraud, cannot be curbed.[68] The addition of artificial intelligence to a blockchain-facilitated tax regime could relieve the tax agency of manual auditing and be a prescriptive solution for tax evasion in real-time. In Fiji, digitalisation has meant real-time reporting and increased data protection. Further, because (almost) all businesses who pay VAT are digitalised, Fiji can uniformly adjust its VAT rate instantaneously, without need for administrative costs or time lag. Most importantly, the information is secure and encrypted.[69]

Overall, a digitised tax regime is a smarter, faster, safer, more efficient way of tracking tax reporting and invoicing, therefore cutting administrative burdens and increasing the tax yield. Blockchain would only increase this efficiency.

4 Existing Blockchain Solution to VAT Fraud

Ainsworth, Alwohaibi, and Cheetham propose a blockchain solution for VAT fraud ('VAT Blockchain Model') which could lead to even higher collection of taxes based on higher compliance rates due to real-time, digitalised reporting and a reduction in administrative burdens.[70]

The VAT Blockchain Model can only be implemented after a digital invoicing system has been realised, like in Fiji. The authors envision that data on each transaction in the supply-chain will be recorded digitally and automatically (in real-time) and then sent to the

[68] ibid 523ff.
[69] Richard T Ainsworth and Goran Todorov, 'Fiji: Digital Invoice System Fights Fraud and Enforces Real-Time VAT Compliance' (2018) 92(7) Tax Notes International 697 (698).
[70] Ainsworth, Alwohaibi, and Cheetham (n 65).

tax authority to be stored on the blockchain and validated; in response, the tax authority will assign a specific digital receipt to be attached to each good, which can be scanned by the buyer, auditor, or tax authority to check the validity of such goods. By putting a digital, scannable code on each good and matching it to each transaction, each good as well as each transaction in the supply-chain can be tracked digitally. Importantly, the authors also include artificial intelligence (AI) to analyse all transactions stored in the blockchain.[71] This will be a major step in recognising fraud in real-time, instead of waiting for an audit up to nine months later, which is the upper limit of the current wait time in the EU.[72]

In addition, the authors also envisage a crypto-tax-currency ("VATCoin") stored on a separate blockchain in order to track the money paid to the internal revenue in the VAT transactions.[73] This cryptocurrency approach adds sophistication to their blockchain model in combatting VAT fraud, but it also adds a layer of difficulty. Many countries are still dreaming of adding digital invoicing, so this secondary layer of automation may not be realistic for many years to come. For this reason, the more interesting VATCoin will be set aside, while AI, being more palatable and more pertinent for auditing, will be implemented into my tax reporting blockchain model.

I presume that the VAT Blockchain Model is a permissioned blockchain, though not expressly stated, where the nodes are the tax authority, the VAT registered businesses, and VAT-paying customers.[74] The tax authority should then have full access to all information stored on the blockchain, while the taxpayers/businesses will only have access to the information that they store specifically or that is in their supply-chain.[75] The underlying

[71] ibid.
[72] Ainsworth and Alwohaibi (n 65) 13; Stu Bradley, '6 Essentials for Fighting Fraud with Machine Learning' (MIT Technology Review, 18 November 2019) <www.technologyreview.com/2019/11/18/131912/6-essentials-for-fighting-fraud-with-machine-learning/> accessed 17 April 2020.
[73] Ainsworth, Alwohaibi, and Cheetham (n 65).
[74] ibid.
[75] Ainsworth and Alwohaibi (n 65).

protocols of the blockchain, as opposed to the tax authority, authenticate all transactions and store the data automatically and autonomously, creating a system based on trust of the underlying code, not in the third party institution.[76]

The authors propose that this blockchain tax structure should be shared between all members of a community (i.e. the EU).[77] Each member state (i.e. the UK) would have their own blockchain with their corresponding tax authority (i.e. the HMRC) allocating permission and access to information on the blockchain. Each member state would then come together to create a larger blockchain in order to match records on transactions that cross borders within the community. The GCC has already set up the foundation for such a central tax administration for the exchange of transaction-level data, called the Tax Information Center. Currently the EU does not go as far as sharing transactional data across borders or between member states.[78]

Though the examples provided here are for intra-community sharing of information, the nature of blockchain does not necessitate a supranational authority or a central regulator. There are just no examples of this yet in the tax world that I am aware of. Necessarily, blockchain creates a trustless platform built solely on code where no supranational authority or central regulator has to facilitate the exchange of information, as discussed.[79] Therefore the underlying protocols of the network are the only arbiter of goodwill and good faith. Changing the scale of the blockchain model so that state institutions as well as individuals and corporations can interact on the blockchain should not change the inherent nature of the technology: it will still be an autonomous, resilient, tamper-proof distributed ledger. However, it is hard to imagine any database relating to tax without some form a central regulator, therefore the tax reporting blockchain model that will be proposed in this paper

[76] De Filippi and Wright (n 1) 43.
[77] Ainsworth, Alwohaibi, and Cheetham (n 65) 523ff.
[78] ibid 517.
[79] De Filippi and Wright (n 1) 43.

will necessarily need some basic structures, and permission to the blockchain at the very least, agreed upon at its outset by a 'central regulator.' The OECD should act as the organiser for the tax reporting blockchain, allocating permission and being responsible for the initial launch of the blockchain, as this would be an improvement to the CRS framework.

5 Applying Blockchain to Tax Reporting

The VAT Blockchain Model increases transparency and trust in tax reporting. This is something that the cross-border tax reporting regimes could benefit from, as discussed in section 2. Therefore, the VAT Blockchain Model is a good starting point for applying a blockchain to tax reporting, after digitalisation is achieved and the loopholes in the CRS framework are closed.

A permissioned blockchain will be needed to manage, store, and secure large amounts of financial data within roughly a hundred jurisdictions participating on the CRS, if all current signatories decide to participate.[80] Furthermore, each participating jurisdiction has a competent and sovereign tax agency which will need access to all of its citizens private and reportable data recorded and encrypted on the blockchain. Thus, the structure will look roughly the same as the VAT Blockchain Model: a blockchain recording, encrypting, and storing transactions in almost real-time, with further AI to analyse each transaction in order to detect fraud patterns. Access will be controlled by a competent authority, the OECD, as discussed.

More permission rights will be given to those nodes that need access for tax purposes, such as the tax authorities, while less permission shall be given to those who do not (taxpayers). (See Diagram 1 for a very basic visual representation of the structure.) Each

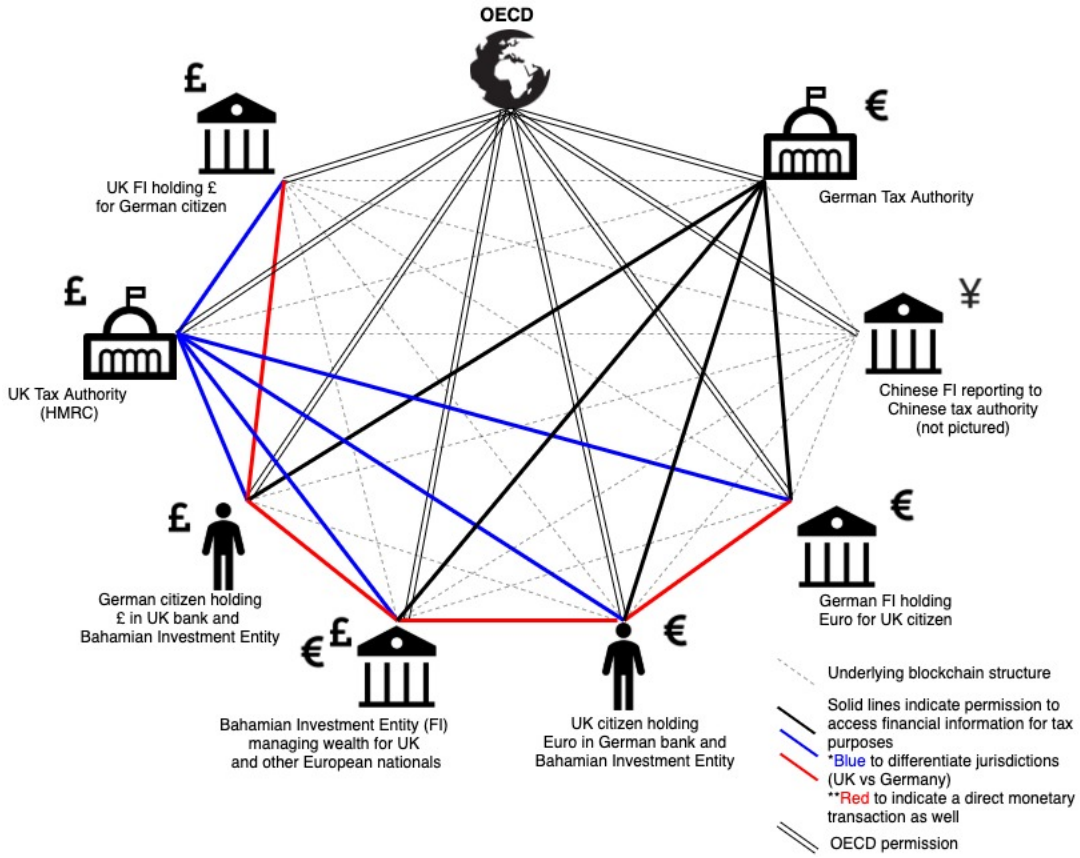
[80] OECD, 'Automatic Exchange Portal' (OECD 2018) <www.oecd.org/tax/automatic-exchange/international-framework-for-the-crs/> accessed 13 April 2020.

transaction by the reporting FI (or self-reporting person) is saved to the blockchain and can be viewed by both the reporting FI (or taxpayer) and the tax authority (represented by the bold lines in Diagram 1). Furthermore, because this reporting scheme is international, all information will be encrypted so that only relevant parties will be able to view sensitive information. No country will be able to see the financial transactions of another country's citizens; this is represented by the dashed lines in Diagram 1 which create the underlying structure of the blockchain. Note that the HMRC has the authority to view information reported by the UK FI and the UK citizen (as shown in Diagram 1 through the bold lines), but not by anyone else. The OECD, though being the organising party who allocates access to jurisdictions, should not be able to access or view transactions on the blockchain (represented with the double line). Their role is purely passive, building the framework for the network and granting permission to participating jurisdictions. Zero knowledge proofs, as mentioned above, will be necessary here to solve privacy issues between jurisdictions on the chain and will be discussed more fully in section 6.[81]

Finally, AI should be implemented in order to comb through transactions and match records in order to combat tax evasion in real time.[82] Bradley argues that machine learning, which is implemented in AI, is the best component to fight fraud, as it can adapt and adjust to changes in patterns without over-adaption.[83]

[81] PVIX Class (n 63).
[82] cf Ainsworth and Alwohaibi (n 65) 26ff.
[83] Bradley (n 72).

Diagram 1:



If the OECD does not make any changes to the way the CRS operates currently, a blockchain structure like this paper is proposing would not be a panacea for cross-border tax evasion. There would still be the problem of people shifting their holdings to other countries who do not participate on the blockchain, and of certain types of holdings that would still go under- or unreported.[84] However, the implementation of a blockchain reporting scheme would severely reduce administrative burdens, almost eliminate the need for physical audits, and automate a very slow and outdated system of reporting, as will be discussed in the next section. It would further solve timing and transparency problems within reporting. For an example, under the current CRS structure, a Bahamian FI reports the holdings of foreign nationals (in this case German and UK) to their local tax authority. The Bahamian tax

[84] Casi, Spengel, and Stage (n 25) 3; Noked (n 5) 4-8.

authority then distributes the relevant tax information to corresponding CRS jurisdictions (i.e. the 'home' jurisdiction) only *once* a year, here Germany and the UK. Under the proposed blockchain model, reporting would occur on *every* transaction automatically, eliminating the administrative trail from FI to local tax authority to home tax authority. Furthermore, it would record *every* transaction on the blockchain, transparently, for both the local and the home jurisdiction to see clearly (as represented by the corresponding solid blue and black lines in Diagram 1). This means that there is less time for FIs or self-reporting persons to manipulate money holdings abroad by under-reporting or withdrawing large sums right before the reporting date. Thus, a tax reporting blockchain greatly increases the frequency of reporting and decreases the window for evasion.

However, this paper sees the limitations of the CRS as it currently stands, as noted in section 2. The most advantageous route for the OECD to take when implementing a blockchain structure to tax reporting is to first close the loopholes created by vague definitions and further mandate reporting on beneficial and non-financial holdings (such as crypto and maybe physical monies, as well as physical goods like art and real estate).[85] This can be done with amendments to the legislation and further ratification in each participating jurisdiction.[86] Without these gaps in the CRS, a blockchain structure can bring tax reporting into the modern era.

6 Is Blockchain the Answer?

The inherently international topic of cross-border tax reporting necessitates a discussion on whether the international community is better off with such blockchain implementation

[85] cf Knobel (n 46).
[86] cf CRS Multilateral Competent Authority Agreement based on Article 6 of The Multilateral Convention on Mutual Administrative Assistance in Tax Matters 2010 <read.oecd-ilibrary.org/taxation/the-multilateral-convention-on-mutual-administrative-assistance-in-tax-matters_9789264115606-en#page1> accessed 13 April 2020.

and heightened oversight. In all, I would like to argue that it is. This technology creates many benefits: efficiency, lower administrative burdens, lower tax gaps, and increased transparency in a secure way. However, the likelihood of a blockchain solution being realised in the near future is quite low due to a full political and environmental agenda in the current international community, which is very much outside the scope of this paper. Therefore, the rest of this paper shall discuss the ramifications of introducing a blockchain solution into the international tax community and why the benefits might outweigh the costs.

6.1 Questions of International Comity

Because the CRS and FATCA call for international cooperation, comity must firstly be discussed. A permissioned blockchain necessarily will infringe further into privacy and security rights than most other international treaties, as this will be a shared, though encrypted, database of tax information. Inherently, nations will be concerned about keeping their information private and secure.[87] There also may be arguments suggesting sovereignty to be an issue, however, I do see these to be an issue.

Permissioned blockchains do not have the anonymity (i.e. privacy) of public blockchains.[88] However, data can be protected with encryption, so that two parties can view the same output, without having to disclose any of their data.[89] In the tax reporting model, this means both the German and UK tax authorities can privately record and view their own tax information, and still share those transactions which cross their shared tax 'borders.' This cryptographic protection is known as zero knowledge proofs (ZKP), as mentioned above.

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[87] Allison Berke, 'How Safe are Blockchains? It Depends' (Harvard Business Review, 7 March 2017) <hbr.org/2017/03/how-safe-are-blockchains-it-depends> accessed 20 February 2020.
[88] Vitalik Buterin, 'On Public and Private Blockchains' (Ethereum Blog, Ethereum Foundation, 7 August 2015) <blog.ethereum.org/2015/08/07/on-public-and-private-blockchains/> accessed 27 February 2020.
[89] PVIX Class (n 63); Elad Verbin, 'Zero Knowledge Proofs and Their Future Applications by Elad Verbin at Web3 Summit 2018' (2018) Web3 Foundation <www.youtube.com/watch?v=J3jKROwTPCs> accessed 11 March 2020.

ZKP allows for actors to have complete, yet artificial, trust, as well as complete privacy within their own computational space on the chain.[90] A real-world example of this is the zero coin protocol, in which nodes on a blockchain use ZKP to prove that that an actor owns currency without disclosing its denomination.[91] This prevents a person from attaching any of that money's history to themselves, which is useful for further privacy in a public and transparent blockchain marketplace.[92]

Verbin believes that ZKP will revolutionise collaboration.[93] Within a structure of decentralisation and complete privacy, actors are free to act completely self-interestedly. This is economically efficient,[94] but allows for collaboration between distrusting actors; this would further increase the economic benefit from increased tax transparency and collection, if the unintended consequences of closing access to tax havens is not greater than the benefits of greater collection.[95] Verbin further explains that this mix of game theory and cryptography can create a positive sum value while working within a framework that keeps all players truthful.[96] Therefore, adding ZKP to the tax reporting model could improve on-chain privacy and security, while boosting trust. This is indirectly applicable to private individuals, whose private information will be safely encrypted and unreadable by jurisdictions irrelevant to their tax reporting.

As stated from the outset, participation on the tax reporting blockchain is voluntary, as is participation in CRS.[97] It is perfectly acceptable under the CRS for jurisdictions to keep their tax laws opaque in order to bring in economic stimulus.[98] The CRS solely mandates

[90] Verbin (n 89).
[91] PVIX Class (n 89).
[92] ibid.
[93] Verbin (n 89).
[94] Following the ideology of Adam Smith: Christina Majaski, 'Invisible Hand Definition' (Investopedia, 5 May 2019) <www.investopedia.com/terms/i/invisiblehand.asp> accessed 15 April 2020.
[95] ibid; Serrato (n 50).
[96] Verbin (n 89).
[97] Knobel (n 46); FATCA, however, is not entirely voluntary. See: Noked (n 5) 2-3.
[98] Scherrer and Thirion (n 39).

what needs to be reported, but not *how much*.[99] The implementation of an international tax reporting blockchain will only change the structure and procedure of reporting (i.e. *how*). This paper is not proposing any substantive tax laws, other than the closing of the aforementioned loopholes in section 2. Thus, there should be no sovereignty issues.

In smart contracting, it is proposed that an actor's autonomy may be eroded through automation, even if the law is unlikely to see a smart contract as completely *legal* yet.[100] I would like to analogise this to the blockchain model, then quickly reject the argument. If automation is believed to diminish party autonomy, then automation of a state's duties is surely to decrease autonomy and, therefore, sovereignty. Some have called this "algocracy" or a complete rule of code.[101] This argument can be set aside quickly, as most authors in smart contracting point out that this loss in autonomy is thin: a party must autonomously trigger the contract; furthermore, party intent is still the legal determinant.[102] Indeed, this technology enhances party autonomy in drastic ways: cryptocurrencies and smart contracts are offered to people who cannot obtain access to traditional banking or contracting services.[103] Extrapolating this to an international stage seems almost silly: the jurisdiction enters into the tax reporting scheme of their own volition and therefore has the autonomy to withdraw if they so choose, under the correct legal mechanisms, which is not unlike Lord Bridge' famous dicta on parliamentary sovereignty from *Factortame (No. 2)*.[104] The mechanism under which reporting is done, blockchain or not, does not change the laws of the international framework or more importantly national tax policy.

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[99] OECD, 'Preventing Abuse of Residence by Investment Schemes to Circumvent the CRS' (Consultation Document, 19 February 2018 – 19 March 2018).
[100] Kevin Werbach and Nicholas Cornell, 'Contracts Ex Machina' (2017) 67 Duke Law Journal 313 (322ff).
[101] Aneesh Aneesh, 'Global Labour: Algocratic Modes of Organtization' (2009) 27(4) Sociological Theory 347-370.
[102] Werbach and Cornell (n 100).
[103] De Filippi and Wright (n 79) 70-71, 81-83; 100thMonkeyChannel, 'Bitcoin: Beyond the Bubble' (19 April 2018) <www.youtube.com/watch?v=LszOt51OjXU> accessed 31 March 2020.
[104] *R v Secretary of State for Transport Ex p. Factortame Ltd. (No. 2)* [1991] 1 AC 603 (659).

With privacy, security, and sovereignty issues settled, it can now be asked: is it really practical for jurisdictions to voluntarily participate on an international permissioned blockchain for tax reporting? Currently, once legislation is ratified, a jurisdiction need only set up the necessary OECD compliance measures with the corresponding FIs.[105] Under the proposed blockchain tax model, the OECD, as the trusted administrator, would need to add the jurisdiction and its corresponding FIs and taxpayers to the chain. This would necessitate much more involvement from the OECD. There would no longer be a system of complete self-implementation.[106]

Importantly, the CRS functions because each jurisdiction *voluntarily* ratifies the conventions and reports annually. Individual FIs are under the pressure of penalties and fines defined by their corresponding jurisdiction in order to comply.[107] As explained in section 1, tax compliance is not something that would happen spontaneously.[108] The OECD encourages such measures as it does not have the mandate to set such penalties for noncompliance, being an international organisation.[109] Therefore, it is highly incumbent on the participating jurisdictions to have penalty schemes in order to keep compliance high in a voluntary scheme.

However, with the implementation of the blockchain model, reporting is mandatory and instantaneous, because of digitisation and automation. Therefore, the 'voluntary' element is non-existent, once jurisdictions ratify the legislation and are fully embedded on the chain. This may mean that noncompliance measures become redundant after the digitisation phase. Nonetheless, penalties are still necessary until digitisation is complete. Fiji had a warning

[105] OECD (n 18).
[106] ibid.
[107] New Zealand Inland Revenue, 'Guidance on the Common Reporting Standard for Automatic Exchange of Information' (New Zealand Government, June 2017) 101ff <www.oecd.org/tax/automatic-exchange/crs-implementation-and-assistance/crs-by-jurisdiction/guidance/NewZealand-Guidance.pdf> accessed 13 February 202.
[108] Slemrod (n 7) 25.
[109] Knobel (n 46).

system and also threatened penalties for non-compliance when adopting their digital reporting VAT scheme.[110] After implementation of the proposed blockchain, the OECD will still not have mandate to set penalties, meaning whole jurisdictions could fall under optimal levels of compliance.[111] Without a central regulator who has coercive power, the system is reliant on jurisdictions' voluntarily participation, which is not unlike any other international treaty or law.[112] It is suggested that once nations sign international treaties, they generally tend to follow them.[113] This is optimistic evidence, but as with all international laws, there are no guarantees.

Thus, the weight of monitoring will ultimately fall upon individual jurisdictions. This seems right, given that an international organisation which mandates penalties might start to look like a supranational authority. For reference, noncompliant UK FIs face a fine of £300 and a further £60 per day. If individuals are found noncompliant, a penalty of 300% of the original tax rate is imposed.[114] Obviously, monitoring is costly, especially when these fines seem fairly low. Costs will be examined next.

6.2 Estimated Costs

Slemrod suggests that relatively disinterested third parties for monitoring and providing information may achieve high compliance rates at a fairly low cost.[115] The proposed tax reporting blockchain, managed by the OECD, may fulfil this monitoring role. However, the

[110] Ainsworth and Todorov (n 69) 697.
[111] cf Knobel's argument for OECD penalties (n 46).
[112] cf Kyoto Protocol to the United Nations Framework Convention on Climate Change, 1998.
[113] Jana von Stein, 'Do Treaties Constrain or Screen? Selection Bias and Treaty Compliance' (2005) 99(4) American Political Science Review 611 (611ff).
[114] 'Common Reporting Standard' (Pinsent Masons, 6 May 2016) <www.pinsentmasons.com/out-law/guides/common-reporting-standard> accessed 29 March 2020.
[115] Slemrod (n 7) 44.

OECD is not known to be a disinterested party; that is why I envision them to have a limited role on chain once it is running.[116]

The purchase of the necessary hardware to build the network infrastructure for the blockchain will be expensive. It may be outside of the scope of this paper to do a full investigation into the costs of employing an international distributed ledger for tax reporting. However, it is important to note the massive costs incurred not just by the OECD and participating jurisdictions but also by the FIs who may need to update their hardware. In the interest of fairness, I propose that the respective participating jurisdictions take on the costs of implementation, maintenance, oversight, and any further costs of running this reporting scheme. Ultimately, the blockchain is a mechanism for collecting national tax; therefore, participating governments should take on the costs associated with it.

Fiji's mandatory digital invoicing scheme may be the best way to benchmark national implementation, even though there is no blockchain system in place.[117] The Fiji Revenue & Customs Service (FRCS) reported an actual revenue loss in 2016/2017 of FJD 138 million, which was much lower than they anticipated. Ainsworth and Todorov explain that this short-term revenue loss is due to the fact that the VAT reduction was universal and immediate (FRCS changed the rate from 15% to 9%), while the technological implementation of the mandatory reporting was gradual.[118] However, FRCS has predicted high future returns, which may end up being much higher than expected.[119]

Ernst & Young (EY) calculated the total cost for launching and operating a permissioned blockchain.[120] Their study does not accurately fit our tax reporting model, as it

[116] See: Ron Gass, 'Speaking Truth to Power' (OECD Observer No 294, January 2013) <oecdobserver.org/news/fullstory.php/aid/3951/Speaking_truth_to_power.html> access 19 April 2020.
[117] Ainsworth and Todorov (n 69).
[118] ibid 2.
[119] ibid 20.
[120] 'Total Cost of Ownership for Blockchain Solutions' (Ernst & Young, April 2019) <www.ey.com/Publication/vwLUAssets/ey-total-cost-of-ownership-for-blockchain-solutions/$File/ey-total-cost-of-ownership-for-blockchain-solutions.pdf> accessed 31 March 2020.

assumes corporate implementation, rather than governmental. Further, their estimations are much lower than what would be necessary for a massive, international tax reporting network. However, they do highlight the necessary components that factor into implementation costs, what they term "key inputs:" transaction volume (daily quantity of transactions uploaded), transaction size (type of data stored), node hosting method (cloud based vs not), and consensus protocol (how the blockchain will verify the transactions).[121] EY estimates a blockchain system using cloud-based node hosting, with 1,000 large transactions a day, using a consensus mechanism called proof of authority would have a five-year fixed cost at $1,565,055. This includes building, deploying, maintaining, monitoring, and cloud-hosting the platform.[122] This EY figure does help project what a permissioned blockchain could cost in the first five years of implementation in a smaller jurisdiction. However, the assumptions they take are problematic, and, as stated, their model does not perfectly align with our goals.[123]

Changes should be as follows: The international tax reporting blockchain will need to be massive in order to incorporate any participating jurisdiction, including all FIs and taxpayers relevant to those jurisdictions. This is an easy fix: each node (jurisdiction) added to the chain will just need to invest in enough hardware to participate on the chain. I will also assume that the transaction sizes will be quite small, as financial data is not a large data file like pictures or videos. The consensus mechanism is less important to cost once proof of work, the most computationally powerful verification mechanism, is discarded. It should be noted that I am inclined to agree with EY on using proof of authority, as it is more computationally efficient. This will be discussed further in the next section. Therefore, the EY projection needs to be modified, and then massively scaled up to fit a nation, not a

[121] ibid 5.
[122] ibid 10-11.
[123] ibid 6.

company. This solution then needs to be multiplied by every jurisdiction who wishes to participate on the chain.

Though the outlined costs could possibly be massive, history has proven that technology and automation can reduce administrative burdens and transaction costs, while increasing efficiency.[124] As noted, technological innovation led Ainsworth and Todorov to predict higher future VAT returns than what FRCS expects in Fiji.[125] Furthermore, the aforementioned Microsoft whitepaper believes blockchain technology could significantly reduce the international tax gap by increasing the efficiency of collection.[126] This proposed blockchain model will have massive onboarding costs, but once the algorithm is running, cost of maintenance, monitoring, and energy will be the only significant costs. For comparison, the UK has budgeted about £3.93 billion in order to heighten tax compliance measures within the next 5 tax years.[127] The IRS 2020 budget (request) is $11.47 billion, of which $8.78 billion is allocated for enforcement and operations support while $290 million is solely budgeted for "business systems modernisation."[128] Clearly investment into a blockchain reporting system is costly, but, as shown, western democracies of greatly different sizes have the capital to invest if they so choose. However, this is an individual policy decision that must be weighed against the estimated tax returns.

[124] Abhijit Jain, 'Automating the Bureaucracy: Using the McDonaldization Theory to Comprehend the Future Evolution of E-Government' (2006) AMCIS 288 <aisel.aisnet.org/cgi/viewcontent.cgi?article=1836&context=amcis2006> accessed 19 April 2020.
[125] Ainsworth and Todorov (n 69) 20.
[126] Baisalbayeva et al. (n 8).
[127] HM Treasury, 'Budget 2020' (UK Government 2020) Table 2.1 <www.gov.uk/government/publications/budget-2020-documents/budget-2020> accessed 17 April 2020.
[128] Department of the Treasury Internal Revenue Service, 'Congressional Budget Justification and Annual Performance Report and Plan: Fiscal Year 2020' (US Government 2020) 2 <home.treasury.gov/system/files/266/02.-IRS-FY-2020-CJ.pdf> accessed 19 April 2020.

6.3 Further Technological Considerations

In addition to privacy and security, there are also many practical technological considerations. Fiji digitalised their VAT regime in phases, mandating that certain sectors digitalise before others.[129] As this tax reporting blockchain may be the first intergovernmental blockchain of its kind, small scale implementation, known as 'beta testing,' confined to few jurisdictions, may be a good first step. Furthermore, the OECD will have to employ a team of IT specialists to manage the underlying protocols of the blockchain.

As with most blockchains, time lags prevent the network from updating. Bitcoin, because of its size and proof of work consensus algorithm, takes more than ten minutes to reach a consensus, whereas Ethereum, another well-known blockchain, only needs about 12 seconds.[130] Because the tax blockchain model is bringing *annual* reporting into almost real time, the difference between 12 seconds and 10 minutes is almost insignificant. Furthermore, as highlighted above, the consensus mechanism proof of authority may be a more computationally efficient verification mechanism for this blockchain tax model, which will allow the blockchain to reach a consensus faster.[131] It works by relying on a central authority (the OECD) to verify certain nodes (I envision certain highly trusted tax authorities like the UK and Germany) which become verifiers of transactions on the system. This consensus mechanism uses less computational power than proof of work, therefore requiring less energy consumption and time.[132]

The biggest concern with a blockchain structure, especially one that is permissioned, is the fact that it could just as easily be structured as a centralised database. A centralised database can perform the same functions as a blockchain server, all without the hassle of time

[129] Ainsworth and Todorov (n 69).
[130] De Filippi and Wright (n 1).
[131] 'Proof of Authority Explained' (Binance Academy 2020) <www.binance.vision/blockchain/proof-of-authority-explained> accessed 31 March 2020.
[132] ibid.

lags and a blockchain's annoying append-only nature.[133] Indeed, the OECD is already acting as a central regulator in this fact scenario, why not house all the information on a more flexible centralised database?

The main thrust of any argument in favour of a blockchain is decentralisation. This, in combination with ZKP, solve the trust problem between actors, discussed at length.[134] In a model with a centralised database, every jurisdiction's tax information will be housed and managed by a central authority. Being an international institution, the OECD has no mandate to actually perform these functions.[135] Furthermore, centralised databases are thought to be less secure because they house all information in one hackable location.[136] Thus, it is of utmost importance that a blockchain and cryptography be used to create a secure and distributed network in order to bypass any reliance on third party institutions. Of lesser importance, but not insignificant, using distributed technology also distributes costs to each participating jurisdiction, while a centralised database would place most of the operating costs on the OECD, whose budget is EUR 386 million and funded by each member country regardless if they participate in CRS, which seems unduly harsh.[137]

6.4 Fairness and Equity

Lastly, this paper considers the social cost of implementing an international tax reporting blockchain, as it is still questionable whether increased tax compliance will increase equity and efficiency in public finances.[138] The marginal social benefit of the reduced

[133] Andrew Tar, 'Decentralised and Distributed Databases, Explained' (Cointelegraph, 2 December 2017) <cointelegraph.com/explained/decentralized-and-distributed-databases-explained> accessed 19 April 2020.
[134] Nakamoto (n 2); Verbin (n 89).
[135] There are no such powers given to the OECD in The Multilateral Convention on Mutual Administrative Assistance in Tax Matters 2010 (n 86).
[136] Tar (n 133).
[137] OECD, 'Member Countries' Budget Contributions for 2019' (OECD 2020) <www.oecd.org/about/budget/member-countries-budget-contributions.htm> accessed 19 April 2020.
[138] Slemrod (n 7) 42.

evasion, which is not well measured or estimated by the increased revenue captured, must be weighed against the marginal resource cost discussed immediately above.[139] Optimistically, one would think an cross-border tax reporting blockchain should lead to a reduction of global tax evasion, and, thus, higher equity between taxpayers.[140] That may not be the case.

Slemrod explains that horizontal inequity is created when people evade, because "equally well-off people end up with different tax burdens."[141] Assuming that more tax is collected after implementation of a tax reporting blockchain, compliance should increase, and horizontal inequity should decrease. However, equity theory suggests that people will strive to eliminate *perceived* inequities. Therefore, taxpayers who perceive the tax system as inequitable are likely to underreport in order to restore this perceived inequity.[142] Castro and Rizzo found that taxpayers within the vertical inequity condition (specifically those at lower income levels) will evade more as compared to those within the equity or horizontal inequity conditions.[143] This means that taxpayers only respond to what they perceive as fair: taxpayers are not concerned about their treatment relative to individuals similar to themselves (horizontal equity), which is what tax evasion creates, but more so with individuals who are dissimilar to themselves (vertical equity).[144] Thus, the correction of tax evasion through heightened reporting on a blockchain will not affect this perceived inequity; structural reform is needed to fix any vertical inequity.[145]

Similarly, Kim found that the more equitable a tax system is perceived to be, the less inclined a taxpayer is to underreport. This is heightened by sanctions imposed on evaders and

[139] ibid.
[140] Baisalbayeva et al. (n 8).
[141] Slemrod (n 7) 42.
[142] Massimo Finocchiaro Castro and Ilde Rizzo, 'Tax Compliance Under Horizontal and Vertical Equity Conditions: An Experimental Approach' International Tax and Public Finance 21, 560–577 (2014) 561-562.
[143] ibid 564.
[144] ibid.
[145] Slemrod (n 7) 42.

higher chances of audit.[146] Therefore, even if more tax is collected by the proposed blockchain model, national tax policy is the only factor that has a direct effect on how taxpayers evade. As offshore structures become less appealing because of higher transparency due to a tax reporting blockchain, tax evaders may switch to other non-reporting jurisdictions or decide to simply underreport.[147] National policy seems to be the only conclusive way to influence equity conditions.

7 Conclusion

Before the FATCA was enacted in 2010, Chief Counsel for the IRS, William J. Wilkins testified before a Congressional subcommittee that the IRS was concerned about the ability of US taxpayers to hide assets in offshore FIs.[148] This theme is seen internationally and was cited as a reason for implementing the OECD's CRS in 2016.[149] Currently, the CRS is still easily evaded through vague definitions, odd loopholes, and "opaque holding structures."[150] Closing the gaps in the international legislation and digitising reporting mechanisms is a step in the right direction, but it may not be enough to curb a "relocation effect" of holdings to non-CRS jurisdictions.[151] However, the implementation of an international blockchain tax reporting scheme to record and store all cross-border transactions, in real time, would revolutionise global tax collection. A model for such a scheme could be that of Ainsworth, Alwohaibi, and Cheetham.[152] This tax reporting blockchain would need to be completely secure, utilizing cryptography like ZPK, and be non-reliant upon the OECD for its function,

[146] Chung Kweon Kim, 'Does Fairness Matter in Tax Reporting Behaviour?' (2002) 23 Journal of Economic Psychology 771-785 (772-773).
[147] Casi, Spengel, and Stage (n 25); Kim (n 146).
[148] US House of Representatives (n 13) 14.
[149] OECD (n 43).
[150] Noked (n 5).
[151] Casi, Spengel, and Stage (n 25).
[152] Ainsworth, Alwohaibi, and Cheetham (n 65).

even if the OECD shall organise its structure.[153] If a tax reporting blockchain is realised, horizontal equity may increase, though vertical equity cannot be decreased without changes in national tax policy.[154] Though participating jurisdictions need to consider the monetary costs of implementation, which may be massive, a blockchain solution could mean higher tax compliance rates, transparency, and efficiency. Blockchain is not going to be a panacea for cross-border tax evasion, especially if the OECD does not close the aforementioned loopholes in section 2. However, increased transparency, real-time reporting, and heightened cooperation may still bring benefits to those countries who wish to mitigate cross-border tax evasion.

Word Count: 9997

[153] Verbin (n 89).
[154] Slemrod (n 7) 42.

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