

**HARNESSING QUANTUM COMPUTING FOR ENHANCED DETECTION AND
FRUSTRATION OF OFFSHORE TAX NONCOMPLIANCE IN THE AMERICAN
TAX SYSTEM**

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**A DISSERTATION SUBMITTED TO THE SCHOOL LAW IN PARTIAL FULFILLMENT OF THE
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Declaration

I Mpaka Peter, declare that this scholarly work is original and is my own work. It has not been submitted to any other institution of higher learning and that it is pure product of my effort.

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Abstract

Offshore tax evasion and avoidance pose a persistent threat to the integrity of the American tax system, costing the U.S. economy trillions of dollars in lost revenue. Despite comprehensive legislation and enforcement efforts by the Internal Revenue Service (IRS), multinational corporations and high net worth individuals continue to exploit legal loopholes and technological limitations to shield income and assets from the U.S. taxman. This dissertation explores the transformative potential of quantum computing in addressing these enforcement challenges. By leveraging quantum principles such as superposition and entanglement, quantum computers offer unparalleled computational power capable of processing vast data sets, enhancing cryptographic analysis and accelerating artificial intelligence applications for financial forensics. This study critically examines the limitations of the current IRS infrastructure, the legal frameworks surrounding offshore tax non-compliance, and the technical and ethical considerations of integrating quantum technologies into tax administration. Ultimately, it proposes a forward-looking model in which quantum computing becomes a key instrument in closing the tax gap and promoting global economic fairness

Dedication

This dissertation is dedicated to my father, Mpaka Peter Masembe, and my mother, Namuli Goretti Maria Mpaka, who have supported me throughout my whole life and inspired me to be the best I could be. I also dedicate this dissertation to my aunt, Nagawa Juliet, who has taken care of me and guided me throughout my secondary and University journey as if I were her own son.

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CHAPTER ONE

1.0 GENERAL INTRODUCTION

Offshore tax evasion and avoidance are major issues faced by governments all over the world, but none more than the United States. Trillions of dollars worth of Government revenue is being hidden from the United States taxman, and as a result, the whole world suffers the consequences. It is no secret that when the American economy suffers, the whole world suffers; and as a result, development and urbanization comes to a halt – since the United States is the biggest donor to the United Nations, World Bank and the International Monetary fund.

For years, the Internal Revenue Service (IRS) has fought tooth and nail against multinational corporations and ultra wealthy individuals to collect revenue that is obligated to the government, however it has still failed to find a proper solution to these problems.

This research aims to identify the challenges faced by the IRS in enforcing anti-tax evasion and avoidance laws, and present a new idea to lawyers and other professionals who read this study. Quantum Computing is the next technological breakthrough in human existence, and because of this, one must be prudent enough to incorporate this technology in order to solve pressing issues – like tax noncompliance. A lawyer must not only understand the law, but must be able to incorporate any tool at his disposal in order to solve difficult issues, and in this study, I present an astrophysical solution to a legal problem.

1.2 BACKGROUND OF THE STUDY

Taxation, the obligatory financial contribution imposed by governmental authorities on individuals and entities, is the basis for public expenditure and the provisioning of essential services to the populace.¹ Taxation is central to building strong and prosperous governmental systems and services through levying a charge on realized earnings, with tax rates varying based on the type of investment and earnings, such as capital gains, long-term earnings, dividends- and short-term profits. Article 1, section 8, clause 1 of the Constitution of the United States of America (Also

¹ Singh, Akashdeep, "Evaluating Responses to Offshore Tax Evasion: A Comparative Analysis of Legislative Reforms in the USA and Canada Post-Panama Papers" (2024). Honours Bachelor of Business Administration. 2. https://source.sheridancollege.ca/swpilon_theses_business_admin/2

known as the Taxing and Spending Clause) states that Congress has the authority to impose and collect taxes, duties, imposts, and excises to fund national debts, defense, and general welfare, ensuring that duties, imposts, and excises are consistent across all states. Section 7701 of the Internal Revenue Code of the United States stipulates that anyone who intentionally tries to evade or avoid paying taxes commits a felony and shall face a fine up to \$100,000 for individuals or \$500,000 for corporations, or imprisonment for up to 5 years, or both.

Tax evasion involves intentionally misrepresenting a taxpayer's financial affairs to the tax authority to lower their tax obligation through dishonest practices like underreporting income, profits, or gains, inflating deductions, bribing officials, or concealing funds in hidden locations. Tax avoidance, unlike tax evasion, involves strategically planning to minimize taxes in ways that align with the letter of the law but not its intended purpose; it aims to reduce tax liability and increase after-tax income². It is the legal use of a single territory's tax system to one's advantage, reducing payable tax through lawful means, usually through the use of tax havens.

Offshore tax evasion and avoidance is quite novel as it became a major concern of the Internal Revenue Service of the United States after the John Mathewson case in 1993³. John Mathewson was the chairman of Guardian Bank & Trust Limited, based in the Cayman Islands, after moving from Chicago to the Cayman Islands in the early 1980s.

He engaged in selling shell companies to wealthy individuals and corporations, which could bank at Guardian in order to hide income from the US taxman. He confessed that as part of Guardian Bank's services, he helped establish Dutch corporations enabling depositors to covertly borrow mortgage funds from their own deposits. These corporations issued fraudulent mortgages to create the perception that the depositor was borrowing from a legitimate foreign lender when in actual sense these funds were coming from the borrower's account with Guardian Bank.

This scheme enabled individuals to access unreported income hidden in offshore accounts at Guardian Bank, claim tax deductions for mortgage interest they paid to themselves, and redeposit that interest into their secret offshore account. Most accounts were held by U.S. citizens who used

² https://apps.irs.gov/app/understandingTaxes/whys/thm01/les03/media/ws_ans_thm01_les03.pdf

³ United States v Mathewson, 839 F. Supp 858 (S.D. Fla. 1993)

the Cayman Islands bank not to launder money from illegal activities, but to evade federal income taxes on legally earned income, enabling them to take advantage of the lack of income tax and strict bank secrecy of the Caymans. The IRS subsequently resolved 1,165 cases with individual taxpayers, collecting a total of \$3.2 billion. The Mathewson story had a major political impact in Washington and became a warning sign to the Internal Revenue Service, as the evasion itself was brazen and if replicated on a large scale, would threaten the integrity of the tax system as a whole.

Quantum computing is an advanced area of computing that leverages principles of quantum mechanics - the fundamental theory that explains how the world operates at a subatomic level - to solve problems that conventional computers cannot even comprehend.

Quantum computing exploits quantum effects to compute in ways that are faster and more efficient through the use of a quantum mechanical model for information and its processing, which not only changes the physical processes used for computation and communication, but the very fundamentals of information and computation themselves⁴.

Quantum computing began to take shape in the 1970s and early 1980s, driven by prominent physicists and computer scientist including Charles H. Bennett of IBM, Paul A. Benioff of Argonne National Laboratory in Illinois, David Deutsch of the University of Oxford, and Richard P. Feynman of Caltech. In 1982, Feynman developed an abstract model demonstrating how a quantum system could perform computations and serve as a simulator for quantum physics problems. His goal was to build a machine capable of conducting quantum physics experiments that conventional technology could not support.

Feynman showed that quantum computers could efficiently solve complex quantum mechanical many-body problems, which are impractical for classical computers due to their exponentially increasing computation time. In contrast, quantum computer could perform these calculations in polynomial time, making them fast and effective.⁵

⁴ Ray, Ishita, 'Quantum Computing' (2011) University Institute of Engineering and Technology, Panjab University, Chandigarh, India, rayria06@gmail.com

⁵ Prashant, 'A Study on the Basics of Quantum Computing', Department d'Informatique et de recherche operationnelle, Universite de Montreal, Montreal. Canada. {prashant}@iro.umontreal.ca <http://www-etud.iro.umontreal.ca/~prashant>

In 1985, David Deutsch recognized that Feynman's ideas could transform technology. He showed that a quantum computer could model any physical process suggesting that it could surpass the capabilities of traditional computers. In 1994, Peter Shor proved that a quantum algorithm could factor large numbers into primes much more efficiently than any classical algorithm.

The implementation of Shor's algorithm on a large scale could render ineffective any widely used cryptosystems used to encrypt data, as they operate on the premise that no conventional algorithm exists to factor the complicated codes used in encryption. This sparked off a silent arms race among various entities, including Google, IBM, Microsoft and Amazon with startups like Rigetti and Ionq, in order to harness and control the full potential of quantum computing.

1.3 STATEMENT OF THE PROBLEM

Despite the existence of adequate and extensive legislation and case law, there remains a gap between the provisions of the law and its enforcement. As a result, mega corporations are able to exploit the Tax Code through advanced and intricate evasion and avoidance schemes.

This study aims to evaluate the potential of quantum computing to bridge the technical and practical gap faced by the Internal Revenue Service in detecting and frustrating offshore tax noncompliance schemes in the American tax system; being that the American dollar is the base currency for international trade, what affects the American economy affects every other country.

1.4 GENERAL OBJECTIVE

To explore and assess the potential of quantum computing technology in enhancing the detection and prevention of offshore tax non-compliance within the American tax system, focusing on identifying current challenges and proposing innovative solutions for financial forensics.

1.5 SPECIFIC OBJECTIVES

- To identify current legislation in the American tax system codified by Congress to combat offshore tax evasion and avoidance.
- To analyze American case law regarding offshore tax evasion.
- To analyze current tax avoidance schemes used by Multinational Corporations (MNCs)
- To understand the challenges faced by the Internal Revenue Service

- To understand the basics of quantum computing.
- To investigate the potential of incorporating quantum computing in detecting and frustrating offshore tax evasion and avoidance.
- To analyze the potential challenges faced in incorporating quantum computing into the American tax System.

1.6 RESEARCH QUESTIONS

- What is the current legislation in the American tax system that Congress passed to combat offshore tax evasion?
- What is the current case law regarding offshore tax evasion?
- What are the current tax avoidance schemes used by MNCs?
- What are the challenges faced by the Internal Revenue Service?
- What does quantum computing entail?
- What potential does quantum computing have in detecting and frustrating offshore tax evasion and avoidance?
- What potential challenges may be faced in incorporating quantum computing into the American tax system?

1.7 SCOPE OF THE STUDY

This study is focused on the tax system of the United States of America, with emphasis on the Internal Revenue Service (IRS) which is tasked with the implementation and collection of taxes passed by Congress. The time period spans from the early 1980s to 2025, as tax evasion and avoidance only recently became an obstacle to the IRS after the John Mathewson Case.

1.8 JUSTIFICATION OF THE RESEARCH

The social contract that exists between the people and the government is a well-established one. For society to prosper, there must be a government to look after the interests and security of the people it governs, and in turn, the people must allow a certain amount of control from the government, fulfilling certain obligations and roles set by this government. Government is not a

perpetual machine that runs on merry-wishes, but an entity facilitated by revenue collected from society in the form of taxes. Taxes are the backbone of society, without which it would collapse. It is noteworthy that mega companies, multinational corporations, and even wealthy individuals have devised means of evading taxes, mostly through offshore evasion and avoidance tactics, enabling these entities to withhold trillions of dollars worth of taxes from the American economy.

This study aims to propose an effective solution to this problem. Quantum computing is a groundbreaking technological system that may have unlimited and unfathomable impacts on our daily lives. Through this study, I aim to provide a clear understanding of how quantum computing can enhance the enforcement of Title 26 of the United States tax code; and through this, demonstrate its potential global application in combating offshore tax non-compliance.

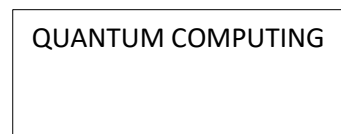
1.9 SIGNIFICANCE OF THE STUDY

This study aims to provide an innovative and novel solution to the problem of offshore tax evasion and avoidance that has cast the American economy into a deficit of over two trillion dollars. Although it may seem less important on a global scale, it is a fact that when the American economy suffers, so does the rest of the world.

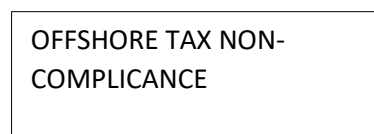
Thus, it is important to fix macro-economic problems first before focusing on the micro-economic problems faced by the rest of the world. Quantum computing is a niche that is yet to be explored, let alone harnessed for the good of humanity, thus I aim to broaden my reader's interest in the realm of astrophysics and juxtapose it with offshore tax evasion to create a melody of intellectual thinking that will solve today's problems for a better tomorrow.

1.10 CONCEPTUAL FRAMEWORK

DEPENDANT VARIABLE



INDEPENDENT VARIABLES



1.11 LITERATURE REVIEW

Tax avoidance refers to the tactical employment of tax regulations, deductions, and loopholes to reduce tax commitments without infringing upon legal mandates, while tax evasion involves intentional misrepresentation, deceit, or concealment aimed at evading tax obligations, resulting in legal repercussions and harm to one's reputation⁶.

Even though tax avoidance is a legal way of reducing one's tax liability, analysts contend that large multinational corporations (MNCs) and affluent individuals employ aggressive tax avoidance tactics to transfer profits to low-tax regions, thus eroding the tax base. In contrast, tax evasion involves employing unlawful acts to intentionally hide income, misrepresent financial statements, or participate in fraudulent behaviours to evade tax obligations. Underreporting income, exaggerating deductions, and concealing assets in offshore accounts are examples of dishonest practices employed by evaders.

The role of tax administrations is based on the implementation, enforcement, and administration of tax laws put down by legislative bodies. However, with the emergence of sophisticated tax evasion and avoidance schemes, tax administration has become increasingly difficult to carry out. The evolution of digital technologies has transformed both tax administration and tax noncompliance schemes, starting with the emergence of Artificial Intelligence. In order for tax administrators to keep up with the growing challenge of tax noncompliance, they must employ the newest technology as a tool to enforce compliance with tax policies.

Tax fraud poses a major threat to government revenue causing trillions in losses through various forms of evasion and avoidance. **Kehinde Olagoke** noted that conventional fraud detection methods which depend heavily on manual audits and rule-based systems, are inadequate for tackling the scale and complexity of contemporary tax fraud⁷. As a result, AI technologies have been implemented to facilitate automated analysis of large datasets, real-time anomaly detection

⁶ Priyam Katiyar and Dr. Arvind Kumar Singh, "Tax Avoidance vs Tax Evasion: A Legal Perspective on Corporate Tax Planning", *Indian Journal of Legal Review*, volume 5, issue 1, 2025.

⁷ Kehinde Olagoke, Oluwashola Fausath Bello, Tolulope Foyekemi, Oladiipo Ishola, Ifeoluwa Uchechuwkuw, and Ebenezer, "Leveraging Artificial Intelligence for Enhanced Tax Fraud Detection in Modern Fiscal Systems", *GSC Advanced Research and Reviews*, 2024, <https://doi.org/10.30574/gscarr.2024.21.2.0415>

and predictive modeling of fraudulent behavior patterns. The United States Internal Revenue Service (IRS) led the way by incorporating machine learning algorithms into its Return Review Program (RRP), which resulted in a 40% improvement in detecting fraudulent returns from 2020-2023⁸. The system handles over 200 million tax returns each year, employing sophisticated pattern recognition to detect potential fraud indicators, while reducing false positive rates by 35%⁹.

Sharifur Rahman and Rafiqus Salehin Khan state that Machine Learning models can process large datasets to identify subtle patterns that enable tax administrations to improve detection capabilities while optimizing resource allocation¹⁰. From automated risk profiling and anomaly detection to analyzing complex tax crimes and document reviews, AI presented a change in the course of fraud prevention and risk management in taxation¹¹.

Identifying anomalies in taxpayer behavior is essential to identifying tax noncompliance schemes. Machine Learning models have been used to detect outliers or deviations from expected patterns in income, transaction volumes, or reported deductions; isolation forests, support vector machines, and cluster analysis are some of the techniques used by the IRS in scrutinizing data sets for irregularities that may point to fraudulent behavior or errors in reporting. These systems can analyze volumes of data and identify cases of probable fraud much better than manual or rule-based approaches¹².

Even though AI technology has been implemented in tax administration, the IRS still faces challenges with implementation and use of these AI systems, preventing it from curbing tax noncompliance. According to **Olagoke**, The IRS faces significant implementation delays and cost overruns due to the need to overhaul complete systems and outdated infrastructure in order to

⁸ Ibid

⁹ Ibid

¹⁰ Sharifur Rahman and Rafiqus Salehin Khan, "An Exploration of Artificial Intelligence Techniques for Optimizing Tax Compliance, Fraud Detection, and Revenue Collection in Modern Tax Administrations", TensorGate Publishing, March 2024, <https://www.researchgate.net/publication/387585676>

¹¹ Ibid

¹² Ibid

accommodate modern AI technologies. The IRS has not yet implemented the specialized hardware and software needed to support the complexity of AI algorithms¹³.

AI technology's effectiveness relies heavily on high-quality and consistent training data; thus, standardization of data is important. **Oluwashola Fausath Bello**, a co-writer with Kehinde Olagoke, stated that inconsistent data formats, incomplete records, and varying quality standards across different sources- which are all products of human error- make it impossible to ensure data standardization¹⁴. As long as technological systems are dependant on human capabilities, there will always be an error to exploit, which has enabled MNCs to continue to evade and avoid taxes.

Harley Thomas¹⁵, forensic accountant at MKS Law stated that as tax and regulatory authorities adopt AI tools more widely, individuals seeking to evade and avoid taxes follow suit; tax evaders now harness AI technology to exploit loopholes, employing advanced algorithms to conceal transactions, forge identities and manipulate financial records¹⁶. Since AI is readily available and inexpensive, it is easy for individuals and MNCs to conduct sophisticated schemes without being detected by the IRS.

Rapid technological advancement presents challenges in cybersecurity and data privacy. The IRS handles large volumes of sensitive information about taxpayers, which is prone to cyber-attacks. Although AI technology may be able to detect anomalies in data sets, it does not prevent the IRS from being infiltrated by tax evaders who might alter information for their own benefit or access

¹³ Kehinde Olagoke, Oluwashola Fausath Bello, Tolulope Foyekemi, Oladiipo Ishola, Ifeoluwa Uchechuwkuw, and Ebenezer, "Leveraging Artificial Intelligence for Enhanced Tax Fraud Detection in Modern Fiscal Systems", GSC Advanced Research and Reviews, 2024, <https://doi.org/10.30574/gscarr.2024.21.2.0415>

¹⁴ Ibid

¹⁵ Harley Thomas, "Is Artificial Intelligence a Game-Changer in the UK's Battle Against Tax Evasion", MKS Law, March 18 2025, <https://mks.law/is-artificial-intelligence-a-game-changer-in-the-battle-against-tax-evasion/>

¹⁶ Harley Thomas, "Is Artificial Intelligence a Game-Changer in the UK's Battle Against Tax Evasion", MKS Law, March 18 2025, <https://mks.law/is-artificial-intelligence-a-game-changer-in-the-battle-against-tax-evasion/>

sensitive data. There is a need for strong cybersecurity measures and data encryption in order to prevent data breaches¹⁷.

Quantum computing has the potential to revolutionize multiple aspects of tax administration, including Artificial Intelligence (AI), Machine Learning, cybersecurity, and encryption, placing it in a better position to detect fraud and enforce tax compliance. **Jeff Saviano**¹⁸, a principal focused on advanced technology, policy, and governance at Ernst & Young LLP in Boston, stated that the implications of quantum technology for the tax profession are massive. AI systems employed by tax agencies are set to be augmented by quantum computing, as the amount of data needed to train the algorithms used by AI programs is dramatically reduced, and may handle significantly larger data sets when powered by quantum computing.

Channing Flynn¹⁹, EY Global Technology Tax Sector Leader, says that once quantum audit technologies are adopted, they won't just double-check the numbers in real-time, but also spot every flaw the second it happens. This will enable tax authorities, in particular the IRS, to detect anomalies in audits and identify fraud schemes hidden within terabytes of data instantaneously. **Flynn** states that quantum computing is set to revolutionize tax audit processes by delivering exponential reductions in both time and cost requirements. When integrated with AI, advanced analytics and multidimensional ledger analysis, quantum computing enables near real-time

¹⁷ Sharifur Rahman and Rafiqus Salehin Khan, "An Exploration of Artificial Intelligence Techniques for Optimizing Tax Compliance, Fraud Detection, and Revenue Collection in Modern Tax Administrations", TensorGate Publishing, March 2024, <https://www.researchgate.net/publication/387585676>

¹⁷ Ibid

¹⁷ Ibid

¹⁷ Kehinde Olagoke, Oluwashola Fausath Bello, Tolulope Foyekemi, Oladiipo Ishola, Ifeoluwa Uchechuwkuw, and Ebenezer, "Leveraging Artificial Intelligence for Enhanced Tax Fraud Detection in Modern Fiscal Systems", GSC Advanced Research and Reviews, 2024, , <https://www.researchgate.net/publication/387585676>

¹⁸ Marna Ricker, Jeffrey Saviano, Channing Flynn, "Three Steps Tax Teams Should Take to Prepare for Quantum Computing", EY Global, 2023

¹⁹ Ibid

processing and verification of taxpayer transactions, offering the potential for instantaneous identification and assessment of audit discrepancies²⁰.

Carrie Brandon Elliot²¹ stated that most systems that use advanced algorithms to detect fraud produce a high number of false positives, which leads to institutions wasting a lot of time revising this data and blocking legitimate transactions. She states that data modeling capabilities of quantum computers demonstrates superior performance in pattern recognition, classification tasks, and predictive analytics.

A support -vector machine operates by categorizing data points into distinct classes separated by optimal decision boundaries known as a hyperplane. Its algorithm learns by example to assign labels to objects. After training the machines, they can assign new data to the appropriate category²². Quantum support vector machines employ machine learning techniques that use supervised machine learning models to sort data, make predictions, and spot unusual patterns, helping to reduce false positives.

Vijai Chandrasekar and Worakmol Wisetsri²³ stated that quantum machine learning (QML) algorithms can help detect abnormal patterns or suspicious transactions by analyzing large volumes of transactional and behavioral data, thereby identifying potentially fraudulent activity. They also said that Quantum neural networks, which leverage quantum mechanical properties of superposition and entanglement to improve learning and prediction skills, can offer more correct predictions and insights in financial transactions than any other machine learning program, thus enabling it to detect fraud more expeditiously and efficiently²⁴. **Abraham Itzhak Weinberg and Alessio Faccia** state that Quantum Machine Learning aims to create and apply methods that run on quantum computers to address the core tasks of classical Machine Learning, such as supervised

²⁰ Ibid

²¹ Carrie Brandon Elliot, “Quantum Computing Can Revolutionize Tax Administration”, TaxNotes, 2022

²² Ibid

²³ Vijai Chandrasekar and Worakamol Wisetsri, “The Prospects for Applications of Quantum Computing in the Financial Sector”, Routledge, 2025.

²⁴ Ibid

learning, unsupervised learning and Reinforcement Learning (RL) found in Machine Learning (ML)²⁵. QML takes advantage of powerful quantum features like superposition, tunneling, entanglement, and parallelism to process information in way that traditional AI cannot. By combining these quantum effects with advanced algorithms, QML presents the opportunity of solving complex problems that are out of reach for even the most sophisticated classical systems.

Carrie Brandon Elliot²⁶ stated that by combining a quantum processor with Artificial Intelligence and advanced machine learning, big data can be collected and analyzed more efficiently. Big data refers to data sets so large and complex that traditional processing tools struggle to handle them. While machine learning is typically used for classification of such data, **Carrie** explains that quantum computers can create new types of classifiers capable of mapping out more complex data structures. This may allow researchers to build more powerful AI systems that can detect patterns hidden from classical computers and also improve data classification accuracy.

Encryption and cybersecurity are critical areas of tax administration that affect the ability of the IRS to enforce tax compliance. Evaders and abusive tax avoiders use advanced encryption techniques to hide assets, accounts, and illegal transactions from the tax authority, while also conducting cyber attacks on IRS data bases to alter, manipulate or erase crucial information.

Vijai Chandrasekar and Worakmol Wisetsri²⁷ both agree that encryption and cybersecurity are important issues within the monetary area. They say that quantum computer systems have the potential to break current encryption algorithms that rely on the difficulty of factorizing large numbers. Quantum cryptography techniques, which use quantum phenomena, offer greater cybersecurity than any other existing program, offering unbreakable encryption of data, ensuring

²⁵ Abraham Itzhak Weinberg and Alessio Faccia, “Quantum Algorithms: A New Frontier in Financial Crime Prevention”, AI Experts, Tel Aviv, Israel, University of Brimingham Dubai, Dubai, UAE, March 28, 2024.

²⁶ Carrie Brandon Elliot, “Quantum Computing Can Revolutionize Tax Administration”, TaxNotes, 2022

²⁷ Vijai Chandrasekar and Worakamol Wisetsri, “The Prospects for Applications of Quantum Computing in the Financial Sector”, Routledge, 2025.

security to financial institutions, including the IRS²⁸. **Maksym Lazirko**²⁹ states that algorithms at risk of becoming obsolete include common algorithms like Diffie-Hellman (DH), RSA, and Elliptic Curve Cryptography (ECC). According to **Maksym**, Shor's algorithm efficiently solves the discrete logarithm problem, which forms the basis of DH's security. The same applies to RSA encryption which relies on the challenge of factoring large numbers for its security, which is a simple task for Shor's algorithm. Shor's algorithm can be adapted to solve the discrete logarithm problem on elliptic curves, which makes up the ECC program³⁰.

However, **Francesco Bova**³¹ states that with the advent of this technology, industries and businesses around the world shall change their cryptographic practices, such as through the use of longer key lengths. To this end, organisations like the National Institute of Standards and Technology (NIST) in the United States are actively working to select public-key cryptographic algorithms designed to safeguard sensitive information well into the future; even in a world where quantum computers are widely used³². **Maksym Lazirko** states that advancements in Post-Quantum Cryptography (PQC) algorithms, Quantum Key Distribution (QKD), and hybrid cryptographic systems will revolutionize cybersecurity³³. The use of these algorithms is likely to ensure sophisticated defense mechanisms against emerging cyber threats; however, these advancements will not only be available to government bodies, but shall eventually be available to the public, making it possible for MNCs and wealthy individuals to take advantage of this technology. **Channing Flynn** states that there is a real risk that international criminal organizations

²⁸ Ibid

²⁹ Maksym Lazirko, "Quantum Standards and Accounting Information Systems", Department of accounting and information systems, Rutgers University, <https://arxiv.org/pdf/2311.11925>

³⁰ Ibid

³¹ Francesco Bova, Avi Goldfarb, and Roger G. Melko, "Commercial Applications of Quantum Computing", EPJ Quantum Technology, 2021.

³² Ibid

³³ Maksym Lazirko, "Quantum Standards and Accounting Information Systems", Department of accounting and information systems, Rutgers University, <https://arxiv.org/pdf/2311.11925>

will be able to harness quantum technology to conceal their illicit activities more effectively, potentially sparking a quantum arms race between these bad actors and tax authorities³⁴.

It is the researchers view that in order to stay ahead of MNCs and wealthy individuals, it is essential to stay on top of emerging technologies and put them into practice as soon as possible. Quantum computing is a groundbreaking technological advancement that could greatly improve tax administration. By enhancing AI, machine learning, cybersecurity and encryption, it has the potential to assist the IRS better detect and prevent tax noncompliance.

Quantum computing offers several advantages over conventional Artificial Intelligence technology, making it a better option for the IRS to adopt in order to combat tax noncompliance. **Abraham Itzhak Weinberg and Alessio Faccia** state that quantum algorithms offer exponential speedups for ML, simulation, and optimisation tasks, allowing for real-time or predictive analysis of significantly larger datasets³⁵. Quantum Artificial Intelligence (QAI) has the potential to solve problems that are beyond the reach of classical computers- such as integer factorization and certain advanced machine learning tasks. Additionally, the inherent parallelism of quantum systems enables QAI models to identify complex patterns within vast datasets, potentially outperforming the capabilities of traditional AI³⁶.

Quantum computing techniques such as “amplitude amplification” and “quantum dimensionality reduction” are particularly effective at automatically uncovering meaningful features in data without the need for human intervention. **Abraham Itzhak Weinberg and Alessio Faccia** state that quantum representations can encode highly non-linear and intricate relationships between variables that are a characteristic of real-world data and are not simple for AI algorithms to decipher. Furthermore, entanglement of quantum systems has the potential reveal deeper, more intuitive insights into data that go beyond what classical models are capable of. Quantum technology can potentially analyze bigger data sets at a fraction of the speed of classical computers,

³⁴ Marna Ricker, Jeffrey Saviano, Channing Flynn, “Three Steps Tax Teams Should Take to Prepare for Quantum Computing”, EY Global, 2023

³⁵ Abraham Itzhak Weinberg and Alessio Faccia, “Quantum Algorithms: A New Frontier in Financial Crime Prevention”, AI Experts, Tel Aviv, Israel, University of Brimingham Dubai, Dubai, UAE, March 28, 2024.

³⁶ Ibid

the training time of QAI models is significantly lower than AI models due to leveraging quantum acceleration or amplification, and quantum parallelism has the potential to exponentially improve the scalability of QAI models, thus enabling the integration of larger datasets and more complex parameters.³⁷

Quantum computing presents a variety of advantages that can be applied to detecting and preventing financial crime. **Abraham Itzhak Weinberg and Alessio Faccia** state that QML models such as Quantum Neural Network (QNN) and Quantum Support Vector Machine (QSVM), have the potential to process vast amounts of financial transaction datasets significantly faster than traditional AI methods. Additionally, Quantum Natural Language Processing (QNLP) can rapidly analyze diverse text sources, such as reports and transcripts, to uncover indicators of economic crimes by more effectively interpreting semantics and contextual nuances³⁸.

Quantum Reinforcement Learning (QRL) agents can engage with simulated financial environments at a large scale, allowing them to uncover emerging vulnerabilities exploited by criminals, while offering critical insights for enhanced security measures³⁹.

Through harnessing quantum computing capabilities, agencies may revolutionize financial crime detection and tax noncompliance schemes in way that conventional AI systems cannot.

Through analyzing large volumes of unstructured data, such as transactions, documents and communications, quantum computing technology can surpass human analysts in detecting complex patterns and anomalies that might otherwise be overlooked.

Vijai Chandrasekar and Worakamol Wisetsri state that there are critical regulatory and moral issues that need to be addressed before applying quantum computing technology to the financial sector. They say that financial institutions operate on a heavily regulated environment that promotes transparency, safety, and honest practices⁴⁰. Quantum technology poses a challenge for

³⁷ Ibid

³⁸ Ibid

³⁹ Ibid

⁴⁰Vijai Chandrasekar and Worakamol Wisetsri, “The Prospects for Applications of Quantum Computing in the Financial Sector”, Routledge, 2025.

regulators who must assess whether it aligns with existing guidelines and compliance standards; they may need to update or develop new regulatory frameworks to address the potential risks associated with the adoption of quantum computing.

Vijai Chandrasekar and Worakmol Wisetsri State that quantum technology has the potential to handle vast amounts of sensitive financial and personal data. It is thus crucial to have in place strong safeguards to protect the privacy and confidentiality of this information⁴¹.

The IRS is faced with the task of ensuring that quantum technology is used subject to safety regulations in order to prevent breach of data privacy and protection rights of individuals. The researcher agrees that quantum computing does pose a security threat to personal information, however the potential benefit that this technology presents outweighs the risk, as it will enable the IRS to retrieve trillions of dollars worth of unrealized tax revenue, enabling the government to provide much needed public services.

Although tax avoidance is a legal way of avoiding taxes, it is still a pressing issue to the United States government. The enactment of FATCA and the implementation of ‘the Strategy’ show how crucial accountability and transparency is to the United States Government, and also prove that tax avoidance is an unacceptable practice that is detrimental to public interest.

These strategies, often operating within the boundaries of legal frameworks, leverage offshore jurisdictions, complex financial instruments, and regulatory loopholes to shield income and assets from the U.S. tax authority. From profit shifting and transfer pricing to the use of tax havens and trusts, these schemes have had a significant impact on tax equity and government revenues in the U.S.

A tax haven, also known as an Offshore Finance Centre (OFC) OR International Finance Centre (IFC), is a jurisdiction that provides minimal or zero direct taxation along with strong protections for financial privacy, anonymity and confidentiality. These jurisdictions often offer low operating costs, flexible capitalization rules, and permissive company incorporation laws. They are typically characterized by strict regulation in select sectors and lenient oversight in others creating an environment conducive to discreet and tax-efficient financial activity, stated by **Gregory Rawlings**

⁴¹ Ibid

⁴². **Nicholas Shaxon**⁴³ says that tax havens pose a serious though often overlooked, threat to global economic stability. They facilitate tax evasion, erode legal and regulatory systems and provide a safe haven for organized crime. By enabling the wealthy to avoid contributing their fair share, they deepen economic inequality, undermine trust in democratic governance and contribute to the rise of populist movements.⁴⁴ They undermine fair competition in market economies by privileging multinational corporations over local businesses not because of greater efficiency or innovation, but due to access to tax avoidance strategies. They also amplify the profits of powerful global banks, allowing them to concentrate wealth and influence far beyond their domestic rivals⁴⁵.

Gabriel Zucman, a professor of economics at the Paris School of Economics and UC Berkley, estimated that 8 percent of the global financial wealth of households was held in tax havens, about \$7.6 trillion at the end of 2013⁴⁶. United States Senator Sheldon Whitehouse stated in a U.S Senate Budget Committee on 10th April, 2024, that the ultra wealthy are hiding close to \$2 trillion in offshore tax havens; more than one-third of this amount is held by just 13,000 households- the top 0.01% of Americans- often through intricate networks of shell companies.⁴⁷.

The IRS estimates that tax evasion costs the U.S. at least \$688 billion in 2021 alone. Former IRS Commissioner Charles Rettig, appointed during the Trump administration, testified before the Senate Finance Committee that the annual tax gap could be as high as \$1 trillion⁴⁸. This all goes

⁴² Gregory Rawlings, 'Regulatory Theory; Shifting profits and hidden accounts: Regulating tax havens', Australian National University Press, <http://www.jstor.com/stable/j.cttlqlcrtm.50>

⁴³ Nicholas Shaxon, 'How to Crack Down on Tax Havens: Start With the Banks', (2018), Foreign Affairs, Vol. 97, No.2, pp.94-107, Council on Foreign Relations, <http://www.jstor.com/stable/j.cttlqlcrtm.50>

⁴⁴ Ibid

⁴⁵ Ibid

⁴⁶ Gabriel Zucman, 'Taxing across Borders: Tracking Personal Wealth and Corporate Profits', (2014), The Journal of Economic Perspectives, Vol.28, No.4, pp.121-148, American Economic Association, , <http://www.jstor.com/stable/j.cttlqlcrtm.50>

⁴⁷ Senate Budget Committee, (2024), 'Sunny places for Shady People: Offshore Tax Evasion by the Wealthy and Corporations', Report to the Senate of the United States, 118th cong., 2nd session, S. Hrg. 118-293 <https://www.budget.senate.gov/chairman/newsroom/press/whitehouse-offshore-tax-evasion-by-big-corporations-the-wealthy-cheats-american-people>

⁴⁸ Ibid

to show the extent to which tax havens have decimated the United States taxation system, by facilitating the concealment of trillions of dollars from the U.S taxman.

Rawlings states that the global financial landscape has evolved into distinct zones of offshore specialization, with various jurisdictions catering to specific sectors. The Cayman Islands serves as a base for major U.S. mutual funds while Bermuda is known for its captive insurance industry. Switzerland, Singapore, and Dubai have become prominent wealth management hubs while countries like Luxembourg, Ireland, and the Netherlands are favoured for profit shifting, corporate registrations and customized tax deals with cooperative governments.⁴⁹

In Asia, Hong Kong functions as China's offshore financial gateway as it offers a low-tax environment for capital movement with limited oversight. Singapore is a preferred destination for affluent individuals from Australia, Indonesia, and Malaysia seeking financial secrecy. Even American states like Delaware, Nevada and Wyoming act as tax havens, allowing the creation of anonymous shell companies that shield owners from scrutiny and hinder tax and criminal investigations.⁵⁰

Transfer price manipulation is another method used by multinational corporations in reducing their tax liability. Transfer price is the price of an intrafirm transfer, while transfer price manipulation is the over or under invoicing of transfer prices by multinational corporations (MNCs) in response to external pressures, such as government regulations like taxes, tariffs and exchange controls⁵¹. MNCs operate globally and, as a result, have multiple facets of operation.

A single company may manufacture goods in one country and may sell them in another country, thus the transaction between them is an intrafirm transfer, and the price of the goods sold between

⁴⁹ Gregory Rawlings, 'Regulatory Theory; Shifting profits and hidden accounts: Regulating tax havens', Australian National University Press, <http://www.jstor.com/stable/j.cttlqlcrtm.50>

⁵⁰ Zucman Gabriel, "The Hidden Wealth of Nations: The Scourge of Tax Havens", (2015), University of Chicago Press.

⁵¹ Lorraine Eden, 'Transfer Price Manipulation, (2012), Draining Development; Controlling Flows of Illicit Funds from Developing Countries, International Bank for Reconstruction and Development/International Development Association or the World Bank.

the two facets is the transfer price. **Lorraine Eden**⁵² states that the potential for abuse arises because MNCs try to boost their after-tax profits by adjusting transfer prices; when the manufacturer's country has a higher tax rate, the transfer price is set low to shift taxable income to the seller. Conversely, if the reseller's country has a higher tax rate, the transfer price is raised to reduce the reseller's taxable profit, concentrating the profit to the manufacturer instead⁵³.

The Arms Length Standard (ALS) was the response to the transfer pricing problem by seeking to determine whether transaction between related taxpayers reflect their (true) tax liability by comparing them to similar transactions between unrelated taxpayers dealing at arm's length⁵⁴. The case of **Hall v Commissioner**⁵⁵ highlighted the misuse of transfer pricing and reinforced the arm's length standard. Hall sold products to a Venezuelan affiliate at cost plus 10%, effectively granting a 90% discount, while independent distributors were given only a 20% discount.

The Tax Court found that this pricing scheme arbitrarily shifted income to the Venezuelan entity. The IRS's reallocation adjusted Hall's income to reflect what it would have been had the transactions occurred between unrelated parties as required under the arm's length principle. The court ruled that Hall had intentionally manipulated the transfer price to evade taxes.

Dhammika Dharmapala⁵⁶ defines Profit shifting as a strategy used by multinational corporations to avoid taxes across borders, primarily through exploiting intercompany debt structures and manipulating transfer pricing between affiliated entities.⁵⁷. Simply put, it is the process of MNCs shifting profits from high-tax countries to low-tax countries or tax havens. There are three main

⁵² Ibid

⁵³ Avi-Yonah, Reuven S. "Transfer Pricing Disputes in the United States.", (2012), In *Resolving Transfer Pricing Disputes: A Global Analysis*, edited by E. Baistrocchi and I. Roxan. New York: Cambridge Univ. Press.

⁵⁴ Ibid

⁵⁵ Hall vs Commissioner of Internal Revenue, 294 F.2d 82 (5th Cir. 1961)

⁵⁶ Dhammika Dharmapala, 'Profit Shifting in a Globalized World', (2019), AEA Papers and Proceedings, Vol.109, Papers and Proceedings of the One Hundred Thirty-First Annual Meeting of The American Economic Association, pp.488-492, American Economic Association, : <https://www.jstor.org/stable/10.2307/26723995>

⁵⁷ Ibid

methods employed by these companies, that is transfer pricing manipulation, intercompany debt and the use of intangible assets. Transfer price manipulation, as discussed above, is where high-tax affiliates sell goods and services to low-tax affiliates at a low price in order to record low profits earned by the high-tax affiliate, thus reducing the corporate taxes paid; vice versa. **Molly J. Saunders-Scott** states that profit shifting through intercompany debt is a cunning tactic, where a lower-tax affiliate makes a loan to a higher-tax affiliate, which reduces its pre-tax profit since the interest payments are deductible from the affiliates tax liability⁵⁸.

This shifts profits earned in higher-tax countries, which usually provide high pre-tax revenue, to lower-tax countries hence enabling MNCs to retain more profit than intended. The third method used is the manipulation of intangible assets, which include intellectual property rights, in order to shift profits using royalties and licensing fees. MNCs with headquarters in a higher-tax country will set up a subsidiary in a lower-tax country and register Intellectual Property rights, such as trademarks and patents. Subsequently, the affiliate in the higher-tax country will pay royalties and licensing fees to the subsidiary, which will reduce the after-tax profits of the main affiliate.

This reduces the corporate taxes paid by the MNC while shifting the majority of the profits to the subsidiary in the form of royalties and licensing fees. Patents and trademarks being unique and non-uniform assets, make it harder for tax authorities to assess whether their transfer prices comply with the arm's length principle, especially when compared to more common goods⁵⁹.

The double Irish with a Dutch sandwich is a commonly used tax avoidance strategy by MNCs. **Daniel Thorne**⁶⁰ states that due to its intangible nature, intellectual property can be easily transferred or licensed between entities across different jurisdictions. Companies with significant

⁵⁸ Molly J. Saunders-Scott, 'substitution Across Methods of Profit Shifting', (2015), National Tax Journal, Vol.68, No.4, NATIONAL TAX ASSOCIATION SPRING SYMPOSIUM; 20th Century Tax Code in a 21st Century World: Where are the Pressure Points?, pp.1099-1119, National Tax Association, <https://www.jstor.org/stable/44014506>

⁵⁹ Peter Schwarz, 'Tax-Avoidance Strategies of American Multinational: An Empirical Analysis', (2009), Managerial and Decision Economics, Vol. 30, No. 8, pp.539-549, Wiley, <https://www.jstor.org/stable/27735460>

⁶⁰ Daniel Thorne, 'The Double Irish and Dutch Sandwich Tax Strategies: Could a General Anti-Avoidance Rule Counteract the Problems Caused by Utilisation of these Structures?', (2013), Victoria University of Wellington, Faculty of Law, LLM Research Paper.

intellectual property holdings often exploit this flexibility to shift profits and reduce their income tax obligations.⁶¹ This tax avoidance strategy leverages a provision in Irish law that allows a company incorporated in Ireland to be treated as a non-resident for tax purposes under certain conditions.

Typically, an MNC establishes an Irish subsidiary (company A) which in turn creates a wholly owned second subsidiary (company B), also based in Ireland. Although Irish incorporated companies are generally considered tax residents, the Finance Act of 1999 introduced exceptions; one of which allows company A to be classified as a foreign tax resident if it qualifies as a ‘relevant company’ and conducts trade within Ireland.

This arrangement enables the parent corporation to reduce or avoid corporate tax liabilities while maintaining operations through an Irish entity⁶². To be considered a ‘relevant company’ an entity must be controlled by a resident of the European Union or a country that has a double taxation treaty with Ireland.⁶³ Since Ireland has a double-taxation agreement with the United States, subsidiary A, when controlled by a U.S. parent company, can avoid Irish tax residency status and instead be treated as a resident of a tax haven like Bermuda⁶⁴

Once this structure is established, the parent company transfers its intellectual property rights to subsidiary A, through a licensing agreement usually for a modest royalty fee. Subsidiary A then sublicenses those rights to subsidiary B enabling it to use and profit from the intellectual property. Consequently, revenues from the global use or sale of the IP outside the parent company’s home country are directed to subsidiary B⁶⁵. Subsidiary B will then pay substantial royalties and licence

⁶¹ Ibid

⁶² Finance Act 1999, s.23A(3) (Ireland)

⁶³ Ibid

⁶⁴ Convention Between the Government of Ireland and Government of the United States of America for the Avoidance of Double Taxation and the Prevention of Fiscal Evasion with Respect to Taxes on Income and Capital Gains, Ireland-United States (signed 28 July 1997).

⁶⁵ Stephen C Loomis “The Double Irish Sandwich: Reforming Overseas Tax Havens” (2012) 43 St Mary’s Law Journal 825 at 839.

fees to subsidiary A, which will eventually end up in a tax-free offshore haven, in this case, Bermuda.

The Dutch Sandwich structure mirrors the Double Irish; however, it introduces a third entity, subsidiary C, based in the Netherlands. This entity is basically a shell company with no staff, physical presence or actual business activity, serving solely as a conduit in the tax strategy⁶⁶. Instead of transferring the income from subsidiary B directly to subsidiary A through inflated royalty and service fees, the earnings are funneled through subsidiary C in the Netherlands.

This setup takes advantage of EU Directive 2003/49 which exempts interest and royalty payments between companies in different EU member states from taxation, provided the recipient is the beneficial owner and operates within the EU jurisdiction.⁶⁷ This enables subsidiary B to avoid paying any withholding taxes that it would otherwise be liable to pay if it were paying royalties and fees to subsidiary A.

Susan H. Godar states that a tax inversion is a corporate restructuring strategy where a domestic company shifts its legal incorporation from its home country to a foreign jurisdiction with more advantageous tax regulations⁶⁸. In a tax inversion scheme, a U.S. company retains its operational base and workforce domestically but shifts its legal tax residence to a foreign country. This usually happens through a merger with a smaller foreign firm, after which the foreign entity becomes the parent company. **Kimberly Clausing** says that the primary motive is to benefit from lower corporate tax rates and more advantageous tax regulations abroad⁶⁹.

⁶⁶ Daniel Thorne, 'The Double Irish and Dutch Sandwich Tax Strategies: Could a General Anti-Avoidance Rule Counteract the Problems Caused by Utilisation of these Structures?', (2013), Victoria University of Wellington, Faculty of Law, LLM Research Paper.

⁶⁷ Directive 2003/49 on the Taxation of Cross-Border Interest and Royalty Payments in the European Union, OJ L 157, P. 0049 – 0054, Article 1.

⁶⁸ Susan H. Godar, Patricia J. O'Connor and Virginia Anne Taylor, 'Evaluating the Ethics of Inversion', (2005), Journal of Business Ethics, Vol. 61, No. 1, pp. 1-6, Springer, <https://www.jstor.org/stable/25123597>

⁶⁹ Kimberly Clausing, 'Corporate Inversions', (2014), Urban-Brookings Tax Policy Center.

The United States tax system encourages corporate expatriation through a combination of factors; a relatively high corporate tax rate compared to other countries, a global taxation system that imposes taxes on foreign earnings when brought back to the U.S., and regulatory constraints aimed at limiting the extent to which multinational firms can shift profits out of the U.S. to reduce their tax burden⁷⁰. Cash earned by a company's foreign subsidiaries, before an inversion, is subject to tax when brought back to the U.S.; however, after forming the new foreign parent, the company's existing foreign subsidiaries can lend money directly to the parent, bypassing the U.S. entity and avoiding taxes.⁷¹

This enables the US corporation to use the 'loans' to fund issuance of dividends, repurchasing shares, or funding domestic investments without having to repatriate funds back to the United States.

Corporate lobbying is a simple but effective strategy used by MNCs in order to minimize their tax liability. Lobbying involves attempting to influence legislation through engaging with legislators, their staff or government officials involved in lawmaking with the primary intent of affecting the outcome of the legislation⁷². **Lee Drutman** stated that in the 1970s, corporations initially entered the political arena with a defensive strategy primarily focused on halting the progression of regulatory policies and curbing the influence of the expanding regulatory state⁷³.

They pushed back against efforts to establish a consumer protection agency, opposed labour law reforms and responded to a growing belief that government regulation was overshadowing free market principles, as well as threatening economic stability.⁷⁴ As time went by, corporations stopped seeing the government as a threat, but rather as a potential ally. In 2017, corporate

⁷⁰ Ibid

⁷¹ Ibid

⁷² <https://govrelations.duke.edu/ethics-and-compliance/lobbying-definitions-exceptions-and-examples>

⁷³ Lee Drutman, 'Corporate Lobbying', (2020), Yale University Press, <https://yalebooks.yale.edu/2020/07/21/corporate-lobbying/>

⁷⁴ Ibid

lobbyists succeeded in influencing Congress to reduce the corporate tax rate from 35% to 21% and transition to a more territorial tax system, meaning U.S. based MNCs were largely no longer subject to U.S. taxes on their foreign profits⁷⁵.

It is the researcher's opinion that the most common strategy used by Corporations and wealthy business owners is the use of tax havens, where they channel profits to jurisdictions with minimal or no taxation, such as the Bahamas, cayman islands, British Virgin Islands and others.

Through the establishment of subsidiaries or shell entities in offshore localities, companies have significantly reduced their U.S. tax liability while continuing to operate domestically. These arrangements, although legally permissible, often lack economic substance and siphon substantial revenue from the U.S. government, which ultimately affects the country at large.

Transfer pricing is another common practise of corporations and wealthy individuals, involving the legal pricing of transactions between subsidiaries in different countries, often used and abused in order to shift profits from the U.S. to low tax jurisdictions, leading to substantial revenue escaping the U.S. tax man.

Although tax avoidance strategies are compliant with statutory requirements, they lead to significant revenue losses to the U.S. Treasury. As a result of these schemes, the tax burden has been disproportionately placed on the middle- and lower-income taxpayers who lack access to such sophisticated tax planning tools. Beyond the economic impact of these strategies, the perception that corporations and wealthy individuals exploit loopholes to minimize their tax liability fosters a sense of systemic inequality.

This disillusionment threatens the social contract that exists between the people and the government, entailing equitable contributions of taxes for collective benefit. Without addressing

⁷⁵ Chuck Marr and George Fenton, 'Corporate Lobbying Campaign Against Biden Tax Proposals Is Inaccurate, Unpersuasive', (2021), Center on Budget and Policy Priorities, <https://www.cbpp.org/research/federal-tax/corporate-lobbying-campaign-against-biden-tax-proposals-is-inaccurate>

this problem, diminished public confidence may lead to reduced voluntary compliance, increased tax evasion, or broader societal discontent, threatening the stability of society.

1.12 METHODOLOGY

1.12.1 INTRODUCTION

This chapter outlines the research methodology employed in this study. It covers the research design, study area, sources of information, target population and sampling methods, definition of variables and indicators, data collection procedures, instruments used for data gathering, quality control measures, ethical consideration, and expected methodological limitations.

1.12.2 RESEARCH DESIGN

This study is a qualitative study of how quantum computing may impact offshore tax evasion and avoidance. It incorporates an exploratory research design that aims to investigate a possible solution to the gap that exists between the enactment of legislation to prevent offshore tax evasion and avoidance, and the enforcement of these laws. It aims to gain a better understanding of the problem of offshore tax evasion and avoidance and present a solution to this problem. Quantum computing is the dependent variable and also a solution to the lack of enforcement of offshore tax evasion and avoidance laws that are abundant in writing, but scarce in practicability.

1.12.3 AREA OF STUDY

This study focuses on the United States of America. The rationale behind this is that the American economy is by far the biggest economy in the world and the American dollar is the base currency for international trade. That being said, whatever impacts the American economy will inevitably impact economies all over the world, thus by finding a solution to arguably one of the biggest problems faced by the American economy, we inevitably find a solution to problems faced by economies all over the world.

1.12.4 SOURCES OF INFORMATION

This study incorporates primary sources of information including the Constitution of the United States, various statutes like the FATCA act, treaties like ‘the Strategy’ from the OECD, case law from American law reports, and official dictionaries. The secondary sources of information incorporated in this study include journal articles and textbooks from legal cites like JSTOR and

Google Scholar; newspaper articles from the internet, and thesis papers from JSTOR and Google Scholar. Reviews from law firms like PricewaterhouseCoopers (PwC) were also incorporated in this research.

1.12.5 POPULATION AND SAMPLING TECHNIQUES

Due to the exploratory nature of this study, I incorporate a theoretical sampling technique. I used data presented by the IRS, TIGTA, and GAO where information is based on the population of the entire United States, which is comprised of 334.9 million people as of 2023. The rationale behind this is that these are government bodies that accept, analyze, and report information based on national statistics, such as the use of tax returns and FATCA forms that are presented by the majority of the population.

1.12.6 VARIABLES DEFINITION AND MEASUREMENT

The dependant variable in this study is quantum computing, while the independent variables are offshore tax evasion and avoidance. Quantum computing is dependant on

1.12.7 PROCEDURE FOR DATA COLLECTION

Majority of data collected for this research was obtained through legal sites like JSTOR and Google Scholar. I would log on to these sites and comb through articles and textbooks made available to me through the search engines. I would also use articles from renowned tech companies, including IBM and Google Quantum AI. These are mega-tech companies that are leading the race in quantum computing. Reports from TIGTA and GAO were also used by logging on to their websites and accessing the information available.

1.12.8 DATA COLLECTION INSTRUMENTS

The data collection instruments used include content analysis, case studies, and data visualization. Due to the exploratory nature and geographical scope of this study, many of the tools used are purely qualitative since I do not have access to the American population, being a Ugandan national.

1.12.9 QUALITY CONTROL

The use of JSTOR and Google Scholar ensures the quality and reliability of the research, as only peer-reviewed articles and textbooks are uploaded to these search engines. Also, the use of sites for renowned tech giants like IBM and Google Quantum AI ensures the authenticity of the

research. Due to the qualitative nature of this study, only authenticated sites and peer-reviewed articles could be used for my solution to have efficacy.

1.12.10 ETHICAL CONSIDERATIONS

All the information presented in this study was obtained through public sites and thus, proper reference to these articles has been made available throughout the paper. Due to the public nature of the articles, textbooks and other documentation, consent and confidentiality do not apply to this research. Proper acknowledgment has been observed throughout this study and will be made clearer in the bibliography.

1.12.11 METHODOLOGICAL CONSTRAINTS

One major limitation I faced while conducting this research was the geographical constraint of being in Uganda while writing a paper based on the American tax code. Very many constraints, such as not being able to conduct surveys, interviews, observations, and the like follow suit as I was not able to go to the United States and conduct these methodologies myself. Thus, I was limited to research and data collected by third parties. Another challenge I faced was the effort needed to understand a totally different jurisprudence as I was not acquainted with the American tax code before doing this study. Thus, my research may not adequately describe and inform the reader of the legislation on offshore tax evasion and avoidance as intended.

1.12.12 CONCLUSION

Through this research, lawyers will be able to expand their knowledge in multiple fields; including astrophysics, technology and taxation law. This will equip them with a practical solution to one of the worlds most pressing challenges – tax enforcement. This research aims to fill the technological and practical gap between the enactment and enforcement of taxation laws. This discussion of the current American legislation on tax evasion and avoidance, case law, tax avoidance schemes, challenges faced by the IRS, and how quantum computing may remedy the challenges faced offers a holistic solution to tax noncompliance.

CHAPTER TWO

2.0 AN ANALYSIS OF THE LEGAL REGIME REGARDING OFFSHORE TAX NON-COMPLIANCE IN THE AMERICAN TAX SYSTEM

2.1 INTRODUCTION

This chapter shall discuss the current legislation on taxation that Congress passed to combat offshore tax evasion and avoidance. It shall focus on Title 26 of the United States tax code, which is the Internal Revenue Code (IRC) containing the federal laws governing taxation in the United States. It provides for income taxes, employment taxes, excise taxes, and procedures and enforcement. This chapter shall also focus on other forms of legislation, including The Foreign Account Tax Compliance Act (FATCA) and the Standard for Automatic Exchange of Financial Account Information set by the Organization for Economic Co-operation and Development (OECD), and common law doctrines.

2.2 INTERNATIONAL FRAMEWORK

The Foreign Account Tax Compliance Act (FATCA) is a monumental statute enacted for the sole purpose of combating offshore tax evasion and avoidance. Under FATCA, certain U.S. taxpayers with financial assets held outside the United States are required to report these assets to the IRS using Form 8938- Statement of Specified Foreign Financial Assets. Additionally, FATCA mandates that foreign financial institutions report directly to the IRS details about financial accounts owned by U.S. taxpayers or by foreign entities in which U.S. taxpayers have a substantial ownership interest.⁷⁶

Under FATCA, withholding agents are required to withhold tax on certain payments made to Foreign Financial Institutions that fail to comply with reporting obligations. This includes institutions that do not agree to provide the IRS with information about their U.S. account holders, including accounts held by certain foreign entities with substantial U.S. ownership.⁷⁷

⁷⁶ <https://www.irs.gov/businesses/corporations/summary-of-fatca-reporting-for-us-taxpayers>

⁷⁷ Foreign Tax Compliance Act (FATCA), Document No. D 13134 (Rev. 08/2013) Catalog Number 65179U, Department of the Treasury Internal Revenue Service publish.no.irs.gov

The Organization for Economic Co-operation and Development (OECD), in collaboration with the G20 countries and in close coordination with the EU and other stakeholders, developed the ‘Standard for Automatic Exchange of Financial Account Information’ commonly referred to as, ‘the Standard’.⁷⁸ This is a standardized model for automatic exchange is based on the FATCA framework, aiming to enhance efficiency and reduce administrative costs. The Standard comprises of several components with the Common Reporting Standard (CRS) outlining due diligence procedures that financial institutions must follow to gather and report relevant information, thereby enabling the automatic exchange of financial data;⁷⁹

The Model Competent Authority Agreement (CAA) establishes the legal framework for information exchange under the Common Reporting Standard;⁸⁰ it outlines the specific financial information to be shared as detailed in the accompanying Commentaries, which provide interpretation and clarification of both the CAA and the CRS.⁸¹ Additionally, the agreement includes technical guidance such as the XML scheme for data exchange, as well as the standards for data protection, confidentiality, secure transmission, and encryption.⁸²

Tax Information Exchange Agreements (TIEAs) are critical tools in the fight against offshore tax evasion, designed to enhance transparency and cooperation between jurisdictions. TIEAs are bilateral agreements aimed at facilitating the exchange of tax-related information between countries to combat tax evasion and improve tax compliance⁸³. They are commonly used by tax authorities to access data on offshore accounts in jurisdictions with no, or minimal, tax information like tax havens.

The U.S. has TIEAs with various jurisdictions like the Cayman Islands and Bermuda, thus giving the IRS the mandate to request and exchange information with financial institutions in these

⁷⁸ The Common Reporting Standard (CRS) Automatic Exchange of Financial Account Information, (2016), <https://www.oecd.org/content/dam/oecd/en/topics/policy-issue-focus/aeoi/jersey-guidance-notes-crs.pdf>

⁷⁹ Ibid

⁸⁰ Ibid

⁸¹ Ibid

⁸² Ibid

⁸³ <https://home.treasury.gov/policy-issues/tax-policy/tax-information-exchange-agreements-tieas>

jurisdictions⁸⁴. This has enabled the IRS to recover billions of dollars worth of taxes from U.S. nationals, for example the U.S.-Cayman Islands TIEA enabled the IRS to request account details from Cayman banks like the Cayman National Securities Ltd. And Cayman National Trust Co. Ltd, which enabled the IRS to recover more than \$130 million in Cayman Bank Accounts⁸⁵. Although these agreements are useful, the IRS faces challenges with jurisdictional cooperation, capacity constraints limiting developing countries to process and act on exchanged information, loopholes exploited by MNCs and wealthy individuals, and refusal of requests by tax havens if they deem them overly broad or if providing information conflicts with domestic laws.

The Joint Chiefs of Global Tax Enforcement (J5) is a collaborative initiative launched in 2018 by the tax authorities of the United States, United Kingdom, Australia, Canada, and the Netherlands. It was established with the aim of addressing the growing sophistication of transnational tax evasion schemes, which exploit offshore jurisdictions with complex financial structures and emerging technologies⁸⁶. It operates as a coordinated intelligence-driven alliance with flexible operational mechanisms rather than a formal treaty-based structure.

These members share data on taxpayers, financial institutions, and enablers involved in suspected tax crimes; conduct joint investigations, pooling resources, expertise, and legal authorities to target complex schemes; target professionals who design or facilitate evasion schemes, such as lawyers and accountants, in order to reduce the ability of MNCs and wealthy individuals to conduct evasion schemes. And share advanced analytic technology, machine learning, and artificial intelligence capabilities in order to process large datasets.

The J5's impact is often hampered by jurisdictional limitations from non-member countries, preventing them from accessing vital information; resource constraints due to budget and staff shortages makes it difficult to carry out investigations and upgrade technology; emerging technologies like cryptocurrencies and decentralised finance (DeFi) platforms, which make it

⁸⁴ Ibid

⁸⁵ <https://www.justice.gov/usao-sdny/pr/two-cayman-island-financial-institutions-plead-guilty-manhattan-federal-court>

⁸⁶ <https://www.irs.gov/compliance/joint-chiefs-of-global-tax-enforcement>

difficult to trace transactions and evasion schemes; and resistance from various jurisdictions to cooperate with agreements, making it difficult to carry out investigations⁸⁷.

2.3 DOMESTIC FRAMEWORK

A Withholdable payment refers to any payment of interest, dividends, rent, salaries, wages, premiums, annuities, compensation, remuneration, emoluments or other fixed or determinable annual or periodic gains, profits and income, provided that the payment originates from sources within the U.S..⁸⁸ If a withholdable payment is made to a Foreign Financial Institution that fails to comply with the requirements of this section, then the withholding agent must impose a tax equal to 30% of the payment amount.⁸⁹ The same applies to withholdable payments to non-financial foreign entities.⁹⁰

Each United States person must disclose information about any foreign business entity, including its name, main place of business, type of business conducted and the country in which it is legally incorporated.⁹¹ For a domestic corporation that is 25% foreign owned, the secretary is required to provide the name, principal place of business, nature of business, and the country or countries of each related party that engaged in any transaction with the reporting corporation during its taxable year.⁹²

Any person obligated to pay a tax imposed under this title who willfully fails to collect, accurately account for or pay the tax shall be subject to penalties and may be convicted of a felony, attracting a \$10,000 fine or 5 years in prison or both.⁹³ The Title goes on to declare that any person who willfully makes and subscribes any return, statement, or other document that contains falsities, or aids and assists through counsel or advising commits an offense.⁹⁴

⁸⁷ Ibid

⁸⁸ 26 U.S Code § 1473

⁸⁹ 26 U.S Code § 1471

⁹⁰ 26 U.S Code § 1472

⁹¹ 26 U.S Code § 6038

⁹² 26 U.S Code § 6038A

⁹³ 26 U.S Code § 7202

⁹⁴ 26 U.S Code § 7206

Fraudulently executing or signing bonds, permits, entry or other documents required by the Internal Revenue Code is also illegal and is clearly stipulated in title 26; not to mention removal, deposits, or concealment of any goods or commodities for the purpose of evading taxation is also an offense.⁹⁵

The transfer pricing rules set out in section 482 of the IRC prevent companies from artificially shifting income to subsidiaries in lower-tax jurisdictions. These rules grant the Secretary the authority to distribute, apportion or allocate gross income, deductions, credits or allowances among organizations that are owned or controlled, either directly or indirectly by the same interests. This authority may be exercised when such action is deemed necessary to prevent tax evasion or to clearly reflect the income of any of the involved organizations⁹⁶.

In cases of transfer or licensing of intangible property, the secretary may require that the valuation be conducted on an aggregate basis or based on the realistic alternatives to the transfer⁹⁷. This prevents MNCs from exploiting transfer or licensing techniques to avoid paying taxes in high-tax jurisdictions, while transferring most of the profits to low-tax jurisdictions.

The Corporate Anti-inversion Rules set out in section 7874 are designed to curtail corporate inversions by constricting the ability of U.S companies to become subsidiaries of newly formed foreign holding companies without significant tax consequences. New foreign parent corporations that are a result of the inversion of domestic corporations or partnerships are treated as surrogate foreign corporations (SFCs).

A foreign corporation will be classified as an SFC if it acquires- directly or indirectly- substantially all of the assets of a domestic target after obtaining at least 60% of the domestic target's stock and if it lacks substantial business activities in the foreign country where it is incorporated ⁹⁸. These rules reclassify the foreign parent company as a domestic corporation if it qualifies as a surrogate foreign corporation thereby subjecting it to U.S. taxation under the Internal Revenue Code.

⁹⁵ Ibid

⁹⁶ 26 U.S Code § 482

⁹⁷ Ibid

⁹⁸ 26 U.S. Code § 7874

The economic substance doctrine codified in section 7701(o)(5)⁹⁹ is a common law doctrine that prevents corporations from benefiting from transactions aimed at avoiding taxes. It permits courts to deny the tax benefits of a transaction if it lacks economic substance, or a genuine business purpose beyond tax avoidance.

The ‘business purpose’ test examines the taxpayer’s intent in undertaking the transaction, while the ‘economic substance’ test assesses the transaction’s actual economic impact. In **Helvering vs Gregory**¹⁰⁰, the case centered on Mrs. Gregory, a taxpayer who devised a complex series of transactions aimed solely at avoiding federal income tax. As the sole shareholder of Corporation A, which held share in Corporation B, Gregory wanted to sell her interest in Corporation B for a profit without triggering significant capital gains tax; to achieve this, she formed Corporation C, transferred all shares of Corporation B to it on the same day and shortly thereafter, Corporation C sold the shares at a gain. Just three days later, Gregory dissolved Corporation C. She claimed that the transaction qualified as a corporate ‘reorganization’ under the tax code and therefore the gain was not taxable.

However, the IRS commissioner contested this position, arguing that the sole intent behind the formation and dissolution of Corporation C was to avoid taxes, rendering the transaction ineligible for reorganization treatment under the law. The Supreme Court agreed with the Commissioner’s ruling that although the transaction technically followed the structure outlined in the tax code, it lacked any genuine business purpose. The court concluded that the arrangement was simply a tax avoidance scheme disguised as a corporate reorganization, stating that it was, “an elaborate and devious form of conveyance masquerading as a corporate reorganization and nothing else”.

Substance-over-form doctrine is a common law principle that permits courts to look beyond the formal structure of a transaction to assess its true substance, ensuring that legal consequences are based on the transaction’s actual nature rather than its outward appearance¹⁰¹. This developed from

⁹⁹ 26 U.S. Code § 7701(o)(5)

¹⁰⁰ *Helvering vs Gregory*, 69 F.2d 809 (2d Cir. 1934), *aff’d*, 293 U.S. 465 (1934)

¹⁰¹ *WT Ramsey Ltd vs Inland Revenue Commissioners* (1982) AC 300

the Ramsay principle set out in **Ramsay vs IRC**¹⁰², where the company realized a substantial capital gain subject to taxation, engaging in a complex series of self-cancelling transactions designed to create artificial capital losses solely to avoid paying capital gains tax. The House of Lords ruled that when a transaction involves a pre-arranged artificial step with no commercial purpose other than tax avoidance, the correct approach is to tax the overall effect of the transaction, enabling the IRS to disregard the legal form of transactions and focus on their true substance, preventing corporations from using elaborate schemes to evade taxes.

The Controlled Foreign Corporation (CFC) rules under subpart F of the IRC and the Global Intangible Low-Taxed Income (GILTI) were both enacted to combat tax avoidance schemes. They were designed to prevent U.S. taxpayers from deferring their taxes on certain types of income earned by foreign subsidiaries to low-tax jurisdictions.

These anti-deferral provisions target income that might otherwise escape immediate U.S. taxation by taxing the income received from abroad instead of waiting for the funds to be repatriated. A CFC is a foreign company in which U.S. shareholders own more than 50% of the stock.

Thus, according to CFC rules, a U.S. shareholder is someone who owns at least 10% of the foreign corporation's stock. Subpart F focuses on specific types of income that are passive or easily shifted, which are vulnerable to tax avoidance.

It mandates that U.S. shareholders include their proportionate share of Subpart F income in their taxable income of each year regardless of whether the income is actually distributed.¹⁰³ Subpart F income includes several categories of income; Foreign Personal Holding Company Income (FPHCI) covers dividends, interest, royalties, rents and capital gains from property sales; Foreign Base Company Sales Income (FBCSI) arises from transactions involving the purchase or sale of personal property that is manufactured and sold outside the CFC's country of incorporation, particularly when related parties are involved, for example, a CFC in a low tax country buying goods from a related U.S. company and selling them to customers outside its jurisdiction, generating Subpart F income; Foreign Base Company Services Income (FBCSI) includes income

¹⁰² Ibid

¹⁰³ 26 U.S. Code § 951-965

earned from services performed outside the CFC's country of incorporation for a related party, such as consul-ting services provided by the CFC to a related U.S. company for use abroad. Other categories include insurance income from insuring risks located outside the CFC's country of incorporation and income derived from illegal activities.¹⁰⁴.

The GILTI is a regime that expands the anti-deferral framework to tax U.S. shareholders on a broader range than the CFC rules, particularly income derived from intangible assets or low-taxed active income not covered by Subpart F. it was introduced under the Tax Cuts and Jobs Act of 2017 and codified in section 951A of the IRC. GILTI aims to curb profit-shifting form intangible assets by taxing CFC income that exceeds a normal return on tangible asset, assuming the excess is largely attributable to intangibles or low-taxed operations¹⁰⁵. It does this by targeting income exceeding a 10% return on the CFC's tangible assets, known as Qualified Business Asset Investment.

This excess return is deemed to be GILTI and must be included currently in the U.S. shareholder's income. This discourages profit-shifting to low-tax jurisdictions by taxing excess returns at a minimum tax rate, effectively creating a global minimum tax for U.S. multinationals, complementing Subpart F's focus on passive and base company income.

2.4 CASE LAW

There are major cases that have led to the recovery of millions of dollars worth of taxes and fines for the defendants; in particular United States vs UBS AG that paid over \$780 million in penalties alone. Although the American Government was able to prosecute numerous offenders, offshore tax evasion is still prevalent in todays' economy.

In the case of **Alphonse Capone vs United States**¹⁰⁶, the defendant was a notorious Prohibitions-era gangster and leader of the Chicago Outfit gang. He was charged with federal income tax evasion and failure to file tax returns, which were crimes under the Revenue Acts of 1926 and 1928. On June 5th, 1931. A federal grand jury indicted Capone on 22 counts of income tax evasion

¹⁰⁴ Ibid

¹⁰⁵ 26 U.S. Code § 951A

¹⁰⁶ Capone vs United States, 51 F.2d 609 (7th Cir.1931)

for the years of 1925 through 1929, alleging he failed to report and pay taxes on approximately \$1 million in income from illegal activities. It was established that income from illegal activities such as bootlegging and gambling were subject to income tax. This case established tax evasion as a criminal act that may result in imprisonment and that tax laws serve as an effective tool for law enforcement against financial crimes.

In the case of **United States vs UBS AG**¹⁰⁷, Switzerland's largest bank entered into a deferred prosecution agreement after being accused of conspiring to defraud the U.S. government by obstructing the IRS. After acquiring the brokerage firm, Paine Webber in 2000, UBS agreed to report income and identify details of its U.S. clients holding U.S. securities, and to withhold taxes on foreign securities investments directed from the U.S. in order to avoid these requirements, UBS employees and managers, with the knowledge of some executives, helped U.S. taxpayers open accounts under nominee names or sham entities to conceal their ownership.

The court records show that assets were transferred into these hidden accounts to prevent the IRS from identifying the true owners. Swiss bankers frequently traveled secretly to the U.S., around 3,800 times in 2004 alone, in order to promote Swiss banking services to clients aiming to evade U.S. taxes. UBS staff used encrypted laptops and other tactics to avoid detection of their activities and protect client identities and assets.

Clients then filed false tax returns as they hid their income in Swiss accounts without reporting them to the IRS. Under the deferred prosecution agreement, UBS took the unprecedented step of immediately providing the U.S. government with the names and accounts of certain U.S. clients involved in its cross-border business. The bank also paid \$780 million in penalties, interest, and restitution.

In **United States vs Zwerner**¹⁰⁸, the U.S. Government initiated legal action on June 11 2013, in the southern district of Florida to recover civil penalties totaling to \$3,488,609.33 for Carl R. Zwerner's willful failure to file timely FBAR reports (Form TDF-90-22.1) FBAR or Report of Foreign Bank and financial Accounts, is required in order for the reporting of foreign financial

¹⁰⁷ United States vs UBS AG, No. 09-20423 (S.D. Fla.)

¹⁰⁸ United States vs Zwerner, 1: 13-CV-22082 (S.D. Fla) c

accounts with an aggregate balance exceeding \$10,000 at any time during the year. Between 2004 and 2007, Zwerner had a financial interest in a Swiss bank account at ABN AMRO Bank. From 2004 to 2006, the account was held under an entity called the Bond Foundation, and in January 2007, it was transferred to another entity called the Livella Foundation. The government claimed that Zwerner was the beneficial owner of the account throughout this period and that the balance always exceeded \$10,000. As a result, he was required to file FBARs by June 30th of each year from 2005 to 2008. In a letter dated August 9 2010, to the IRS, Zwerner admitted to knowing that he should have reported both the existence of the account and the income it generated.

This admission, along with his signing of tax returns that falsely stated he had no financial interest in a foreign account, demonstrated willful noncompliance with tax policies. Based on this evidence, the court ruled in favor of the government.

The case of **United States vs Paul M. Daugerdas**¹⁰⁹ was a landmark criminal tax fraud case involving a prominent tax attorney and Certified Public Accountant who orchestrated one of the largest fraudulent tax shelter schemes in U.S. history. In the late 1990s and early 2000s, Daugerdas and his accomplices capitalized on a booming market for tax shelters, targeting wealthy individuals seeking to reduce tax liabilities.

These shelters were marketed as legitimate tax-minimization strategies but were later flagged off as being fraudulent due to lack of economic substance and being designed solely to evade taxes. Daugerdas created and sold tax shelters with names like Short Option Strategy (SOS), Short Enhanced Option Strategy (SHOES), Swaps, and Currency Options Bring Reward Alternatives (COBRA). These shelters used complex financial transactions to generate artificial losses, enabling clients to claim them as deductions to reduce taxable income.

This scheme involved multiple law firms, accounting firms, and investment banks, making it a sophisticated fraud scheme. This scheme involved complex transactions such as paired options trades or currency swaps, executed through Deutsche bank; for example, in the SOS shelter, clients purchased and sold options simultaneously, creating losses without economic risk, which were then claimed as deductions. The shelters generated over \$7 billion in fake losses for over 600

¹⁰⁹ United States vs Daugerdas, (2020) 613 F.Supp.3d 807

clients, reducing their taxable income by millions of dollars. Daugerdas personally earned \$95 million in fees. IRS experts stated that the transactions were pre-arranged to ensure no real financial risk to clients, violating tax laws. The defendant was found guilty of orchestrating a fraudulent tax shelter scheme that generated approximately \$7 billion in fictitious tax losses, causing \$1.6 billion in lost tax revenue.

In the case of **United States vs Robert Brockman**¹¹⁰, the defendant was a billionaire CEO of Reynolds & Reynold who orchestrated a decades long scheme to hide income and assets from the U.S. tax man, primarily through the use of offshore accounts and entities in tax havens. The scheme incorporated legal and illegal tactics to hide ownership, evade taxes on capital gains and other income, and fund lavish personal expenditures, such as a yacht and real estate, without the IRS realizing. Brockman allegedly established a network of shell companies and trusts in tax havens, like Bermuda and the Caribbean, where they would hold and manage his income and assets outside U.S. jurisdiction, where tax reporting requirements are minimal or non-existent.

These entities were managed through intermediaries such as lawyers and financial advisors, who ensured that Brockman's name did not appear on official documents. Brockman employed nominees who acted as nominal owners of the offshore accounts and assets to further distance himself from the funds. Prosecutors alleged that Brockman used nominees to purchase assets like a \$15 million yacht and real-estate in Colorado, enabling him to control the assets without actually being the owner on paper. He created falsified records, including backdated documents and fabricated loan agreements which were designed to make offshore transactions appear legitimate and non taxable.

The tax evasion scheme in this case was a masterclass in financial deception, utilizing a combination of offshore shell companies, nominees, falsified records, and layered transactions to hide \$2 billion from the IRS. Its complexity exposed the lengths ultra-wealthy individuals could go to evade taxes and the challenges faced by authorities in dismantling such schemes.

¹¹⁰ United States vs Brockman, No. 3:20-cr-00371 (N.D.Cal.2020)

2.5 FINDINGS CONCERNING THE LEGAL ASPECTS OF THIS CHAPTER

The American tax system is governed by an extensive legal regime that includes statutory law, administrative regulations, and judicial interpretations, each designed to ensure that individuals and entities contribute their fair share to public revenue. This creates a complex and fragmented environment for enforcing tax compliance due to its complexity, which discourages tax payers from complying with tax policies. The legal regime distinguishes between tax avoidance, which is legal but ethically questionable, and tax evasion, which is illegal. However, the line between the two is often blurry. Wealthy individuals and corporations exploit gray areas in the law with sophisticated strategies which often mimic evasion in all but the name.

While the IRS has robust tools for auditing, levying penalties and sifting through the vail of transactions to detect and prosecute bad actors, it is often constrained by limited resources and technology. Funding reductions have left the IRS ill-equipped to track down complex cases of offshore evasion or crypto-based tax shelters which has enabled bad actors like Robert Brockman to evade and avoid taxes for decades.

The IRS is frequently outpaced by technological innovations which are often available to these ultra rich individuals and entities making enforcement of FATCA and CRS regulations extremely difficult. On top of this, various loopholes and jurisdictional constraints limit the effectiveness of these regulations, proving that better enforcement measures are needed in order for the IRS to curb the sophisticated schemes employed by these bad actors.

CHAPTER THREE

3.0 THE NON-LEGAL CHALLENGES FACED BY THE IRS LEADING TO HIGH LEVELS OF OFFSHORE TAX NONCOMPLIANCE

3.1 INTRODUCTION

The Internal Revenue Service (IRS) plays a critical role in enforcing tax compliance across the United States; however, it faces significant non-legal challenges which hinder its ability to fulfill its duties. Beyond legislative or regulatory obstacles, the IRS grapples with issues such as resource constraints, outdated technology, insufficient staffing, and others, which hamper its ability to effectively audit and enforce tax laws.

Additionally, the growing complexity of financial systems, coupled with sophisticated tax avoidance strategies employed by corporations and wealthy individuals, further strains the agency's capacity. These challenges create gaps in oversight and enforcement, enabling corporations and wealthy individuals to exploit the system through different tax evasion and avoidance schemes. This section examines the key non-legal obstacles confronting the IRS and their impact on tax compliance.

3.2 NON-LEGAL CHALLENGES

Large multinational corporations utilize vast networks of legal, accounting and financial experts to organize their structures and transactions in ways that minimize tax liability. This presents a serious challenge for the IRS, as it usually lacks the necessary resources and technical capacity to effectively detect and counter these complex strategies. According to IRS data, transfer pricing audits from Fiscal Year (FY) 2018 to FY 2023 yielded average proposed tax adjustments of \$219 million, significantly higher than the \$56 million average for other audit types within the Large Business and International (LB&I) Division¹¹¹.

Each year, the IRS processes hundreds of millions of tax returns and other forms, accumulating vast amounts of sensitive data. This information is housed across various computer systems, but

¹¹¹ Treasury Inspector General for Tax Administration (TIGTA), 'The IRS Faces Challenges to Address Tax Avoidance Strategies of Large Multinational Corporations', (2024), Report Number: 2024-400-045

in the absence of strong security protocols and skilled personnel, these systems are exposed to risks, such as human error, unauthorized access, and data leaks, making them vulnerable to fraud and abuse¹¹².

This strain on IRS data systems presents a challenge of ineffective and sluggish execution of duties. A notable example is the rollout of the Employee Retention Credit (ERC) introduced in the pandemic relief legislation. Since the law was passed during an ongoing tax filing season, the IRS lacked the time needed to update its systems to detect incorrect or fraudulent claims; as a result, ERC processing was delayed by a full year. This delay created a significant backlog; with the IRS reporting 1.4 million ERC claims still pending as of April 2024¹¹³. With this level of inefficiency, the IRS faces no chance against the complicated strategies used by MNCs, as the vigilant scrutiny needed to detect anomalies in data is unachievable with the current computer systems.

The IRS faces a human capital problem. With the extensive work-load and data required to be processed, the IRS needs a huge workforce to balance the boat. The IRS spends a huge amount of funds just for staff salaries and benefits alone, which diverts funds that would otherwise be used for operations and technical capital. As of June 2024.

The IRS indicated that employee compensation represented its highest expense, totaling about \$2.6 billion; of this amount, approximately \$1.3 billion was specifically used to recruit more customer service agents to manage phone support and to increase staffing at Taxpayer Assistance Centers (TACs)¹¹⁴. Instead of investing money into offshore tax noncompliance personnel and resources, majority of funds are being spent on service agents. With such spending, it would take trillions of dollars to curb offshore tax avoidance and evasion schemes.

¹¹² Treasury Inspector General for Tax Administration (TIGTA), 'Management and Performance Challenges Facing the Internal Revenue Service for Fiscal Year 2025', (2024), U.S Department of the Treasury, Washington, D.C.

¹¹³ Ibid

¹¹⁴ Ibid

While modernizing its information technology and business systems is crucial to the IRS's ability to serve the nation effectively, the agency continues to operate using some of the oldest legacy systems in the federal government¹¹⁵.

The IRS allocated over \$4.8 billion to Business Systems Modernization, but as of June 2024, the IRS has spent only \$ 1.6 billion.¹¹⁶ This depicts the inefficiency and subpar nature of the information system of the IRS, which is not a new phenomenon, as the IRS has faced persistent challenges in establishing strong security protocols and audit trails during the rollout of new technology. To remedy these inefficiencies, the agency is now introducing an AI-powered Enterprise Data Catalog (EDC) designed to offer a centralized overview of its data assets; this initiative seeks to standardize data sets, enhancing their discoverability, organization and traceability across the system.¹¹⁷

In its 2020 report on the IRS'S 2019 filing season, the Government Accountability Office (GAO) found that many customer service representatives and frontline managers frequently encountered computer related issues. It stated that between 60 to 70 individuals reported problems such as systems freezing, long reboot times and login difficulties, all of which impaired their ability to assist taxpayers. Additionally, 25 representatives noted that there was limited access to technical support on site to help resolve these challenges¹¹⁸. This greatly hampered their ability to carry out their duties efficiently, depicting the sub-standard state of the technology systems of the IRS.

Financial opacity is a major obstacle in taxing ultra-high-net-worth individuals. Prior to 2017, most offshore financial institutions exchanged information with foreign tax authorities only upon request; usually when tax payers were under suspicion¹¹⁹. Although information exchange

¹¹⁵ Ibid

¹¹⁶ Ibid

¹¹⁷ Ibid

¹¹⁸ GAO, '2019 Tax Filing: IRS Successfully Implemented Tax Law Changes but Needs to Improve Service for Taxpayers with Limited-English Proficiency', GAO-20-55 (Washington, D.C.: Jan. 15, 2020).

¹¹⁹ Gabriel Zucman, 'A Blueprint for a Coordinated Minimum Effective Taxation Standard for Ultra-High-Net-Worth Individuals', (2024), commissioned by the Brazilian G20 Presidency, <https://gabriel-zucman.eu/files/report-g20.pdf>

agreements like FATCA and the Common Reporting Standard (CRS) – which was implemented among more than 100 countries and territories in 2017 – limits on information sharing remain a problem. To better the taxation of ultra high net worth individuals, it is essential to improve the exchange of information between countries¹²⁰, and this can only be achieved through international cooperation and streamlined information systems.

The IRS faces challenges with encryption and cybersecurity enforcement. The IRS’s Unauthorized Access, Attempted Access, or Inspection of Taxpayer Records (UNAX) program identifies when employees inappropriately access taxpayer data. According to the Treasury Inspector General for Tax Administration (TIGTA), there were 1028 UNAX violations between fiscal year 2018 to 2023.¹²¹ Although 62% of cases were referred for prosecution, only 6 were either accepted or remained under review for prosecution. TIGTA cited several barriers to successful litigation, including: the transfer of protected data to jurisdictions outside regulatory control, technological constraints in identifying sensitive data based on structure alone, encryption and private storage setups that hinder investigator access and the use of personal or non-IRS email accounts to send sensitive information¹²². This shows the need for the IRS to modernize and enhance its security protections, as well as its data structure systems.

3.3 THE FINDINGS CONCERNING THE NON-CONCERNING THE NON-LEGAL CHALLENGES FACED BY THE IRS

This chapter analyzes the different challenges faced by the IRS in enforcing compliance with tax policies. The most significant of these challenges is the long-standing lack of sufficient funding, leaving the agency understaffed and outdated in terms of technological capabilities. This has hindered the ability of the IRS to conduct audits, investigate complex returns, and detect anomalies in transactions, enabling corporations and wealthy individuals to evade and avoid their tax liability.

¹²⁰ Ibid

¹²¹ Justin Doubleday, 'IRS Working to Improve data Security After Major Tax Return Leak', (2024), Federal News Network, <https://federalnewsnetwork.com/cybersecurity/2024/08/irs-working-to-improve-data-security-after-major-tax-return-leak/>

¹²² Ibid

The rise of cryptocurrencies, decentralized finance, and encrypted transactions has created an avenue for tax avoidance and evasion, as the IRS still faces a problem of outdated systems and slow adaptation to technological innovations. The vast amounts of information from tax returns and other documents coupled with the lack of modern infrastructure and analytical tools to process these documents has enabled the corporations and wealthy individuals to conduct their schemes.

These findings emphasize that many of the obstacles faced by the IRS aren't rooted in the law, but in the capacity to enforce the law. Strengthening the IRS's non-legal foundations is the best solution to ensuring tax compliance. A well funded, modernized IRS with adequate staffing and advanced technology would ensure efficient processing of returns, increased detection of fraud, and improved pursuance of tax evaders. These efforts would not only close the tax gap but also strengthen public trust and ensure a more equitable tax system.

CHAPTER FOUR

4.0 HOW QUANTUM COMPUTING WORKS AND HOW IT MAY BE USED TO ADDRESS THE CHALLENGES FACED BY THE IRS IN COMBATING OFFSHORE TAX NON-COMPLIANCE

4.1 INTRODUCTION

Quantum computing represents a revolutionary leap in computing power, harnessing the quantum mechanical principles such as superposition, entanglement, interference and others, to process data at unprecedented speeds. For the Internal Revenue Service (IRS), which faces significant challenges in combating offshore tax non-compliance due to resource limitations, outdated technology, and the sophistication of global tax evasion and avoidance schemes, quantum computing offers transformative potential.

Through enhancing data analysis, quantum systems could enable the IRS to detect hidden offshore accounts, unravel intricate financial networks, and improve enforcement efficiency. This section aims to explore the fundamentals of quantum computing and its prospective application in strengthening the enforcement mechanism of the IRS.

4.2 HOW QUANTUM COMPUTING WORKS

For more than thirty years, scientists have explored the quantum realm to unlock breakthroughs in computing and communication. The concept of using quantum mechanics to build powerful computers was first introduced in the early 1980s by visionaries such as, Richard Feynman of Caltech and David Deutsch of Oxford.¹²³ The concept stayed in the realm of theory until 1994 when Peter Shor introduced an algorithm demonstrating that quantum computers could rapidly factor large numbers. This pivotal discovery sparked a surge of research and development, setting the stage for today's advancements in quantum computing.¹²⁴

Classical computers represent information in bits – the smallest encoding possible for information represented as either 0 or 1- that are then combined to represent larger units of information such

¹²³ Christopher R. Monroe, Robert J. Schoelkopf and Mikhail D. Lukin, 'QUANTUM CONNECTIONS', (2016), Scientific American, Vol. 314, No.5, pp. 50-57, Scientific American, a division of Nature America, Inc., <https://www.jstor.org/stable/10.2307/26046953>

¹²⁴ Ibid

as characters. Quantum computers use a similar, but more powerful type of representation for information called quantum bits, or ‘Qubits’ for short.¹²⁵ Qubits are subatomic particles, such as electrons, photons, trapped ions and more, that are extracted by scientists in order to process information like transistors on a computer chip. Not only can they occupy the binary state of 0 and 1, but everything in-between, existing in multiple states simultaneously.¹²⁶

This state is referred to as superposition and allows for the encoding of information, not only at multiple positions, but also multiple positions in angles from the poles; for example, at 90-degrees, 30-degrees, 15 degrees in all directions as depicted in Figure 1 below. Multiple orientations of data give rise to the concept of quantum digits, or ‘Qubits’, allowing for quantum computers to encode and process data at a rate exponentially faster than the fastest supercomputer.¹²⁷

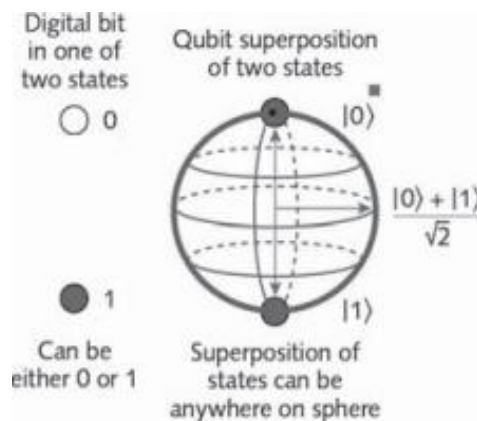


Figure 1. Multiple positions in all directions simultaneously.¹²⁸

When examining quantum computing, it is essential to recognize that quantum mechanics defies the conventions of classical physics; the behaviour of quantum particles can seem paradoxical or illogical yet it is governed by precise laws that shape the structure and function of the natural

¹²⁵ Mandeep Singh and Albert H. Carlson, ‘An Introduction to Quantum Computing and Its Applications’, (2024), *The Cyber Defensive Review*, Vol. 9, No. 2, Data in the Cybersecurity Landscape, pp.73-92, Army Cyber Institute, <https://www.jstor.org/stable/10.2307/48784776>

¹²⁶ Ibid

¹²⁷ Ibid

¹²⁸ Ibid

world¹²⁹ To understand quantum computing, a few key terms must be discussed: superposition, quantum entanglement, decoherence and interference.

Qubits have a counterintuitive ability to exist in multiple states at the same time, which in scientific terms is referred to as superposition.¹³⁰ The concept of quantum superposition is difficult to conceptualize, however, a renowned physicist, Erwin Schrodinger, presented a brilliant thought experiment to explain this phenomenon, called ‘Schrodinger’s Cat’. Schrodinger proposed a thought experiment in which a cat is placed in a sealed box with a vial of poison that may or may not be released within an hour. According to quantum mechanical principles, the cat is considered to be in a *superposition* of *both* alive and dead at the same time.

The only way to know which state the cat is in is by observing or *measuring* the state of the cat. This thought experiment demonstrated the absurdity of quantum science but also perfectly depicted how superposition works in subatomic particles. When qubits exist in a state of superposition, they can evaluate countless possible outcomes at the same time, enabling incredibly fast computation; however, once measured, their quantum states collapse instantly into definite values of either 0 or 1, revealing a single outcome.¹³¹

Quantum entanglement is a term coined by Erwin Schrodinger in 1935, who defined it as a quantum mechanical effect in which the states of two or more particles become linked such that the state of one cannot be fully described without considering the state of the other, regardless of the physical distance¹³². It can be described as an invisible link between distant quantum objects, that have the same origin, allowing one to instantly affect the other. This phenomenon leads to a paradox as the behaviour of entangled particles is inexplicable, incomprehensible and has baffled

¹²⁹ Micheal A. Nielsen and Isaac L. Chuang, “Quantum Computation and Quantum Information”, (2010), 10th anniversary edition, Cambridge University Press.

¹³⁰ Martin Giles, ‘Explainer: What is a Quantum Computer?’, (2019), MIT Technology Review, <https://www.technologyreview.com/2019/01/29/66141/what-is-quantum-computing/>

¹³¹ Ibid

¹³² Bertrand Wong, ‘On Quantum Entanglement’, (2019), Dept. of Science & Technology, Eurotech, S’pore Branch, International Journal of Automatic Control System

the smartest scientist, including Albert Einstein, who dubbed it “spooky action at a distance”.¹³³ In entangled quantum systems, qubits are so closely connected that observing one instantly provides insight into the state of the others; once measured, the system transitions from a superposition of multiple possibilities to a definite binary outcome, 0 or 1, mirroring classical computing logic.¹³⁴

Quantum decoherence is an important aspect of quantum computing as it is how information is transmitted from a quantum state to a classical state. Quantum decoherence happens when a qubit interacts with its surroundings, including internal factors and external influences, like heat and light. This interaction disrupts the qubit’s quantum state, causing the off-diagonal elements of its reduced density matrix to quickly decay, leading to a loss of coherence¹³⁵.

Simply put, it is the process by which qubits transition from a state of superposition to a binary state that may be observed on a classical computer in the form of 0s and 1s. Fundamentally, decoherence serves as a dynamic process that filters quantum states, allowing only classical-like superposition states to be reliably formed and sustained, while effectively suppressing most nonclassical superposition states due to their instability in the presence of environmental interactions-which are not consistent and are essentially random states in the quantum realm.¹³⁶

This allows a superposition of multiple answers of a complex question to be trimmed and focused into the most accurate answer, which is then reflected to the classical interface through a quantum algorithm (similar to Peter Shore’s algorithm discussed above), thus enabling the computer user to access quantum information and exploit its capabilities.

¹³³ Ibid

¹³⁴ Josh Schneider and Ian Smalley, ‘What is Quantum Computing?’, (2024), International Business Machines Corporation (IBM), <https://www.ibm.com/think/topics/quantum-computing>

¹³⁵ Howard E. Brandt, ‘Qubit Devices and the Issue of Quantum Decoherence’, (1999), Qubit devices and the issue of quantum decoherence, Volume 22, Issues 5–6, pp. 257-370, <https://www.sciencedirect.com/science/article/pii/S0079672799000038>

¹³⁶ Maximilian Schlosshauer, ‘Quantum Decoherence’, (2019), Physics Reports, Vol.831, pp.1-57, <https://www.sciencedirect.com/science/article/pii/S0370157319303084>

Quantum interference is a quantum mechanical effect resulting from the wave like properties of particles, such as electrons and photons, where overlapping superposition states interact to amplify (constructive interference) or cancel out (destructive interference) one another.¹³⁷

In quantum theory, light and matter have both wave and particle characteristics, behaving more like waves than particles in subatomic matter like neutrons, electrons, trapped ions and the rest. There are equations of quantum mechanics that provide ways of describing these wave properties, where the square of the *amplitude* – the maximum displacement of a wave from its equilibrium position - of such a wave corresponds to the probability of finding the particle at a particular location at a certain time, and the *phase* describes the relative position of the wave’s crests and troughs – highest and lowest point of the wave.¹³⁸

The phase is key when waves overlap or interfere; like ripples in a pond, waves cancel each other out when a crest meets a trough, and amplify each other when crest meets crest or trough meets trough..¹³⁹ These waves can build on each other when many of them peak at a particular outcome, or cancel each other out when crests and troughs interact, enabling an observer to extract the correct answer from the amplified probability with the most constructive waves.

In short, a quantum computer operates by preparing a superposition of computational states. The user constructs a quantum circuit that applies operations to create entanglement, resulting in interference between these states, as dictated by an algorithm. This process cancels out many possible outcomes while boosting others, with the amplified results representing the final solution¹⁴⁰.

¹³⁷ <https://quantum.microsoft.com/en-us/insights/education/concepts/interference>

¹³⁸ Ivars Peterson, ‘Quantum Interference’, (1989), Science News, Vol. 136, No. 23, pp.363, Society for Science & the Public, <https://www.jstor.org/stable/3973768>

¹³⁹ Ibid

¹⁴⁰ Josh Schneider and Ian Smalley, ‘What is Quantum Computing?’, (2024), International Business Machines Corporation (IBM), <https://www.ibm.com/think/topics/quantum-computing>

4.3 HOW QUANTUM COMPUTING MAY BE USED TO ADDRESS THE CHALLENGES FACED BY THE IRS IN COMBATING OFFSHORE TAX NON-COMPLIANCE

Quantum computing, through its principles of superposition and entanglement, offers a novel approach to big data processing that is fundamentally superior to classical computing. It also offers a solution to intricate encryption methods used by MNCs to hide assets and other financial information. Quantum encryption presents a solution to hackers who infiltrate the IRS system to obtain and alter information for their own benefit. It also presents an opportunity to enhance already established AI programs, which will improve the efficiency and productivity of the IRS. There are countless benefits quantum computing would have on tax enforcement and the following are the main advantages presented by this new technology.

Big data involves techniques for analyzing and extracting insights from data sets that are too vast, or complex, for conventional data processing tools to manage.¹⁴¹ Since quantum computing utilizes qubits instead of bits, which exist in multiple states simultaneously, they are able to provide exponential growth in processing power, enabling them to handle the complexities of big data in ways that conventional systems can not.

Quantum computing is increasingly being applied to Big data analytics in practical ways; quantum algorithms are being developed to tackle complex problems like optimization, pattern recognition, and machine learning, offering the possibility of faster and more efficient solutions compared to classical methods.¹⁴²

Through harnessing and exploiting this processing power, the IRS would be able to instantaneously process the hundreds of millions of tax returns and other documents that present a strain on the current information system. It would drastically reduce the work load of employees

¹⁴¹ Isabelle Ramdoo, 'KEY EMERGING TECHNOLOGY TRENDS', (2019), International Institute for Sustainable Development (IISD), <http://www.jstor.com/stable/resrep21976.5>

¹⁴² Akoh Atadoga, Ogugua Chimezie Obi, Femi Osasona, Shedrack Onwusinkwue, Andrew Ifesinachi Daraojimba, & Samuel Onimisi Dawodu, 'QUANTUM COMPUTING IN BIG DATA ANALYTICS: A COMPREHENSIVE REVIEW: ASSESSING THE ADVANCEMENTS, CHALLENGES, AND POTENTIAL IMPLICATIONS OF QUANTUM APPROACHES IN HANDLING MASSIVE DATA SETS', (2024), Computer Science & IT Research Journal, Vol. 5, Issue 2, pp. 498-517, Fair East Publishers, www.fepbl.com/index.php/csitj

by processing and organizing all required forms in appropriate data sets at unfathomable speeds, thus enabling the organization to focus most of its efforts on detecting and frustrating offshore tax evasion and avoidance schemes.

Quantum computing poses a major risk to current encryption techniques because it can carry out mathematical calculations that are impossible for the most advanced supercomputers. Encryption is based on mathematics and generally involves two types; symmetric and asymmetric cryptography. Symmetric cryptography uses the same secret key and algorithm for both encrypting and decrypting data between the sender and the receiver; while asymmetric cryptography, or Public Key Cryptography (PKC), uses paired keys- each user has a public key to encrypt messages and a private key to decrypt them¹⁴³.

One of the most important public-key schemes is RSA, invented by Ronald Rivest, Adi Shamir and Leonard Adleman in 1977.¹⁴⁴ RSA exploits the difficulty of factorizing bi-prime numbers, playing an important role in every electronic communication system as it ensures that only parties that have exchanged keys can read the encrypted message.¹⁴⁵

Quantum computers threaten the main goal of every secure and authentic encryption code with the application of Shor's algorithm in asymmetric cryptography and Grover's algorithm in symmetric cryptography. Shor's algorithm, discussed in his paper, 'Algorithms for Quantum Computation: Discrete Logarithms and Factoring'¹⁴⁶, proved that quantum computers can decode RSA encryption in a matter of seconds, since it is based on large prime integer factorization. A normal computer would take 6 quadrillion years to crack 2048-bit RSA code.¹⁴⁷ Lov Grover created an algorithm that uses quantum computers to search unsorted databases at a *quadratic improvement*

¹⁴³ Vasileios Mavroeidis, Kamer Vishi, Mateusz D. Zych, Audun Jøsang, 'The Impact of Quantum Computing on Present Cryptography', (2018), Department of Informatics, University of Oslo, Norway,) International Journal of Advanced Computer Science and Applications, Vol. 9, No. 3, 2018.

¹⁴⁴ Ibid

¹⁴⁵ Ibid

¹⁴⁶ P. W. Shor, "Algorithms for Quantum Computation: Discrete Logarithms and Factoring," (1994), in Proceedings of the 35th Annual Symposium on Foundations of Computer Science, ser. SFCS '94. Washington, DC, USA: IEEE Computer Society, pp. 124–134.

¹⁴⁷ Jon R. Lindsay, 'Surviving the Quantum Cryptocalypse', Strategic Studies Quarterly, Vol. 14, No. 2 (SUMMER 2020), pp. 49-73, Air University Press, <https://www.jstor.org/stable/10.2307/26915277>

over classical algorithm. This means that Grover's algorithm requires a number of operations on the order of the square-root of the number of operations required to solve unstructured data classically (\sqrt{N}) – or simply, it takes quantum computers square root of the time it would take classical computers to find a key in an unstructured data base.¹⁴⁸

By adopting quantum algorithms in its data decryption techniques, the IRS would be able to decrypt any encrypted data information of potential fraudsters, and enable it push through the wall of secrecy and confusion that enables MNCs to hide their financial information from the IRS. The IRS would no longer be subjugated to the whims of tax havens that assist MNCs in hiding their financial data through red-taps and filibustering, as it would be able to access information efficiently and expeditiously through decryption algorithms that would enable them discover the source of income, true scope of assets owned and other information.

Due to the counterintuitive properties of quantum computing systems, quantum computing can potentially enhance artificial intelligence's (AI's) capabilities by overcoming limits on data volume, complexity and processing speed. Scientists are actively applying quantum computing to improve AI methods, for example in predicting protein structures in healthcare.¹⁴⁹ Investigators are focusing on machine learning methods that are very effective at predicting the structure of small proteins, but are unable to handle the mass amounts of data and time required for larger proteins. To overcome this limitation, a new framework was developed to combine the best of machine learning methods with the power of quantum computing.¹⁵⁰

The same could be done for AI systems used by the IRS. **Jeff Saviano**, a principal focused on advanced technology, policy and governance at Ernst & Young in Boston, noted that classical computers can adequately model the direct impacts of tax legislation, but fall short in analyzing

¹⁴⁸ <https://learning.quantum.ibm.com/course/fundamentals-of-quantum-algorithms/grovers-algorithm>

¹⁴⁹ Cleveland Clinic Lerner Research Institute, 'How Quantum Computing Will Affect Artificial Intelligence Applications in Healthcare', (2024), <https://www.lerner.ccf.org/news/article/?title=+How+quantum+computing+will+affect+artificial+intelligence+applications+in+healthcare+&id=79c89a1fcb93c39e8321c3313ded4b84005e9d44>

¹⁵⁰ Ibid

secondary effects. In contrast, AI powered by quantum computing requires much less data for training, and can efficiently manage far larger data sets¹⁵¹.

The Enterprise Data Catalog (EDC), powered by artificial intelligence, that the IRS plans to implement in order to give a comprehensive view of data sets and enable them to be standardized (discussed above), would benefit tremendously from the implementation of quantum computing in its simulations and machine learning programmes.

The IRS has already deployed a new file system, referred to as Modernized e-File (MeF), which is an online system that facilitates the electronic submission of corporate, individual, partnership, exempt organization and excise tax returns; it includes updated error code explanations that accurately pinpoint errors within the tax return or associated documents, thus offering comprehensive details in the Acknowledgment File.¹⁵²

These AI programmes have already had a positive impact on the tax administration of the IRS, but coupled with quantum computing training, tax return anomalies and fraud schemes would be identified immediately, making it virtually impossible for MNCs to withhold taxes from the government.

Quantum computing presents an opportunity to reinforce and improve the cybersecurity of the huge data sets controlled by the IRS. It is important to note that quantum computing development is not exclusive to just American companies like IBM and Google. There is an active arms race for the control of this ground-breaking technology all over the world, especially from China. It is thus prudent for important government bodies to safe-guard critical data from future attacks from quantum cryptography practices, including the IRS.

Fortunately, an expanding industry is dedicated to assisting companies in preparing for the eventual decline of traditional encryption methods. KETS Quantum Security is developing

¹⁵¹ Ernst & Young Global Ltd, Marna Ricker, Jeffrey Saviano, Channing Flynn, ‘Three Steps Tax Teams should take to Prepare for Quantum Computing’, (2023), https://www.ey.com/en_no/insights/tax/three-steps-tax-teams-should-take-to-prepare-for-quantum-computing

¹⁵² Internal Revenue Service, ‘Modernized e-File (MeF) Overview’, (2024), <https://www.irs.gov/e-file-providers/modernized-e-file-overview>

compact thumbnail sized on-chip quantum encryption devices that utilize Quantum Key Distribution (QKD) technology to securely distribute cryptographic keys using the fundamental principles of quantum mechanics¹⁵³. Additionally, evolutionQ - founded by University of Waterloo professors and quantum computing/ cryptography experts Michele Mosca and Norbert Lutkenhaus - provides quantum risk assessment, risk management and cybersecurity solutions.¹⁵⁴

Adopting these quantum advancements is a prudent strategy to help the IRS safeguard critical information from dubious parties who would use such information to enable fraudulent schemes, such as by altering information to reduce the tax liability of an individual or an entity, thus promoting cyber security.

Google has made a huge leap in the development of quantum technology by introducing the Willow quantum chip. With its 105-qubit structure, Willow can complete a complex computational task in just 5 minutes, a process that would take today's fastest supercomputers 10 septillion years (10^{25}) to complete.¹⁵⁵ Willow's possible applications are endless and present a new solution to the toughest problems faced by organisations and Governments today, especially offshore evasion and avoidance.

Harnessing and exploiting the capabilities of this microchip would enable the IRS accomplish tasks in virtually no time at all; analyzing huge data sets, detecting anomalies, encrypting sensitive information and decrypting critical information for financial tracking. Tax evasion schemes would be detected in seconds and flagged off, enabling the IRS to reduce expenditure on human capital and thus focusing it on efforts to apprehend culprits, retrieving much needed tax dollars. AI programming and training would be expediated and accomplished with ease, ensuring the best AI

¹⁵³ Francesco Bova, Avi Goldfarb, and Roger G. Melko, 'Commercial applications of quantum computing', (2021), Rotman School of Management, University of Toronto, Toronto, Canada; Creative Destruction Lab, Toronto, Canada; Dept. of Physics & Astronomy, University of Waterloo, Waterloo, Canada; Perimeter Institute for Theoretical Physics, Waterloo, Canada., EPJ Quantum Technology., <https://doi.org/10.1140/epjqt/s40507-021-00091-1>

¹⁵⁴ Ibid

¹⁵⁵ Prof. Dr. AYŞEGÜL ALAYBEYOĞLU, 'Pioneer and Innovative Studies In Computer Sciences and Engineering', (2024), All Sciences Academy, https://www.allsciencesacademy.com/files/ugd/13252f_2d4bfe34926e43e69c1d2fff7b74bf11.pdf#page=45

tax systems in the world. Accountability would be guaranteed, and information would be properly organized, enabling easy access to information. Quantum computing technology presents boundless possibilities to revolutionize tax administration and achieve a future where a tax gap of trillions of dollars is unthinkable and impossible.

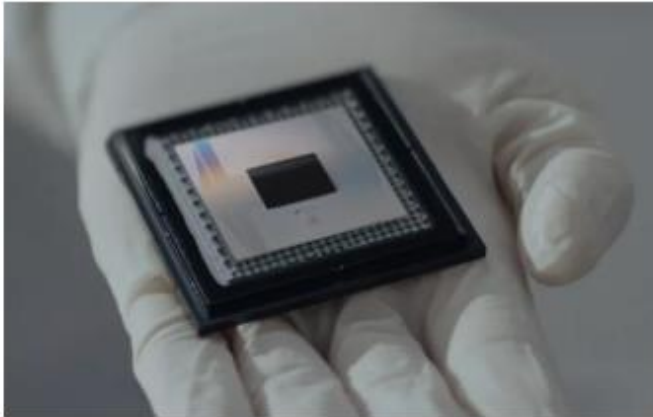


Figure 2. Willow Quantum Chip¹⁵⁶

4.4 FINDINGS OF THIS CHAPTER

Quantum computing operates on qubits instead of classical bits, enabling it to exploit the various quantum mechanical properties of superposition, entanglement, and quantum interference to perform computations. Algorithms such as Shor's algorithm and Grover's algorithm demonstrate the exponential and quadratic speedups of processing power, having implications on data security and fraud detection. The IRS faces challenges of complex data environments, resource limitations, data analysis inefficiencies, detection latency and evolving evasion tactics which can all be solved using quantum computing technology. Quantum computing offers enhanced pattern recognition, cryptographic disruption and reinforcement, optimization of enforcement resources, faster anomaly detection and simulation of complex networks.

The integration of quantum computing into IRS tax enforcement strategies represents a revolutionary stage in the agency's approach to compliance and fraud detection. By leveraging the unparalleled computational power of quantum systems, the IRS may be able to analyze vast and complex amounts of financial datasets at speeds and depths far beyond any conventional computer

¹⁵⁶ Ibid

system. This transformation would not only enable the detection of sophisticated tax avoidance patterns in near real-time, but also enhance predictive analytics to flag potential non-compliance before it escalates. This chapter makes it clear that quantum computing is a necessary innovation that the IRS should invest in in order to effectively carry out its duties.

CHAPTER FIVE

5.0 SUMMARY OF THE FINDINGS

In this research, I found out that despite the international and national efforts of the Foreign Account Tax Compliance Act (FATCA), OECD's Common Reporting Standard (CRS), and the Internal Revenue Code, tax noncompliance remains a growing concern for the American government. This research outlines how wealthy individuals and Multinational Corporations (MNCs) exploit legal loopholes, data opacity, and jurisdictional secrecy to obscure ownership and income sources.

The current legal framework depends on voluntary compliance with tax policies, yet it is human nature for individuals to be greedy with their resources. The IRS lacks real-time transactional data across borders and does not have the technology to keep up with the sophisticated schemes of MNCs and wealthy individuals. This research highlights the gap between the enactment of sufficient anti-tax avoidance and evasion laws, and the enforcement capacity of the IRS.

I also found out that the IRS still depends heavily on traditional computing systems that are struggling with the sheer volume and complexity of today's financial data. Even though it has taken steps to modernize its tax administration with the implementation of AI technology, the IRS continues to face significant challenges in curbing tax-noncompliance, contributing to a substantial and ongoing loss of revenue amounting to trillions of dollars for the American economy. Traditional algorithms often fail to detect complex non-linear transaction patterns that may indicate evasion, especially when these are distributed across multiple jurisdictions and disguised through layers of intermediaries.

On top of this, AI software and other sophisticated technology is readily available to MNCs and wealthy individuals, enabling them to exploit their capabilities in order to avoid detection by the IRS system.

I found out that quantum computing offers an exponential shift in processing power, enabling the IRS to bolster its enforcement capabilities. Quantum algorithms present a solution to all the technical problems faced by the IRS, such as Grover's algorithm which offer a quadratic speed-up for unstructured search tasks, offering a significant enhancement in the ability to detect anomalies in large databases of financial transactions. Shor's algorithm demonstrates the ability to factor

large numbers efficiently, which dismantles the security offered by most modern encryption methods. This would enable the IRS to decrypt communication or documents in legal scenarios where decryption is authorized. Quantum machine learning (QML) capabilities like quantum-enhanced support vector machines or quantum Boltzmann machines, could process patterns in high-dimensional financial data faster and more accurately than classical ML models.

Together, these quantum tools promise to improve the identification of tax non compliance patterns, particularly in large and complex datasets where evasion and avoidance signals are hard to detect.

Although quantum computing presents numerous advantages to the IRS system, there are limitations and challenges that may be faced in implementing this technology. Quantum computers are expensive to build and expensive to maintain; they require advanced cooling systems and highly trained personnel to operate the system. Not only is it expensive, but it is still under development, thus new and improved versions of the micro chip are constantly being engineered, making it difficult to know when to purchase a micro chip and when to wait for the newest developments.

The most obvious limitation to implementing quantum computing technology is the cost. As of 2024, the cost comparison of quantum chips compared to conventional chips worldwide is USD 10-100 per unit for a conventional chip, while a quantum chip is USD 10-15 million per unit; development cost for a traditional chip is USD 10-15 million, while a quantum chip is USD 100-300 million; a single quantum computer is USD 10-15 million.¹⁵⁷ Not only is production and unit cost expensive, quantum computers require specific infrastructure and personnel to function, like complex cooling systems, the need for highly qualified specialized personnel, very precise production technologies and continuous research and development investments. Special cooling systems cost USD 1-2 million, cryogenic units are USD 500,000-1 million, electromagnetic isolation rooms are USD 250,000-750,000, monthly energy consumption costs around USD 50,000-100,000, maintenance and repair costs USD 500,000-1 million annually, and cost of

¹⁵⁷ Ibid

specialized personnel is USD 2-5 million per year.¹⁵⁸ Implementing quantum technology would put a strain on the already meagre budget of the IRS.

Qubits that make up quantum computers require temperatures near absolute zero (zero kelvin or -273.15, which is colder than outer space) in order to reduce the likelihood of decoherence by environmental forces. Although some progress in this area has been made with the photonic quantum chip, Willow, and light absorbing metal-ion qubit, the need for extreme cold is still a significant problem with quantum computing today due to the difficulty of generating and maintaining this temperature.¹⁵⁹

A huge cooling system (figure 3) is needed to reach and maintain such cold temperatures, which is a very difficult task even with the best technical personnel and abundance of resources. This presents a challenge to the IRS as it would need to invest huge funds into innovations and new technology that would ease this task, as well as looking for skilled personnel who could operate this complicated system.

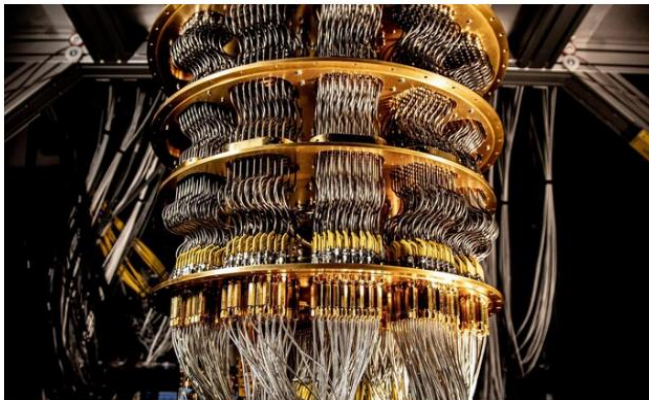


Figure 3. Supercooling system at Google Quantum AI¹⁶⁰

¹⁵⁸ Ibid

¹⁵⁹ Mandeep Singh and Albert H. Carlson, 'An Introduction to Quantum Computing and Its Applications', (2024), The Cyber Defensive Review, Vol. 9, No. 2, Data in the Cybersecurity Landscape, pp.73-92, Army Cyber Institute, <https://www.jstor.org/stable/10.2307/48784776>

¹⁶⁰ Matt Swayne, 'Top Ten Quantum News Stories of 2023', (2023), Quantum Insider, <https://thequantuminsider.com/2023/12/28/top-ten-favorite-quantum-news-stories-of-2023/>

As with new technologies, the number of trained experts needed to design, develop and operate the machines is limited.¹⁶¹ The lack of specialists in this area results in high cost of training and employing such trained personnel, which is a problem for the IRS. Quantum computing requires a deep understanding of quantum mechanics, physics and specialized computer languages, as well as expertise in cryogenics, material science, electrical engineering and software development. It is immensely difficult to find individuals who meet all these characteristics, which is a challenge faced by all quantum developers around the world.

Standardization of quantum technology is impossible right now due to the ever-growing nature of this industry. Many solutions for problems faced by quantum computers are being solved and implemented, leaving little standardization for the designs or methodology of quantum technology, thus leaving uncertainty on what to select and implement into current tasks.¹⁶² For instance, if the IRS were to invest millions into Willow, that only has 105-qubits of processing speed, in just a few years another chip with more storage would be invented, leaving the IRS behind technology-wise and leaving a huge hole in the budget. It is thus difficult to choose which piece of technology to invest in and which one to set aside in hopes of better inventions and innovations in the near future.

Implementing quantum computing may raise ethical considerations that might hinder the implementation of quantum computing. Tax payer privacy is a fundamental right enshrined in the internal revenue code- 26 U.S. Code§ 7803(3). Quantum cryptography presents the power to access any information that is encrypted symmetrically or asymmetrically; thus, the IRS would have the power to violate the right to privacy of tax payers without proper regulation. This might push legislative members of congress to pass bills in order to regulate the operations of the IRS, which would hamper the potential advantages that quantum computing presents.

¹⁶¹ Mandeep Singh and Albert H. Carlson, 'An Introduction to Quantum Computing and Its Applications', (2024), The Cyber Defensive Review, Vol. 9, No. 2, Data in the Cybersecurity Landscape, pp.73-92, Army Cyber Institute, <https://www.jstor.org/stable/10.2307/48784776>

¹⁶² Ibid

5.1 RECOMMENDATIONS

To effectively harness quantum computing for the detection and prevention of tax non compliance, I recommend a multi-layered and carefully phased policy strategy that encourages innovation, ensures strong legal protection and promote inter-agency cooperation.

I recommend that the IRS establishes a Quantum Integration task force. This task force would be charged with exploring, testing and gradually integrating quantum computing technologies into enforcement operations. Through collaborating with federal research laboratories, tech companies, and academic institutions the task force would be able to assess quantum readiness, develop applicable quantum algorithms, and oversee test operations. This could be achieved by investing in the training of IRS data analysts and forensic accountants to interpret quantum-assisted outputs and integrate them with quantum computing specialists.

I also recommend that the IRS initiates public-private partnerships with industry leaders. Through engaging with industry leaders like IBM, Google, Microsoft and academic institutions with quantum research projects, the IRS may be able to develop tax-specific applications curated in order to detect fraudulent schemes. The IRS could set up competitions, grants and sandboxes for these private institutions in order to test quantum models for anomaly detection, network mapping of offshore entities, and cryptographic analysis of financial trails. This would present an incentive for private companies to develop appropriate algorithms and technology that could be used by the IRS to stop MNCs and wealthy individuals from evading and avoiding taxes.

In addition, the government should amend the legal and regulatory frameworks to cater for the implementation of quantum technology in the IRS. The Government should amend the Internal Revenue Code and related statutes to provide for the definition and govern the use of quantum technology-in particular the admissibility of quantum derived evidence, safeguards for the protection of tax payer privacy rights, and provide for procedures for quantum-enabled data decryption. The government should also promote oversight and accountability though appointing a congressional committee to ensure the IRS complies with the duties and procedures envisaged in the amended provisions.

Further, the IRS should conduct phased test programs in order to compare classical and quantum methods of fraud detection. Through these tests, the IRS would be able to evaluate the efficiency of both methods in detection of fraud, recovery of information, and strength of encryption methods.

This information could be used to determine the performance of quantum technology, presenting an informed basis for the scale of application of this technology in tax administration.

In addition to the above, I recommend that the IRS promotes international cooperation and standard setting through quantum enabling tax treaties. Through treaties like tax information exchange agreements (TIEAs) and double taxation treaties (DTTs), the IRS could promote international use of quantum technology by tax authorities through including provisions for quantum data sharing and analysis. This would increase the information available to the IRS, thus reducing the ability of MNCs and wealthy individuals to conduct tax evasion schemes and abusive tax avoidance practices. Working with the OECD, G20, and Financial Action Task Force (FATF) to develop global ethical and technical standards in regards to quantum technology would promote international cooperation and make it difficult for bad actors to carry out fraudulent schemes.

The IRS should secure adequate funding for the implementation of quantum technology. In order for the IRS to successfully implement quantum computing technology, it has to secure federal appropriations to support a 10-to-15-year roadmap for quantum deployment, catering for basic research, personnel training, and infrastructure modernization. This would ensure that the IRS stays ahead of the curve-both in developing quantum computing capabilities and in putting them to practical use for smarter and faster tax enforcement

5.2 CONCLUSION

Offshore tax evasion and avoidance remains one of the most persistent and damaging challenges faced by the American tax system. Despite the numerous policy reforms and integration of emerging technologies, such as artificial intelligence, the IRS continues to face major obstacles in identifying and addressing the sophisticated financial schemes employed by MNCs and wealthy individuals in order to conceal wealth across borders. This has resulted in the loss of trillions of dollars worth of revenue to the government, with implications affecting everything from infrastructure development to income inequality.

This research has examined the potential for quantum computing to reshape tax administration, analyzing its capabilities and limitations. Quantum computing can process vast datasets, identify complex and non-linear relationships, and uncover hidden patterns in ways that classical algorithms cannot. When applied to tax enforcement, quantum computing can dramatically enhance the detection of offshore evasion and avoidance schemes, many of which rely on intricate

layers of transactions and global intermediaries to escape liability. As with any transformative technology, the application of quantum computing comes with challenges, as it is not enough to adopt the tool, but clear strategies for implementation must be developed. This research presents various recommendations in order to solve this problem. The creation of a specialized task force, strong public-private partnerships, legal updates to ensure transparency and constitutional compliance, test programs, international cooperation to set global standards, and long-term investment in quantum development are the possible solutions to the problem of implementation of quantum computing.

Tax noncompliance exploits the gaps between systems, jurisdictions, and technological capabilities. To close those gaps, enforcement must become more proactive, more interconnected, and more adaptive to innovation, quantum computing, though still in its developing stages, offers the potential to lead this evolution. By investing in this technology, the IRS has the opportunity to move from reactive enforcement to intelligent, anticipatory governance-ultimately safeguarding the fairness, effectiveness, and sustainability of the American tax system.

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