THE TAXATION OF OUTER SPACE ACTIVITIES UNDER DOMESTIC AND INTERNATIONAL TAX LAW: A PRINCIPLED AND NORMATIVE TAX POLICY EVALUATION

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Abstract

This work builds on the premise that current tax rules are designed for an Earth-based economy, with the language and structure of existing tax regulations inherently tailored to terrestrial economic activities. It addresses the tax issues arising from the commercialization of space and proposes the necessary adjustments to domestic and tax treaty rules.

The analysis progresses from de lege lata (Part I) to de lege ferenda (Parts II and III). Part I of the study explores the historical developments of the space sector and international space law, and their implications for taxation (Chapter 2). Moreover, it scrutinizes existing rules in the OECD Model Tax Convention (Chapter 4) and selected domestic legislations (Chapter 5) to identify tax issues arising in connection to space commerce and the solutions adopted thus far. Part II delves into how space activities should be taxed, grounding the discussion in concepts of sovereignty and jurisdiction in public international law and space law (Chapter 6). This section provides an in-depth review of states' legitimacy to exercise limited sovereign powers in outer space, arguing that Article VIII of the Outer Space Treaty grants the state of registration (of space objects) the right to tax income sourced in space and connected to the objects registered. This leads to the development of the "Tax Jurisdiction by Registration Principle" (Chapter 7), which is further explored in Chapter 8 as a potential basis for allocating taxing rights in outer space under a benefit-based rationale. Additionally, Part II examines the roles of the ability-to-pay principle and the single tax principle in shaping domestic source rules for taxing space income, and suggests amendments to the OECD Model Tax Convention.

The work concludes with an assessment of the role of taxation and tax incentives in the space sector. It outlines the key elements of a new "Space Debris Mitigation Fiscal Scheme" (Chapter 9.2) and considers the most suitable forum for adopting such a measure, including whether the European Union has the competence to do so (Chapter 9.3). This work discusses the important role of tax incentives for space companies and the potential impact of the OECD GloBE Model Rules and EU State Aid regulations on space companies.

1. Introduction to the study

1.1. Scope, research problem and research questions

This document summarizes the main arguments put forward in the author's Doctoral thesis difended on 25 July 2024 at WU – Vienna University of Economics and Business (referred to as the 'Doctoral Dissertation' or the 'Thesis' in the following pages).

The study addresses the fundamental questions arising in connection with corporate income taxation in the context of the growing space economy. Other taxes (e.g., excise taxes, sales, and use taxes) are discussed in the Thesis merely to explain how space activities are currently taxed; However, they do not form part of the core analysis of this work. The reason for focusing on corporate income taxation is twofold. First, the main emerging actors in the space commerce landscape are private companies (among the more well-known are SpaceX, Blue Origin, and Virgin Galactic). The activities they carry out (or expect to carry out) in space have the potential to generate substantial income, which is subject to taxation. If the tax system is not up-to-date, space income may risk falling outside the scope of existing rules and being either taxed twice or not at all. While this may not constitute a problem per se, ideally, taxation should result from well-thought-out policies, not from loopholes in tax rules. Second, the analysis of tax issues related to taxes other than income tax requires an understanding of the fundamental elements of space taxation, the study of which is almost entirely missing in the literature. For this reason, this work offers an analysis of the 'backbone' of space taxation and the principles governing it. Indirect tax issues arising in connection with space activities will be addressed in a future project.

Research on the taxation of space commerce is still in its infancy. The literature review revealed a substantial gap in the analysis of fundamental questions related to the taxation of income derived from space-related activities, especially concerning the principles, justifications, and goals of space taxation. From the perspective of domestic tax law, there is a significant disparity in the volume and depth of studies on space taxation between the United States and the European Union. In the United States, the adoption of a domestic source rule for income from outer space activities has sparked discussions on the impact of such a rule on the space sector.[1]

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[1] Among others, M.S. Lebowitz & S. Paz, *IRS Reproposes Regulations for Taxing the Final Frontier*, 84 Taxes 1 (2006); Cowan, *supra* n. 15; M.D. Gisby & J. Keller, *Impact of the Proposed 863(d) and (e) Regulations on the Satellite Industry Symposium: International Taxation*, 23 Loy. L.A. Int'l & Comp. L. Rev. 4 (2001); S.M. Maruca, *Proposed Source Rules for Space, Ocean, and Communications Income Sweep Broadly, Set High Hurdles for Taxpayers*, 53 Tax Executive 2 (2001); D.R. Tillinghast & K.S.D. Holm, *Proposed Regulations on Space and Ocean Income and International Communications Income Raise Major Issues for U.S. and Foreign Companies*, 79 Taxes 6 (2001); R. Turner, *Foreign Taxation Highlights of the Tax Reform Act of 1986*, 21 Int'l L. 2 (1987).

In contrast, the near-total lack of contributions on the domestic taxation of space commerce in EU member states might be attributed to the absence of space-related commercial activities generating taxable income. From a tax treaty perspective, the OECD has (so far) failed to consider – and even dismissed the importance of dealing with – taxation of space commerce.[2] While the few existing contributions provide a solid and valuable foundation for the study of the issues discussed in this work,[3] an in-depth principled and normative analysis of the fundamental domestic and international tax issues arising from the new space economy has yet to be offered.

Without claiming or aspiring to be exhaustive, this work addresses these research gaps and aims to contribute to further advance conceptualization and knowledge on the taxation of income from commercial space activities. The Thesis analyzes existing international and selected domestic tax rules from a legal perspective. Where no space-specific tax rules exist, the general tax framework for corporate taxation is analyzed to understand how it applies to the space sector. To reach the stated objectives, the work answers the following research

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[2] See paragraph 4 of the Commentary on Article 7 of the Organization for Economic Co-operation and Development (OECD) Model Tax Convention on Income and on Capital (OECD Model Tax Convention), in its version bewteen 31 March 1994 and 17 July 2008, which read: "There have been, since the 1950s, rapid developments of activities in space: the launching of rockets and spaceships, the permanent presence of many satellites in space with human crews spending longer and longer periods on board, industrial activities being carried out in space, etc. Since all this could give rise to new situations regarding the implementation of double taxation conventions, would it be desirable to insert special provisions in the Model Convention covering these new situations? Firstly, no country envisages extending its tax sovereignty to activities exercised in space or treating these as activities exercised on its territory. Consequently, space could not be considered the source of income or profits, and hence activities carried out or to be carried out there would not run any new risks of double taxation. Secondly, if there are double taxation problems, the Model Convention, by giving a ruling on the taxing rights of the State of residence and the State of the source of the income, should be sufficient to settle them. The same applies with respect to individuals working onboard space stations: it is not necessary to derogate from double taxation conventions, since Articles 15 and 19, as appropriate, are sufficient to determine which Contracting State has the right to tax remuneration and Article 4 should make it possible to determine the residence of the persons concerned, it being understood that any difficulties or doubts can be settled in accordance with the mutual agreement procedure." On 17 July 2008, this paragraph was deleted from the OECD Commentary.

[3] Among the most important scholarly contribution on the topic see: P. Semerád, *Asteroid Mining Tax as a Tool to Keep Peace in Outer Space*, Space Policy, 2023; T. Soares, *Chapter 10: The Rise of Space Taxation: A Tale of Foresight*, NOVA Tax Research Series, 2023; Sadowsky, *White Paper 12.* Taxation. Taxing the Future 2022; G. Savir, *Regulation and Tax in Space* (Series on International Taxation, Wolters Kluwer 2021); G. Zeyen, *Taxation of Outer Space Income Resulting from Air Transport or Employment Activities: Is the OECD Model Convention an Appropriate Tool?*, 49 Intertax 4, 2021; S. Béal, M. Deschamps & H. Moulin, *Taxing Congestion of the Space Commons*, 177 Acta Astronautica, 2020, 313–319; T. Gilliver, *Taxation*, The Space Law Revie*w. II Ed.* (J. Wheeler ed., Law Business Research Ltd. 2020); J. Schwarz, *Taxation of Space: The Final Frontier*, Kluwer International Tax Blog, (27 Sept. 2019), available at https://kluwertaxblog.com/2019/09/27/taxation-of-space-the-final-frontier/ (accessed 10 Aug. 2023); E. Nuku, *IFA Research Paper. Taxation of Outer Space: Challenges and Opportunitie*, 2017; G. Savir, *Tax Infinity & Beyond*, 2016 SSRN Electronic Journal, available at 10.2139/ssrn.2812866 (accessed 21 Sept. 2023); J.P. Jr. Cowan, *The Taxation of Space, Ocean, and Communications Income under the Proposed Treasury Regulations*, 55 Tax Law. 1, 2001–2002; W.L. Andrews III, *The Taxation of the Space Commerce* (Kluwer Law International 2001); C. Kelly, *Federal Income Taxation of Space and Ocean Activities*, 14 Int'l Tax J. 1, 1988.

question: What are the necessary adjustments to be made to the existing international and domestic tax law frameworks to face the challenges posed by the space economy?

Each part of this work answers specific sub-research questions, logically intertwined, which form the building blocks for answering the above-mentioned research question. The following table summarizes the progression of the sub-research in the structure of the dissertation.

Table 1. Summary of research questions.

Main research question	
What adjustments need to be made to the existing international and domestic tax law frameworks to address the challenges posed by the space economy?	
Sub-research questions	
Chapter 2	1. What is the impact of space law in space taxation?
	1.1. How and why did international space law emerge as a legal field? 1.2. What is the rationale of space law principles? 1.3. Which space law principles are relevant for tax law?
Chapters 3, 4 and 5	2. How are space activities currently treated in domestic tax legislations and the OECD MC?
	2.1. How is space income classified under the traditional categories of income? 2.2. How are space activities treated in the OECD Model Tax Convention? 2.3. How are space activities taxed in domestic legislations?
Chapters 6, 7 and 8	3. How should space activities be taxed?
	3.1. What is the consequence of the absence of sovereignty in outer space for tax treatment of space income? 3.2. What lessons can be derived from the taxation of income from commercial activities in other non-sovereign areas? 3.3. What are the scope and extent of Article VIII Outer Space Treaty, and what is the relevance of such provision in tax matters? 3.4. What is the role of the ability to pay principle, the single tax principle, and the benefit principle in justifying space taxation and shaping the tax treatment of space companies? 3.5. How should existing tax rules be amended to overcome the shortcomings described in this study?
Chapter 9	4. What is (and can be) the role of taxation in the space sector?
	4.1. Can a new space tax be practicable? What purpose should it pursue and what principles should inform its design? 4.2. Can a new European space tax ever be feasible?
Chapter 10	5. What is (and can be) the role of tax incentives in the space sector?
	5.1. What is the impact of international tax law on tax incentives for the space sector, with particular regard to the OECD GloBE Rules? 5.2. What is the impact of European Union law on tax incentives for the space sector, with particular regard to EU State Aid regulations?

1.2. Methodology

From a methodological perspective, this manuscript constitutes interdisciplinary research that draws primarily on international and domestic tax law, public international law, and space law. The framework for the taxation of commercial space activities is built upon the interpretation of space law principles and public international law concepts, followed by the study of selected domestic tax disciplines. Given the greater human experience with issues arising from the lack of sovereignty in the High Seas, this work reviews the history of solutions adopted for the taxation of income from activities in the High Seas to assess whether similar ideas could be applied to the context of outer space. Examining solutions from this domain offers the advantage of drawing inspiration from instruments that are familiar to policymakers, making it possible to propose solutions that would be easier to adopt, manage, and administer. However, legal researchers must refrain from blindly extending solutions and conceptual frameworks developed in other areas of law (such as the law of the sea) to the space sector. In this work, such solutions are used purely as inspiration and, where relevant, as supporting arguments.

Within this general methodological framework, each part of the work introduces specific methodologies suited to the investigation undertaken therein. For example, Part I involves a narrative and comparative evaluation of existing tax provisions in selected states. In particular, Part I examines the United States, France, and Luxembourg. In the United States, the analysis covers the federal income tax code as well as the tax legislation of three states: Florida, Virginia, and California. These states were selected due to their inclusion of provisions specifically related to the space sector. They were chosen from a larger pool of states with such provisions (e.g., Texas, Oklahoma) for two reasons: (i) the stronger presence of commercial space companies in these states, and (ii) the characteristics of their tax provisions, which offer academic interest. As for the European Union, France and Luxembourg were selected partly because the author is proficient in the relevant languages (i.e., Italian, English, and French). This linguistic proficiency enables an original and thorough analysis based on the study and interpretation of the history, purpose, and wording of tax provisions and other primary sources. Secondary sources and doctrinal opinions are used to support these interpretations or to offer alternative viewpoints. Despite the relative scarcity of space-specific tax provisions in Europe compared to the United States, Luxembourg and France stand out for having made efforts to account for the peculiarities of the space sector in their tax laws, making them suitable for selection.

Part II of this monograph addresses the tax consequences of the absence of sovereignty in outer space and explores whether Article VIII of the Outer Space Treaty could play a role in the allocation of taxing rights in outer space. To achieve this, Part II develops the 'Tax Jurisdiction by Registration' principle through a deductive research methodology. Rather than filling the research gap by examining how similar cases (such as the taxation of income sourced in the High Seas) have been resolved and automatically applying those solutions to outer space, Part II begins by studying the relevant corpus iuris spatialis, seeks a legal basis for the exercise of (limited) sovereign rights in outer space, and assesses the scope and extent of such powers to determine whether the exercise of taxing rights is included. In other words, the solution is derived from the system of rules that specifically applies to space, not from a different legal framework, such as the law of the sea. Other legal systems are used only as examples that may help support the logic behind the proposed solutions.

Part III combines doctrinal research with an analysis of primary legislation. It builds upon the author's previous published research on space debris mitigation and tax incentives for space companies, expanding on the solutions proposed and further analyzing their consequences.

1.3. A brief account of the historical and legal framework and their relevance for taxation

Space taxation cannot be usefully discussed in isolation from the history of space exploration and the geopolitical forces that underpin international space law principles. Regarding the first area of inquiry, this work examines the historical development of the space sector, highlighting that space commerce only began to emerge in the late 20th century, primarily in the United States. This helps explain the near-complete absence of space-specific tax rules in (i) domestic legislations in European Union countries—where space activities were predominantly carried out by governments and did not generate taxable income—and (ii) bilateral tax treaties, partly because most of these treaties were negotiated before space commerce began generating taxable income, and partly due to the lack of interest in addressing space income taxation or an awareness of its importance.

Furthermore, the possibility of taxing income derived from space activities can only be properly discussed in the context of the principles set out in the Outer Space Treaty. This is because implementing tax rules that contradict these principles could risk violating the international obligations of contracting states. In this context, Chapter 2 of this doctoral thesis focuses on the 'non-appropriation principle' and the 'benefit principle,' due to their significant implications for taxation. The non-appropriation principle establishes that outer space,

including the Moon and other celestial bodies, is not subject to national appropriation by claims of sovereignty or any other form of claim. This means that no state can assert territorial (or tax) sovereignty in outer space. The benefit principle, as outlined in Article I of the Outer Space Treaty, states that activities in the exploration and use of outer space must be conducted "for the benefit of mankind." While the precise meaning of the term 'benefit' remains unclear, the ambiguous nature of this concept may render it suitable as a basis for arguing that revenue generated from space activities should be distributed or apportioned among states.

2. International and domestic space taxation: an analysis *de lege lata*

2.1. Introduction

In the absence of a dedicated income category, the taxation of space income generally follows the rules applicable to the traditional category of income under which it falls, based on the specific space activity and the relevant domestic legislation's classification.

Part II of this doctoral dissertation begins the analysis of the status quo of space taxation by discussing the conditions under which the OECD Model Tax Convention applies to space income. Additionally, it provides a review of space-specific tax rules in selected domestic legislations. While the primary purpose of this section is descriptive, it also critically examines the rationale behind some of the tax rules presented, raising key questions that will be explored in greater detail during the normative analysis in Part III.

2.2. The applicability of the OECD Model Tax Convention to space income

Chapter 4 of the Doctoral dissertation zooms into the OECD Model Tax Convention and analyzes if and when bilateral tax treaties apply to space income. In general, some conditions must be met for a bilateral tax treaty to operate. First and foremost, double taxation shall arise in a *cross-border situation* involving two (or more) states. Second, a *double tax treaty* between these two states shall exist and be in force. The tax treaty will apply if there exists a taxpayer *resident* for tax purposes in at least one of the two contracting states. For the tax treaty to operate, the taxpayer must conduct business, perform services or activities in the other contracting state, or earn income having its *source* in the other contracting state, where his income (or a portion of it) is also taxable. Finally, the tax giving rise to double taxation must be a *tax on income or capital*, falling within the scope of application of the treaty. In the context of space taxation, the Doctoral thesis highlights three main issues.

First, the study focuses on the impact of space activities on the operation of traditional fiscal attachments. In particular, if activities are conducted in outer space it may be difficult to identify the contracting state where income is sourced. The challenges in determining the source country can be further complicated by questions such as: (i) whether a satellite can constitute a permanent establishment in outer space, and (ii) whether the satellite's footprint can create a permanent establishment in another contracting state. Similarly, if a taxpayer spends more than 183 days in outer space – as has already been shown to be possible – the question arises as to whether their tax residence should be reconsidered. Chapter 7 of the Doctoral dissertation offers a potential solution to this issue.

Second, the thesis addresses the question of whether income from space transportation activities can be included within the scope of Article 8 OECD MC. In doing so, the author reviews the history of Article 8 OECD MC, and investigates whether (i) the material scope of the provision extends to space objects, and (ii) the rationale behind the adoption of Article 8 can also apply to space activities. The review concludes that, based on the history, rationale, and purpose of the provision, it is unlikely that a mere interpretative effort will suffice to justify extending the provision to space transportation activities. Therefore, at present, both questions should be answered negatively.

Finally, the thesis considers whether income from satellite transponder leasing agreements should be treated as royalties or business profits. While a definitive, universally accepted answer cannot be provided, an examination of relevant judicial decisions reveals that the classification of such income depends on the specific powers attributed to satellite operators. The analysis also highlights a tendency – at least in some jurisdictions – to push the boundaries of tax treaty interpretation to assert taxing rights as the source state.

2.3. The taxation of space income in selected domestic legislations

While still a relatively rare practice, some countries have begun to incorporate space-specific considerations into their tax codes.

Above all, the United States recognized early on the need to adapt its tax framework to address the unique challenges associated with the taxation of space income. In the United States, the primary law governing income taxes is the Internal Revenue Code (IRC), codified as Title 26 of the United States Code. Within Title 26, a specific section now addresses income derived from certain space and ocean activities. Prior to the 1986 Tax Reform Act (TRA), there was no distinct source rule for income derived from activities conducted on the high seas or in space. As a result, it was first necessary to categorize such income and then determine its source

according to the applicable rules for that category. For example, before the 1986 TRA, income from services performed in outer space was treated as 'foreign-source income,' as it was earned outside the territory of the United States or related to property located outside the United States (i.e., in space). If such income was earned by a foreign person, it was generally not subject to U.S. taxation. If earned by a U.S. resident, it was included in taxable income, but its 'foreign' source allowed for a foreign tax credit. However, such income was typically not subject to foreign tax.[4] This scheme allowed U.S. taxpayers to claim a foreign tax credit against their U.S. tax liability on income that was potentially exempt from the double taxation the credit was designed to alleviate. Additionally, U.S. taxpayers could route this income through a Controlled Foreign Corporation (CFC) located in a jurisdiction with low or no tax on such income, without necessarily triggering the application of Subpart F.[5] As a result, US persons could enjoy a complete deferral of US taxation until repatriation of the income.[6] To address these issues, the 1986 TRA added Section 863(d),[7] defining income from space and ocean activity as a category of income subject to special source rules. Moreover, the 1986 TRA included income from space and ocean activities in the definition of 'foreign base company shipping income' for Subpart F purposes, and in the definition of 'shipping income' for the separate limitations category under Section 904(d) (and thus removed it from the general basket for Section 904(d) foreign tax credit limitation purposes).[8] While the doctoral dissertation provides a detailed explanation of the legislative process, scope of application, and operation of the provision, for the purposes of this brief summary, it is sufficient to note that, as a result of the implementation of Section 863(d) of the IRC, space (and ocean) income earned by U.S. resident taxpayers is considered sourced in the United States. In other words, the taxpayer's tax residence determines the source of space income. For foreign persons, space (and ocean) income is generally treated as foreign-source income, unless earned by a CFC. In the latter case, the income is treated as U.S.-source income, except to the extent that, based on all the

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[4] H.R. Rep. No. 99-426, at 381–82 (1985); S. Rep. No. 99-313, at 357–58 (1986); 1986 TRA Bluebook, at 924–35. But cf. Rev. Rul. 70-304 (insurance proceeds for pilferage on vessel on high seas en route to the Bahamas treated as US-source). A statutory exception applied for certain income from leasing spacecraft (and aircraft) manufactured in the United States that was eligible for the investment tax credit and leased to a US person. See former §861(e), repealed by the 1986 TRA, Pub. L. No. 99-514, §1212(d).

[5] The provisions in Subpart F, Sections 951 to 965, eliminate deferral of US tax on some categories of foreign income by taxing certain US persons on their *pro rata* share of such income earned by their CFCs.

[6] Kelly, *supra* n. 2, at p. 70.

[7] 1986 TRA, Pub. L. No. 99-514, §1213.

[8] See former §904(d)(2)(D), and former §954(f).

facts and circumstances, the income is attributable to functions performed, resources employed, or risks assumed in a foreign country.[9]

At the state level, several (generic and space-specific) tax incentives apply to space companies. The tax incentives currently in force pertain primarily to exemptions from sales taxes,[10] fuel taxes,[11] and property taxes,[12] as well as income tax subtractions[13] and tax credits.[14] Moreover, specific apportionment and allocation rules apply in California, for the apportionment of income of space transportation companies among US states.[15] Some space-specific tax incentives, however, have been proposed but never entered into effect.[16] Others were repealed after a brief time of operation.[17] The review reveals that tax incentives have in some cases played an important role in the decisions of space companies regarding where to establish or relocate their headquarters. For example, California's success in attracting space companies has been partly attributed to the California Compete Tax Credit and other tax exemptions granted to space companies. However, tax incentives alone cannot address the various technical, regulatory, and economic challenges that space companies may face. A report evaluating the effectiveness of space-specific tax incentives in Virginia emphasized the importance of (non-tax) supporting measures in fostering a healthy environment for space companies in the state, recommending the repeal or amendment of space-specific tax incentives.

In the European Union, France and Luxembourg stand out for the attention dedicated to the space sector in their tax codes. As for France, under the territoriality principle expressed in Section 209-I of the French Tax Code,[18] income subject to corporate tax in France is that of companies operating in French territory or whose taxation is attributed to France by a double

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[9] U.S. Code of Federal Regulations, 26 C.F.R. § 1.863-8(b)(2)(ii).

[10] In Florida, see Section 212.08.5(b), 2024 Florida Statues; Section 212.08.5(d), No. 5, 2024 Florida Statutes; Section 212.08.5(j), No. 1.b. and No. 7.d., 2024 Florida Statutes; Section 212.08.16, 2024 Florida Statutes; Section 212.08.17(c), 2024 Florida Statutes. In Virginia, see Section 58.1-609.3.(13)(i)(ii) and (iv), Code of Virginia. In California, Cal. Rev. & Tax Code Section 6380.

[11] In Florida, see Section 206.42(4), 2024 Florida Statutes. In Virginia, see Section 58.1-609.3.(13)(iii), Code of Virginia.

[12] In California, Cal. Rev. & Tax. Code Section 242.

[13] In Virginia, see Section 58.1-402, No. 22 and No. 23, and Section 58.1.-322.02, No. 22 and No. 23, Code of Virginia.

[14] Cal. Rev. & Tax. Code Section 23689.

[15] Title 18, Section 25137-15 Cal. Code Regs. New section filed 9-28-2017; operative 9/28/2017 pursuant to Government Code section 11343.4 (Register 2017, No. 39).

[16] For example, SB 1466 (Aerospace Commerce), available at https://www.flsenate.gov/Session/Bill/2022/1466 (last access 20 July 2024); HB 65/2022, available at https://www.myfloridahouse.gov/Sections/Bills/billsdetail.aspx?BillId=73079& (last access 20 July 2024).

[17] For example, Section 220.194, 2022 Florida Statutes; Section 288.1045, 2022 Florida Statutes; Section 288.106, 2022 Florida Statute.

[18] Code général des impôts, Section III : Détermination du bénéfice imposable, Article 209-I.

tax treaty. There is no legal definition of 'residence' for the purpose of corporate income taxation. According to the guidelines set forth by tax authorities, resident companies are those that either have their official registered address (*siège social*) in France, or have their place of effective management (*siège réel*) in France.[19] Thus, corporate taxes apply to resident and non-resident companies as long as there is a connection between their profits and activities conducted within French territory. It follows that, in principle, space income would not be taxed in France. With the aim to clarify the rules applicable to the territoriality of corporate tax for businesses operating communication satellites in France, the French Tax Code was amended in 2018 to specify that profits from the operation of communication satellites by a company settled in France shall not be considered as profits realized in France and shall therefore not be subject to French corporate taxation.[20] If space companies conducted activities in the French territory from which taxable income arises, they may still benefit from generic (i.e., non space sector-specific) research tax credits and other tax incentives.

Different from France, Luxembourg taxes the worldwide income of its resident taxpayer. Thus, in principle, space income of companies resident in Luxembourg is subject to Luxembourg corporate income tax. The 2020 Luxembourg Space Act (the 'Space Act') restructured the legal landscape for space companies in the state. Inter alia, Article 16 of the Space Act is devoted to the revision of two tax provisions: The first one extends the tax exemption provided for by Article 4 of the Insurance Tax Act,[21] to insurance contracts related to space objects registered in Luxembourg.[22] The second one extends the tax credit provided for by Article 152bis of the Luxembourg Income Tax Act to operators of space objects (originally conditional on the investments being made in an establishment located in the Grand Duchy and intended to remain there permanently). Other non-space sector-specific tax incentives, such as the IP Box Regime,[23] are also available to space companies.

Despite the differences in the approaches taken by EU countries and the United States, there seems to exist an emerging willingness to support and incentivize the growth of the space economy through taxation. Both the American states and the EU countries under review have

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[19] BOI-IS-CHAMP-60-10-20-20120912, No. 1.

[20] Article 247, Code général des impôts.

[21] LU: Insurance Tax Act ('Versicherungssteuergesetz'), Loi modifiée du 9 juillet 1937.

[22] Loi modifiée du 9 juillet 1937 concernant l'impôt sur les assurances. A point 9 is added worded as follows: "9. for contracts of insurance related to space objects falling within the scope of application of Article 15 of the Law of 15 December 2020 on space activity."

[23] LU: Loi du 17 avril 2018 portant modification de la loi modifiée du 4 décembre 1967 concernant l'impôt sur le revenu, en ce qui concerne le régime fiscal de la propriété intellectuelle, et modifiant la loi modifiée du 16 octobre 1934 concernant l'évaluation des biens et valeurs (« Bewertungsgesetz »), Journal Officiel du Grand-Duché de Luxembourg. Mémorial A254. (accessed 20 Sept. 2023).

introduced a series of tax measures or modified existing provisions in their tax codes to attract space companies to their territories. The analysis of domestic legislation reveals three key lessons.

The first, and least groundbreaking, lesson is that both in the United States and the European Union, taxation has been used as a tool to attract investments in the space sector and incentivize space companies to relocate. While the international community largely focuses on preventing tax arbitrage in the digital economy, the taxation of space commerce could introduce a new element of tax competition.

The second lesson is that there may be opportunities for double non-taxation of space income based on the structure of domestic tax systems. For instance, if a satellite company were resident in a state with a territorial tax system, its income from space activities could be exempt in the residence state (since the income is sourced outside that territory), while most likely being taxable nowhere else.

The third lesson concerns the rationale(s) behind the adoption of space-specific tax rules. For example, the history of the implementation of Section 863(d) of the IRC suggests that the adoption of the source rule for space is informed by the same logic that informs the "single tax principle." On the other hand, the 'exemption' of space income in countries with a territorial tax system may be justified by a benefit-based rationale. Both the single tax principle and the benefit principle are explored in Chapter 8 of the dissertation, which provides tax policy recommendations (see Section 3.7 for a summary).

3. International and domestic space taxation: an analysis *de lege ferenda*

3.1. (The absence of) Sovereignty in outer space

From *lege lata* to *lege ferenda*, Chapters 6, 7, and 8 of the doctoral dissertation explore how space activities can and should be taxed. In this context, Chapters 6 and 7 explain the consequence of the absence of sovereignty in outer space with regard to the tax treatment of space income. Both chapters derive lessons from the maritime and aviation sectors, while acknowledging that a complete juxtaposition of these concepts and solutions is not possible and would be (methodologically) misleading.

The concepts of sovereignty[24] and jurisdiction in public international law are closely interconnected, and Chapters 6 and 7 of the Doctoral Dissertation provide a historical overview

[24] Although the notion of sovereignty is a multifaceted principle that spans various disciplines and branches of law, the study conducted in the Doctoral dissertation is limited within the boundaries of public international law

of their development. These chapters also discuss the legal status of outer space. In this context, the 1944 Chicago Convention affirms that states exercise complete and exclusive sovereignty over the airspace above their territory. However, such sovereignty does not extend indefinitely. According to Articles I and II of the Outer Space Treaty, outer space, the Moon, and celestial bodies are the "province of all mankind" and are not subject to national appropriation by claim of sovereignty (or any other claim). Neither the Outer Space Treaty nor the Chicago Convention specifies the boundary between airspace and outer space. This ambiguity is important when analyzing the tax issues arising from the growing commercialization of space. In the absence of territorial sovereignty in outer space, the question arises as to whether, and how, states can exercise their right to tax (tax jurisdiction) income derived from commercial space activities.

3.2. Jurisdictional powers in outer space: Article VIII Outer Space Treaty

The exclusion of state sovereignty under Article II of the Outer Space Treaty refers to sovereignty on a territorial basis. In other words, it pertains to freedom from national appropriation of "the area of outer space, or any part thereof.".[25] As a consequence of the 'non-appropriation' principle of Article II of the Outer Space Treaty, Article VIII of the same Treeaty attributes jurisdiction and control over space objects and the personnel thereof to the states on whose registries such objects are carried.[26] The attribution of jurisdiction under Article VIII serves the same purpose as the assignment of nationality to ships and aircraft. In other words, it is designed to protect the legal order in the absence of any sovereign power that would otherwise be exercisable.[27] By establishing a rule that a state retains its jurisdictional rights (and duties) over space objects and the individuals on board, Article VIII of the Outer Space Treaty provides a clear indication of the laws applicable to space activities.[28] The analysis of the scope and extent of Article VIII of the Outer Space Treaty emphasizes the prominent role

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and international tax law. This work does not analyse sovereignty within international relations theory or political theory, nor does it address aspects of the debate specific to the European Union (unless they are pertinent to the development of sovereignty in international law). Moreover, the Doctoral dissertation touches upon the issues that are instrumental in answering the specific research questions raised. Consequently, it unavoidably omits significant facets of the discourse surrounding sovereignty and jurisdiction. As these aspects fall outside the scope of the Doctoral dissertation, the text of the dissertation guides readers to the relevant existing literature for a deeper analysis of specific topics.

[25] von der Dunk, *supra* n. 788, at p. 466. As exmp

[26] Lafferranderie, *supra* n. 788, at pp. 229–230.

[27] On the role of the flag state in the law of the sea, see United Nations Office on drugs and crime, *Flag State Jurisdiction and Transnational Organized Crime at Sea. Issue Paper* p. 8 (2023); On the role of the state of registry in space law, see von der Dunk, *supra* n. 788, at pp. 470–471.

[28] von der Dunk, *supra* n. 788, at p. 471.

of space object registration in the exercise of jurisdiction in outer space.[29] While under the current status of treaties, claims of *territorial* sovereignty of outer space and celestial bodies shall be dismissed for lack of legality (as they would be contrary to Article II of the Outer Space Treaty), legitimate exercises of *functional* sovereignty are permissible under Article VIII Outer Space Treaty.[30] Leaving aside the issues related to compliance with the Registration Convention,[31] it is possible to derive a general principle from the analysis conducted above.

The registration of a space object in a national registry makes the laws of that state applicable to all matters relating to the space object itself, the activities aboard the space object, and the personnel thereof, whether inside or outside the space object. The state of registration is thus allowed to exercise its sovereign powers for limited functional purposes over space activities carried out through the space object in its registry, with an "independent and maximum competence,"[32] even in an area outside its territorial boundaries. In the Doctoral Dissertation, this general rule is codified in a principle that ascribes tax jurisdiction to the "jurisdiction and control" that follows the act of registering a space object in the national registry: the "Tax Jurisdiction by Registration" principle.[33]

Under the 'Tax Jurisdiction by Registration' principle, the state of registration is *entitled* to retain tax jurisdiction over income sourced inside the space object carried in its registry or from

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[29] Note that other states might retain a certain degree of 'control' over space activities. In this respect, Article VI OST requires states parties to the treaty to bear international responsibility for national activities in space. This applies both for governmental and non-governmental space activities. As far as the latter are concerned, 'the appropriate State Party' shall authorize and continuously supervise private space activities. The interpretation of 'appropriate State Party' seems to refer back to the concept of state of registration, as the one retaining jurisdictional and control powers. Marchisio, *supra* n. 788 Moreover, Article VII OST holds each launching state party to the treaty liable for damage cause by the space object to another state party to the treaty or its natural or juridical persons.

[30] Chen & Zhao, *supra* n. 810, at p. 6.

[31] Hertzfeld, *supra* n. 196.

[32] Chen & Zhao, *supra* n. 810, at p. 5.

[33] The scope, extent and exclusivity of the jurisdictional powers granted by Article VIII of the Outer Space Treaty are analyzed in the Doctoral Dissertation. The thesis posits that the scope of Article VIII of the Outer Space Treaty is broad enough to encompass tax jurisdiction. This is because the rationale of jurisdiction rationae instrumenti is to extend the laws of the state in a non-sovereign territory to maintain the legal order. With respect to outer space, Article VIII Outer Space Treaty allows the state of registration to retain functional sovereignty and to subject any space objects and personnel thereof to its national laws – provided that they do not violate international obligations. In this respect, Hobe considered that: "(…) jurisdiction is the legal link that extends the territorial law into outer space with regard to a specific launched space object and persons thereon (…)"

Unlike Article 94 UNCLOS that reserves to the flag state the power to exercise "jurisdiction and control in administrative, technical and social matters [emphasis added] over ships flying its flag" in high seas, Article VIII of the Outer Space Treaty does not restrict the jurisdiction and control of the state of registry to specific purposes/subject areas. The absence of such limitation should be interpreted through the lens of the rationale of the provision, which is to fill the legal voids left by the absence of territorial sovereignty. In sum, absent restrictions and further clarifications, 'jurisdiction and control' must be read as allowing states "maximum leeway" in exercising jurisdictional powers, as long as it takes place within the boundaries of international public law.

activities conducted by the personnel thereof whether inside or outside the spacecraft.[34] Under this perspective, the registration would form a sufficient *link* for the exercise of taxing power in outer space (i.e., the state of registry would be entitled to apply its tax laws aboard the space object).

3.3. Residence-based taxation in outer space

The Doctoral Dissertation explores the interaction between the concept of 'tax residence' and commercial space activities, particularly in light of the 'Tax Jurisdiction by Registration' principle. The analysis of residence-based taxation in outer space in the dissertation addresses two main issues: (i) the determination of corporate tax residence, and (ii) the inclusion of space income within the taxable income of domestic corporations.

Regarding the first issue, the dissertation reviews the criteria used by countries to determine corporate tax residence. This review relies on the most recent IBFD Country Tax Guides and, where possible, domestic legislation in its original language. Among the forty-six countries examined, twenty-nine determine corporate tax residence based on the place of incorporation. Only a few of these countries (i.e., Argentina, Chile, Estonia, Lithuania, and the United Arab Emirates) appear to rely exclusively on this criterion. Other countries combine the place of incorporation with one or more additional requirements, such as the "legal seat" or the 'place of effective management.'

Where a country relies solely on the place of incorporation to determine corporate tax residence, there seems to be little risk that the growing commercialization of space will affect this determination, as long as it remains impossible to incorporate companies in outer space itself, and the Tax Jurisdiction by Registration Principle is applied. The same conclusion holds for countries that combine the place of incorporation with the 'legal seat' requirement. Given the current state of technological advancement, establishing corporate headquarters in space is not yet possible. However, when this becomes feasible, and assuming treaty provisions remain unchanged, activities conducted within installations on the Moon or other celestial bodies would likely fall under the jurisdiction and control of the state governing those facilities.[35] A

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[34] This principle seems to have been implicitely recognized in doctrine in the past. In 1985, Dula affirmed that 'The 1976 registration convention provides a mechanism for registering a space object on a national register. This is important for business because the national registration of a space object, such as a space factory, determines which nation's law applies to the object. If a space factory is enrolled on the United States' registry, then United States laws and courts have jurisdiction over the factory and all events that transpire aboard it. Specifically, such a space object should be subject to United States patent, antitrust and tax law as well as all other federal statutes.' See footnote no. 65 A. Dula, *Private Sector Activities in Outer Space*, 19 International Lawyer 1, p. 177 (1985).

[35] The jurisdiction of the state controlling the facility is implied in the wording of Article XII OST providing that representatives of other states parties to the OST might, on a basis of reciprocity, visit all stations, installations,

more complex question arises when domestic law relies on the 'place of effective management' criterion alone, or in combination with other tests, to determine a legal entity's tax residency. Specifically, if the place of effective management is located aboard a space object, the question arises whether the enterprise could be deemed to be resident in the state of registration under the 'Tax Jurisdiction by Registration' principle.

Among the jurisdictions examined that use the 'place of effective management' criterion, the Doctoral Dissertation reviewed the laws of current and emerging spacefaring nations, such as China, Russia, and India. Based on this analysis, the author concludes that, at present, it is unlikely that China would consider a foreign taxpayer as having its place of effective management aboard a space object registered in China's national registry. In contrast, the review of domestic criteria for determining corporate tax residence in India and Russia suggests that a foreign entity conducting commercial activities aboard a Russian or Indian space object, and deriving taxable income from those activities, could be regarded as having its place of effective management in either Russia or India.[36]

Regarding the inclusion of space income in a domestic corporation's taxable income, the Doctoral Dissertation examines the issues arising from the adoption of a universal versus a territorial tax system. If the residence state adopts a worldwide/universal system of taxation, the taxpayer's taxable base would generally include income from all sources, including space-related income. This holds true as long as the domestic provision defining gross income refers to worldwide income as "all income from whatever source derived,"[37] or from "sources inside or outside" the country,[38] or a similar wording. In such cases, a textual interpretation of the relevant provisions would reasonably lead to the inclusion of income from outer space in the calculation the gross income – absent any specific rule carving out space income from the tax base. Once the question of whether space income should be included in the calculation of the taxable base is (positively) answered, the next question concerns how space income should be computed. First, it is essential to determine whether there is a specific category for space

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equipment and space vehicles on the moon and other celestial bodies, giving reasonable advance notice and avoiding interference with normal operations in the facility. See Lachlan, *supra* n. 788, at pp. 196–197.

[36] See Doctoral Dissertation at pages 202-204.

[37] For instance, US: U.S. Internal Revenue Code, secs. 61 61 61, 26 (accessed 19 Feb. 2024); IT: Art. 3 TUIR - Base imponibile, sec. Article 3 (1) sec. Article 3 (1) para. 1, Testo Unico delle Imposte sui Redditi D.P.R. 22 December 1986, No. 917 (accessed 19 Feb. 2024) which reads 'L'imposta si applica sul reddito complessivo del soggetto, formato per i residenti da tutti i redditi posseduti al netto degli oneri deducibili indicati nell'articolo 10 [...]'; IN: Section 5 - Scope of total income, 1961, sec. Sec. 5, Indian Income Tax Act (accessed 19 Feb. 2024) which reads '[...] the total income of any previous year of a person who is a resident includes all income from whatever source derived [...]'.

[38] For instance, CA: Canadian Income Tax Act, secs. 3, Division B, R.S.C., 1985, c. 1 (5th Supp.) (accessed 19 Feb. 2024).

income in the domestic legislation. To the author's best knowledge, no country has yet included such a specific category in its domestic tax laws. As a result, space income would typically fall within traditional income categories (e.g., business profits, royalties, or income from services—where the latter category is distinct from business profits).

Second, once the appropriate category for space income is identified, it must be determined whether the income is classified as domestic or foreign-sourced. Classifying space income as domestic or foreign has implications for how taxable income is computed. There is no universally correct answer to this question, as it ultimately reflects the tax policy choice of the state of residence. If the Tax Jurisdiction by Registration principle is endorsed, space income would be considered foreign-sourced if earned aboard a space object registered in a foreign country, or if it relates to activities under the jurisdiction and control of that country (e.g., activities conducted outside the space object but still under the quasi-territorial jurisdiction of the country of registration).

If the residence country adopts a territorial tax system, the inclusion of space income in the taxable income of the resident taxpayer would depend solely on its classification as domestic or foreign-sourced income. In other words, if a source rule exists in the domestic tax legislation that classifies space income as domestic income, for example, by linking the source of space income to the taxpayer's residence, space income would be deemed sourced within the territory of the state. Consequently, it would be included in the calculation of gross income, alongside other income items of domestic source. Conversely, in the absence of such a source rule, a residence state adopting a territorial tax system would not consider space income as sourced within its borders and would exclude it from the calculation of the resident taxpayer's taxable base.

With due consideration to the peculiarities of the tax system, an example of the former case is provided by the United States. Although the United States taxes its residents and nationals on a worldwide basis[39] – making the comparison not perfectly fitting – it seems to be the only country having a specific source rule for income from space activities. According to the general rule under Section 863(d)(1) IRC, space (and ocean) income is deemed to be sourced in the United States if earned by a US person. Conversely, is considered sourced outside the United States if earned by a foreign person. This source rule aims at eliminating the risk of double non-taxation of resident taxpayers' space income. However, if income is sourced aboard a

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[39] *United States. Corporate Income Taxation*, Country Tax Guides (IBFD 2023), available at https://research.ibfd.org/#/doc?url=/collections/cta/html/cta_us_s_001.html%23cta_us_s_1.10.1.1. (accessed 26 Sept. 2023).

space object or from activities conducted (outside the space object but) under the jurisdiction and control of the state of registration, and the state of registration endorses the 'Tax Jurisdiction by Registration' principle, the presence of a legal fiction similar to Section 863(d) IRC in the residence state might increase the risk of *double taxation*. In such cases, there would be two source countries, one of them being the state of registration and the other one the state of residence by virtue of the domestic source rule. If a double tax treaty exists between the two countries involved, the applicable allocation rules might help to assign taxing rights[40]. However, a clear-cut answer would be given only if the bilateral treaty assigned taxing rights *only* to the residence state. For policymaking recommendations in this respect, see section 9.

An example of the latter case (i.e., the domestic tax legislation does not include such a legal fiction, thus space income earned by resident taxpayers is not considered as sourced within the country) is provided by France. As seen earlier, France taxes its residents on a territorial basis and has not adopted a domestic source rule for space income. Moreover, the French Tax Code was amended in 2018 to specify that profits from the operation of communication satellites by a company settled in France shall not be considered as profits realized in France and shall therefore not be subject to French corporate taxation.[41]

3.4. Source-based taxation in outer space

The Doctoral Dissertation further studies the interaction between commercial space activities and the notion of 'source' of income, also in light of the 'Tax Jurisdiction by Registration' principle. In this context, space income is subsumed under the category of 'extranational/extra-territorial income,' rather than 'stateless income.'

The analysis of source-based taxation in outer space in the Doctoral Dissertation focuses on two main issues: *(i)* issues deriving from the taxation of income sourced aboard space objects and *(ii)* issues arising in connection with the taxation of income sourced outside space objects and/or on celestial bodies. Particularly, the analysis touches upon the concept of permanent establishment (PE) and discusses whether situations *(i)* and *(ii)* may give rise to PE risks.

As for the first point, the thesis argues that the state of registration could consider as sourced within its jurisdiction income from commercial space activities conducted aboard space objects carried in its registry.[42] This result would be justified by Article VIII of the Outer Space Treaty

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[40] The applicability of treaty provisions shall be verified on a case-by-case analysis; general considerations are, however, provided in Part I of the Doctoral Dissertation.
[41] Article 247, Code général des impôts.
[42] Soares, *supra* n. 14.

that allows the state of registration to retain jurisdiction, including tax jurisdiction, over activities conducted aboard the space object and activities of the personnel thereof even when outside the space object.[43] While Article VIII of the Outer Space Treaty extends the theoretical application of domestic (tax) laws – by making the state of registration entitled to apply its domestic rules in outer space –, the actual applicability of such rules might require interpretative efforts or even the amendment of domestic legislation. For example, generally, income taxation of non-resident persons occurs if income is sourced within the borders of a state, or if income is derived from property or assets located there. If narrowly worded, such territorial delimitation could potentially exclude income sourced aboard registered space objects, being the latter located outside the territory of any state. An interpretative effort may not suffice to overcome such barrier, should the state decide to consider space objects carried in their registries as the potential source of income of non-resident persons conducting income-generating activities therein. In this case, a specific domestic source rule for space income may be needed.

Article VIII of the Outer Space Treaty applies to the taxation of income sourced in outer space or on celestial bodies as well. It extends the jurisdiction and control of state of registry to activities of the personnel aboard the space object whether conducted *inside* or *outside* the spacecraft. Resource extraction activities conducted on the Moon or celestial bodies[44] constitute a potential example of business activities falling within this category. If Article VIII of the Outer Space Treaty did not extend the jurisdiction of the state of registry to activities conducted outside the space object, such activities could have been considered as lacking a source state – a situation that could potentially lead to double non-taxation where the residence country adopts a territorial tax system.

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[43] If the conditions for the applicability of a tax treaty exist (i.e., the existence of two contracting states, a resident of at least one of the two contracting states, income earned in the other contracting state, tax covered by Article 2), double taxation could be avoided or, at least, mitigated by the allocation rules in the applicable bilateral tax treaty - provided that the provision pertaining to the territorial extension of the treaty is worded in a way that includes outer space.

[44] For an analysis of the (absence of a clear) legal framework for space mining activities, see: M. de Zwart, S. Henderson & M. Neumann, *Space Resource Activities and the Evolution of International Space Law*, 211 Acta Astronautica 155–162 (Oct. 2023), available at 10.1016/j.actaastro.2023.06.009; M. Svec, *Outer Space, an Area Recognised as Res Communis Omnium: Limits of National Space Mining Law*, 60 Space Policy 101473 (May 2022), available at 10.1016/j.spacepol.2021.101473; J.G. Wrench, *Non-Appropriation, No Problem: The Outer Space Treaty Is Ready for Asteroid Mining Notes*, 51 Case W. Res. J. Int'l L. [ix]-462 (2019); M. Sterling Saletta & K. Orrman-Rossiter, *Can Space Mining Benefit All of Humanity?: The Resource Fund and Citizen's Dividend Model of Alaska, the 'Last Frontier'*, 43 Space Policy 1–6 (Feb. 2018), available at 10.1016/j.spacepol.2018.02.002; Ganatra & Modi, *supra* n. 174.

Another crucial question related to source-based taxation in outer space relates to whether a 'space permanent establishment' could exist. Through the explanation of a model case study, the Doctoral Dissertation concludes that, *de lege lata,* it is impossible to consider the existence of a permanent establishment in outer space. However, it is not impossible to imagine that the concept of 'space permanent establishment' will be introduced and anchored on the registration of the object, should commercial space activities aboard space objects become profitable. In effect, there is a tendency to detach the concept of permanent establishment from the traditional understanding that the place of business had to be 'fixed'. The geographical component of the permanent establishment criterion has been weakened over time by the realization that several activities are mobile by their nature, as well as the development of the digital economy.[45] This has led to the conceptualization of notions such as 'service permanent establishment' and 'digital permanent establishment.' Two questions would arise in this respect. The first is whether the registration would constitute a sufficiently strong link for a state to consider an activity of a non-resident to give rise to a permanent establishment in its jurisdiction. Under a benefit-based logic, the answer could be positive, as the state of registration plays a crucial role throughout the 'life' of the mission (for example, in providing legal protection, ensuring the correct functioning of the space object, and guaranteeing safety for conducting commercial activities aboard the space object). The second is whether the permanent establishment concept will still hold relevance and keep its *raison d'être* when applied to situations happening beyond our atmosphere. For example, the possibility for a satellite in geostationary orbit to constitute a permanent establishment in the 'territory' of another country depends on the vertical extension of state sovereignty. This means that if a state considers its territory to include its national portion of geostationary orbit, it could argue that a satellite placed there constitutes a permanent establishment, even if the state does not contribute directly to the production of the satellite operator's income. The rationale would be that the only advantage of using the geostationary orbit spot arises from natural forces, rather than services provided by the state.

[45] J. Schaffner, *How Fixed Is a Permanent Establishment?* p. 255 (Series on International Taxation No. 42, Wolters Kluwer Law & Business 2013).

3.5. Adapting the tax system to space income taxation

3.5.1. Adopting domestic source rules

The Doctoral Dissertation suggests the potential wording of two domestic source rules. The first one based on benefit-based considerations and expressing the 'Tax Jurisdiction by Registration principle' (Option 1)[46] while the second one inspired by the single tax principle (Option 2).[47] These two option express different concerns and are motivated by different rationales. Both principles aim to avoid double-sourcing issues by prioritizing other sourcing rules, resulting in different – and potentially opposite – approaches. While they may appear contradictory at first glance, they are not meant to serve as definitive provisions for immediate implementation. Instead, the Doctoral Dissertation is intended to offer guidance to tax policymakers who may consider adopting such measures. However, the author acknowledges that the Dissertation does not sufficiently emphasize the importance of international coordination in implementing these domestic sourcing rules.

It is crucial to highlight that the adoption of uncoordinated measures, based on differing principles, could lead to further complications and inefficiencies. For example, if one state adopts a sourcing rule similar to Option 1, and another state adopts a rule similar to Option 2 (or its variation, as noted in footnote No. 47), the conflicting 'priority rules' would create administrative burdens and could result in double non-sourcing, thus undermining the intended

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[46] The proposed provision might be formulated as follows: Income earned by non-resident taxpayers from activities conducted in space (i) aboard space objects registered in this state, or (ii) that are carried out under this state's jurisdiction according to Article VIII of the 1967 Outer Space Treaty, shall be deemed sourced within this state, unless recognized as sourced within the jurisdiction of a foreign country (as acknowledged by [name of the state]).

[47] This author posits that, *de lege lata,* the single tax principle cannot be upheld as a principle of international law. However, the rationale and importance of the single tax principle within the international tax discourse are highly debated and, for this reason, the single tax principle has been included as a potential optional guiding principle. This source rule could read:

"*Any income derived from activities conducted in space, as defined by [reference to domestic/international law defining outer space]:*

a. if derived by a person resident in [state], shall be considered as sourced in the territory of [state], unless sourced within the jurisdiction (as recognized by [state]) of a foreign country;

b. *if derived by a person other than a person resident in [state], shall be considered as sourced outside [state].*"

A variation of Option 2 could incorporate elements of Option 1 while assigning priority to the state of registry's taxing rights (Option 2.1). This option could read as follows:

"*Any income derived from activities conducted in space, as defined by [reference to domestic/international law defining outer space]:*

a. if derived by a person resident in [state], shall be considered as sourced in the territory of [state], unless sourced within the jurisdiction (as recognized by [state]) of the state of registration or a foreign country;

b. *if derived by a person other than a person resident in [state], shall be considered as sourced outside [state], unless conducted aboard a space object under the jurisdiction of this state or derived by activities carried out under this state's jurisdiction according to Article VIII of the 1967 Outer Space Treaty.*"

effects of these rules. Therefore, while the Doctoral Dissertation provides a basis for policy discussions, the author is mindful of the limitations of the proposed provisions if international cooperation cannot be achieved.

3.5.2. Amending the OECD Model Tax Convention

In light of the challenges posed by source-based taxation in the context of the space economy, the Doctoral Dissertation argues in favor of exclusive residence-based taxation of space income. In a cross-border situation where a double tax treaty applies, income from outer space activities characterized as business profits would generally be subject to taxation in the state of residence of the taxpayer, unless a permanent establishment exists in the contracting state. In such a case, the contracting state where the permanent establishment is located would be entitled to tax the portion of income attributable to that establishment. The same outcome would apply in instances where a specific item of income falls outside the scope of all other distributive rules. Effectively, Article 21 of the OECD Model Convention (OECD MC) functions as a 'catch-all clause,' assigning taxing rights to the state of residence (paragraph 1), unless a permanent establishment exists in the other contracting state (paragraph 2).

As of the time of writing the Doctoral Dissertation, the official position of the OECD is that neither an orbiting satellite nor its footprint can be considered a permanent establishment. The author's opinion, de lege lata, is that it is unlikely that a territorial connection between an activity in outer space and an earthly jurisdiction could give rise to a permanent establishment. In the absence of such an establishment, Article 7(1) and Article 21(1) of the OECD MC would assign exclusive taxing rights to the state of residence. Consequently, there would be no need to amend these provisions.

However, if the Tax Jurisdiction by Registration principle is adopted, and technological advancements enable the establishment of permanent settlements on celestial bodies such as the Moon or Mars, existing solutions will require reassessment. At this stage, the Doctoral Dissertation does not address the more speculative or, at least, uncertain scenarios related to the taxation of income derived from such permanent settlements or space mining activities.

Conversely, commercial space transport activities is already a reality. They include transportation of passengers and cargo *(i)* within the same country (e.g., suborbital flights having touristic purposes, which begin and end in the same state), *(ii)* between earth and space (e.g., from a location on earth to a space station), and *(iii)* between two points in space (e.g., from a space station to the Moon). In Part I, the Doctoral Dissertation concludes that the

wording of Article 8 OECD MC[48] – which refers to the operation of *ships* and *aircraft* – does not include income from the operation of *spacecraft*. Neither a textual nor a historical interpretation of Article 8 OECD MC would support the extension of the provision to spacecraft as it currently reads. However, the analysis carried out reveals that, under certain circumstances, the rationale behind the adoption of Article 8 OECD MC may support its extension to space transportation on the basis of a purposive interpretation.[49] Were the 'Tax Jurisdiction by Registration' principle endorsed, the connection of income from commercial space transportation activities to several jurisdictions (i.e., residence state, state of registry of the space object aboard which passengers or cargo are transported, state of registry of the space object or of the establishment on a celestial body where passengers or cargo are directed to) would resemble to the connection of income from shipping and air activities with several jurisdictions. Against this background, the same rationale that fueled the adoption of Article 8 OECD MC in the first place would revive in the context of space transport activities. Moreover, a broad understanding of the term 'international traffic' could cover space travels. If states wanted to include space travels in the scope of application of Article 8 OECD MC, Article 8(1) OECD could be amended as follows:

"Article 8. International shipping, air and space transport

1. Profits of an enterprise of a Contracting State from the operation of ships, aircraft or spacecraft in international traffic, including outer space, shall be taxable only in that State."[50]

In this context, it would be ideal to agree on a definition of outer space at the international level.

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[48] Similarly, Article 8 of the 2016 U.S.MC and Article 8 (alternative A and B) of the UN MC.

[49] It could be said that assigning exclusive taxing rights to one state responded to a quest for efficiency and simplicity in the administration of taxation.

[50] Should developing countries perceive such a rule as unfairly depriving them from taxing rights, an alternative wording similar to Article 8 (alternative B) of the UN Model Tax Convention could be foreseen. In such a case, the revised provision would read as follows:

"Article 8. International shipping, air and space transport (alternative B)

1. Profits of an enterprise of a Contracting State from the operation of ships, aircraft or spacecraft in international traffic, including outer space, shall be taxable only in that State.

2. Profits of an enterprise of a Contracting State from the operation of ships or spacecraft in international traffic shall be taxable only in that State unless the shipping or space activities arising from such operation in the other Contracting State are more than casual. If such activities are more than casual, such profits may be taxed in that other State. The profits to be taxed in that other State shall be determined on the basis of an appropriate allocation of the overall net profits derived by the enterprise from its shipping or space operations. The tax computed in accordance with such allocation shall then be reduced by […] per cent. (The percentage is to be established through bilateral negotiations.)"

4. The future of space taxation beyond income taxation: The role of tax and tax incentives in the space sector

4.1. The role of taxes in the space economy

The Doctoral Dissertation concludes by discussing the role of taxation in the space industry, addressing the questions of what goals space taxation could achieve (subchapter 9.1) and what types of taxes could be implemented (subchapter 9.2). It evaluates the feasibility of an EU-wide space tax by analyzing the EU's competence in both tax and space matters, as well as the legal basis for adopting such a tax (subchapter 9.3). In this context, the Dissertation suggests that a case for an EU space debris tax could be made, based on three key points: (i) space sustainability is an area where EU action could be more effective than unilateral measures; (ii) the EU has increasingly focused on the threats posed by space debris,[51] and *(iii)* EU member states have yet to legislate on this issue, allowing the EU to intervene under Article 189 TFEU. However, should the European Commission propose an EU space debris tax, the challenges encountered would not only be political but also technical, particularly concerning the legal basis for such a tax. Unanimity would be required in the Council, significantly reducing the likelihood of seeing such a tax implemented.

4.2. The role of tax incentives in the space economy

The Doctoral Dissertation also examines the role of tax incentives in the space economy. It outlines the different types of economic incentives used to support space companies, with a particular focus on their role in spurring research and development activities. The Dissertation addresses the question of what the appropriate role of governments is in promoting growth and development in the space sector, and how the tax system can factor into this equation. Governments pursue a range of social and economic objectives and utilize various tools to achieve them. Tax policy, while important, is only one of the available options at their disposal. From the perspective of companies – especially when considering investments in emerging sectors like space – the overall tax burden within a country and the presence of tax incentives are key components in a broader evaluation.[52] Tax incentives alone are not sufficient by themselves to address the broader challenges that space companies face. While tax incentives can be a valuable tool in promoting investment and business growth, they cannot make up for

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[51] *Council Conclusions on an EU Approach to Space Traffic Management* (2022), *supra* n. 1188; See section 2.2. titled 'The compelling need to act' *EU Approach for Space Traffic Management* (2022), *supra* n. 1178.
[52] United Nations, Design and Assessment of Tax Incentives in Developing Countries: Selected Issues And A Country Experience, 2018, at 5.

weaknesses in other areas, such as legal protections and physical and institutional support necessary for space companies to thrive. This could include access to well-developed facilities (such as launch pads, laboratories, or research centers), a skilled workforce, reliable infrastructure (like communication and transportation networks), and government or private-sector support systems (e.g., permits, financing, and partnerships). Without these services and infrastructure, and clear legal frameworks to protect intellectual property, contracts, investments, and operations, the business environment for space companies would be less conducive to growth and innovation. Nevertheless, tax incentives can enhance the appeal of investing in a specific country and support the growth of emerging industries[53]

As a result of the evolving international tax framework, it is important to maintain the attractiveness and effectiveness of tax incentives and to make sure that the implementation of the OECD GloBE Model Rules does not discriminate space companies. Based on the author's published work,[54] the Doctoral Dissertation further helps to put the Globe MR's impact on tax incentives for space companies into some perspective, and suggests that tax incentives in the European Union[55] (given the prevalence of incentives for the space sector related to corporate income taxes) may be more vulnerable to the application of GloBE provisions[56] than that of space companies benefitting from space-specific tax incentives in the United States.[57] However, the validity of the latter statement shall be considered limited to the analysis of the states reviewed and cannot be considered a general 'truth' for all EU countries and US states.

The study of how tax incentives for space companies might be 'diluted' by other regulations passes through the analysis of European State Aid rules. The Doctoral Dissertation surveys how such regulations have been used (if ever) in the space sector. A review of competition cases reveals the absence of past examples involving economic advantages granted to space companies through tax incentives. With the help of the research tool engine available on the European Commission's website (known as "Competition case search"),[58] the author has been able to extract from the sixty-two thousand, six hundred and thirty-one (62,631) competition cases available on this platform, only those that were granted to companies active in the space sector. In particular, first, only state aid cases were filtered out, bringing the number of cases

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[53] See European Space Policy Institute, *ESPI Report 79 - Emerging Spacefaring Nations - Full Report*, June 2021, at 124.
[54] E.I. Scuderi, *Tax Incentives for the Space Economy and the Potential Impact of Pillar Two*, 49 Air & Space Law 1 (2024), available at 10.2139/ssrn.4551751 (accessed 15 Nov. 2024)
[55] See sections 5.2. and 5.3.
[56] Provided that all conditions for the operation of such rules are met.
[57] See section 5.1.
[58] See the European Commission website https://competition-cases.ec.europa.eu/search (last access 6 June 2024).

to fifty-two thousand, four hundred and thirty-four (52,434). Then, cases were filtered by economic activity, restricting the scope of research to space manufacturing (NACE codes C.30.30 and C33.16) and space transport (NACE code H.51.22), which limited the pool of cases to fifty-seven. Finally, the author selected only those aids granted in the form of *(i)* fiscal measures, *(ii)* parafiscal charges or taxes affected to a beneficiary, *(iii)* tax allowance, *(iv)* tax base reduction, *(v)* tax rate reduction, *(vi)* tax deferment, *(vii)* tax advantage or tax exemption, *(viii)* other forms of tax advantage. This left only one state aid available: a COVID-19-related tax exemption in the aviation sector, irrelevant for this specific analysis. While the validity of this result depends on the completeness and accuracy of the European Commission's platform used for the review, its conclusion appears significant. It suggests a clear preference for direct grants in promoting long-term public interest investments in the space sector. This contrasts with the limited reliance on ex post tax incentives, likely due to the fact that the purely commercial space sector in Europe is still in its early stages.

However, it is the author's opinion that selective tax incentives to space companies could potentially be considered as compatible with the internal market according to Article 107(3) TFEU if granted to promote the execution of an important project of common European interest, or to facilitate the development of certain space activities. This is true as long as such aids do not adversely affect trading conditions to an extent contrary to the common interest.

5. Concluding remarks and future research needs

Given the vastness of the research area and the still existing legal and technical uncertainties, this study is far from representing a 'comprehensive' work on space taxation. The answers to the questions raised in Doctoral Dissertation and the reasoning behind them will hopefully spur academic interest and constitute the basis for future research. In this respect, future research could further expand on topics that have been covered in this manuscript but that, because of the immaturity of the sector or the lack of existing provisions, could not be analyzed in great detail. In this context, further research will be needed in the area of European Union law once the European Space Law will enter into effect.

More work is also needed in the context of space debris mitigation through fiscal policies. In particular, economic studies should assess the expected economic and behavioral impact of taxes nad tax incentives aimed at mitigating the risks stemming from space debris.

Moreover, in the context of direct taxation, it would be useful to expand the review of domestic taxation of space income. This work focuses on the United States, France, and Luxembourg,

and specifically targets their income tax structures. It would be useful to expand this exercise to other countries legislations. A similar effort was made in 2001 by the late Andrews.[59] This important work, however, has not been updated ever since.

Furthermore, it would be important to assess the economic and behavioral impact of the application of the Value Added Tax in business-to-business relationships as opposed to business-to-government/intergovernmental relationships. This is especially relevant as the space commerce progresses and the space economy gains 'independence' from governmental fundings and contracts. Future research could also focus on other indirect taxes and transfer pricing issues that remained outside the purview of this work.

Finally, future studies could better address space mining taxation once it will be determined if such activities will be feasible and profitable, and the legal regime for claiming property rights over resource mined in space will be clearer.

Just as like outer space, there is still so much to explore in the realm of space law, policy and taxation. The objective of this study is twofold: on the one hand, this work aims to support space and tax policymakers in the design of new policies, or in the update of existing ones to enhance tax certainty for space companies; on the other hand, it addresses legal academics with the goal to advance knowledge on this little researched topic. If this manuscript succeeds in forming a new brick in the foundational knowledge of space taxation, its objective can be considered achieved.

[59] Andrews III, *supra* n. 15.