SIFIDE's Double Impact in Portugal: Boosting R&D and Optimizing Taxes

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Economic growth is closely linked to innovation, with R&D playing a key role in generating new knowledge, products, and processes. In Portugal, public policies support R&D through financial incentives and tax benefits. This article examines the relationship between economic growth and R&D investment from both macroeconomic and microeconomic perspectives, focusing on national outcomes and firm-level performance, emphasizing the role of tax incentives in private R&D. Using a linear regression model, we find that innovation-intensive firms investing in R&D exhibit higher levels of tax planning, partly reflecting the direct effect of R&D tax incentives (SIFIDE), and potentially linked to more accurate tax management practices. Our findings align with international evidence while addressing a gap in the Portuguese context. The findings provide insights for policymakers and business leaders, emphasizing the need to monitor private R&D investments supported by SIFIDE and assess their real economic impact, given the scheme's substantial fiscal cost.

Keywords: economic growth, tax planning, R&D, tax benefits, SIFIDE
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Introduction

Innovation is now, more than ever, a critical driver of economic growth for countries and companies. It is a keystone for transitioning a developing country into a developed one, as this process relies not only on the ability to attract investment but also on the capacity to acquire and utilize both cutting-edge and existing technologies (Dhar et al. 2023).

Innovation bridges market demands with scientific and technological advancements, adapting and transforming processes and products to align with market needs. Furthermore, it enhances productivity, providing companies with a competitive advantage over their rivals, which translates into higher profit margins, increased market share, and greater overall financial performance (Caron 2006).

One of the key drivers of technical progress – and consequently innovation and productivity growth in both nations and companies – is investment in Research and Development (R&D). A strong correlation is expected between innovation investments and economic growth over the medium to long term. Economic agents with robust innovation strategies, such as advanced training in science and engineering, investments in R&D, and technological development, tend to achieve higher levels of economic growth and prosperity. Consequently, the efforts of organizations in R&D are widely regarded as critical contributions to innovation, which, in turn, is recognized as a pillar of economic development (Lichtenberg 1992; Guellec and van Pottelsberghe de la Potterie 2001).

Given the importance of R&D investments in fostering innovation and economic growth, analysing the policies and incentives available in Portugal to encourage such activities is crucial. In Portugal, public policy efforts to promote R&D activities primarily rely on financial and tax benefits.

Financial incentives are tools designed to support business development, primarily by assisting companies in executing their investments. Organizations like IAPMEI (Agency for Competitiveness and Innovation) play a strategic public role in supporting small and medium-sized enterprises (SME) in sectors such as industry, commerce, services, and construction to access financial incentives. IAPMEI promotes business growth through various initiatives aimed at fostering expansion and internationalization.

In Portugal, a significant portion of financial incentives stems from European Union funding programmes, such as Portugal 2030. These programmes define the policy framework for economic, social, and territorial development within a given period. They include several systems of incentives designed to stimulate national economic growth and development. For example, the 'Business Competitiveness Incentive System', particularly its 'Productive Innovation' component, aims to encourage innovative business investments. This programme promotes changes in Portugal's economic specialization profile and enhances its external

competitiveness through diversification, differentiation, and innovation. Eligible expenditures include those made by SMEs to develop innovative, digital, and sustainable production capabilities (Presidência do Conselho de Ministros 2023).

Tax benefits, on the other hand, promote productive investments by offering tax savings linked to such expenditures. The most relevant tax benefits for supporting and promoting investment are outlined in the Investment Tax Code (ITC, Portuguese acronym: CFI). Among these, the Corporate R&D Tax Incentive System (SIFIDE – Sistema de Incentivos Fiscais à Investigação e Desenvolvimento Empresarial) stands out as a benefit exclusively targeting R&D activities. Over the years, this benefit has become increasingly vital in supporting R&D investments. SIFIDE is currently the most widely used tax benefit under the ITC, enabling companies in Portugal to deduct €407 million from their assessed corporate tax income in 2021, representing 56.74% of the total deductions that year.

In addition to the importance of innovation investments, effective tax planning is crucial in today's global economic landscape. Optimized tax planning plays a significant role in economic growth, allowing companies to improve profitability through mechanisms such as tax benefits. Thus, tax planning has become an increasingly critical variable for organizational leaders (Fernandes 2013). Tax planning is defined as the structuring of a taxpayer's actions in compliance with tax laws, aiming to minimize, defer, or eliminate tax liabilities (Silva 2008). It is a form of tax management and savings where taxpayers use their knowledge about legal rules to implement the most favourable solutions (Santos 2010).

Within this context, the study contributes to the existing literature by providing new empirical evidence on the relationship between R&D investment and corporate tax planning in a national context. While prior research has extensively examined the links between R&D, innovation, and economic growth, as well as the role of fiscal incentives in stimulating R&D activities, empirical analyses directly connecting R&D investment to corporate tax planning remain limited, particularly at the firm level and within specific institutional frameworks.

The originality of this paper lies in three main aspects. First, it focuses on the Portuguese context, where the SIFIDE represents one of the most generous and widely used R&D tax incentive schemes among OECD countries, but remains relatively underexplored in empirical research. Second, the study uses SIFIDE-approved amounts as a direct and objec-

tive proxy for R&D investment, relying on accounting data rather than indirect innovation indicators such as patents. Third, by combining data from the Portuguese Tax Authority and the Iberian Balance Sheet Analysis System (SABI) database and by analysing a large and balanced sample of beneficiary and non-beneficiary firms, this research offers robust evidence on how R&D-related tax incentives influence effective tax rates and corporate tax planning behaviour.

By addressing these gaps, this study provides a comprehensive analysis of the interplay between economic growth, innovation, R&D activities, and public support mechanisms, contributing to the literature on innovation economics and fiscal policy while offering relevant insights for both corporate decision-makers and public authorities.

The paper is organized as follows. Section 2 offers a literature review by exploring theories and empirical evidence on how R&D investments stimulate economic growth, foster technological innovation, and enhance the competitiveness of nations and companies. Section 2 also characterizes tax benefits for R&D investments, with a particular emphasis on SIFIDE. This includes tracing the historical evolution of SIFIDE, evaluating its impact on innovation, and analysing the dynamics between public and private sectors. Additionally, it offers insights into optimizing fiscal policies to maximize corporate innovation potential and, in turn, drive economic growth. Section 3 deals with methodology applied in this research. Section 4 shows the influence of R&D activities on corporate tax planning practices by analysing the results of the linear regression model developed. Section 5 concludes.

Literature Review

ECONOMIC GROWTH AND INVESTMENT IN R&D

In today's highly competitive and globalized markets, innovation has become a crucial factor for businesses' survival (Pereira 2020). The market is characterized by constant change, making it increasingly essential for companies to stand out. They can achieve this by diversifying their products and services compared to competitors and by enhancing their performance to maximize revenues and minimize costs. In this context, modern economic theory has placed growing emphasis on issues related to knowledge and technological innovation, particularly highlighting the critical role of investment in R&D activities (Kučera and Fiľa 2022).

Economic growth can be defined as an increase in the quantity and quality of goods and services produced by a society over time. The most significant quantitative change occurs when production moves from zero to one, meaning the creation of a new product (Roser 2021).

Two main models of economic growth dominate the literature. The exogenous growth model, representing first-generation growth theories, held dominance for many years. In this model, technology is not an explanatory factor; instead, labour and capital are considered the primary drivers of economic growth. Innovation is viewed as an unintended byproduct of the accumulation of production factors, such as learning through experience or study (Romer 1986; Lucas 1988).

In contrast, the endogenous growth model emerged as a second-generation economic growth theory, positioning knowledge as the central driver of economic growth. It argues that R&D efforts are essential for innovation activities, which increase productivity and ultimately drive economic growth. Unlike the exogenous model, the endogenous approach emphasizes intentional decisions by economic agents aiming for returns on investment. This perspective underscores the direct dependence of technological and human capital intensity on R&D activities, training incentives, and other strategic investments (Romer 1990; Jones 1995).

A prevailing consensus holds that technological progress and innovation are fundamental to economic growth. Guei and Choga (2022) demonstrate that innovation plays a significant role in promoting economic upgrading and long-term growth through global value chains. Their analysis shows that R&D investment increases value creation and productivity, especially when developing countries engage in trade with advanced economies. The study shows that promoting innovation is essential for sustainable economic growth. Innovation, particularly through artificial intelligence (AI) adoption, supports economic growth by enhancing productivity and strengthening competitiveness. As shown by Costa et al. (2025), the dissemination of AI across firms stimulates innovation, efficiency, and creativity – core drivers of sustainable development. Their findings emphasize that innovation capacity is a strategic determinant of both business performance and national economic growth.

This relationship has been extensively studied, with numerous investigations confirming the connection. The evidence can be examined from two perspectives: macroeconomic (national economies, including Portugal) and microeconomic (businesses).

Evidence from European Countries and Portugal

Recent studies underscore the role of R&D investment as a key driver of economic growth across nations, particularly in emerging economies. Tung and Hoang (2024) emphasize that in these contexts, R&D spending has direct and indirect positive effects on economic growth. It helps nations escape the 'middle-income trap' and transition to more advanced economies. Investments in physical capital and education complement R&D activities, further powering growth. These findings highlight the strategic importance of increasing R&D investments to achieve sustainable national development.

Ulku (2004) examined the relation between economic growth, measured by GDP per capita, R&D investment, and innovation (using patents as a proxy). Analysing data from 20 OECD member countries and 10 non-members, the study confirmed that innovation positively influences economic growth. It also demonstrated that R&D investment plays a central role in driving innovation levels, regardless of whether a country is an OECD member.

Maradana et al. (2017) analysed the relation between innovation and per capita economic growth across 19 European countries between 1989 and 2014. They utilized five innovation indicators: patent registrations (by residents and non-residents), R&D expenditure, high-tech exports, scientific publications, and the number of R&D researchers. Their findings identified bidirectional relationships between these indicators, suggesting that innovation drives economic growth, while economic growth can also stimulate innovation. However, their study highlights the need for government intervention to align innovation policies with national development goals.

Kučera and Fiľa (2022) explored the relationship between R&D expenditure, innovation, and economic growth within EU countries. Their study relied on three key indicators: the Summary Innovation Index (SII) to measure innovation levels, R&D spending as a percentage of GDP, and economic growth measured by GDP per capita. They concluded that R&D spending and innovation are crucial determinants of economic growth. Over the long term, sustaining competitiveness requires substantial investment in R&D-driven innovation.

Global projections for 2024 anticipate that R&D funding will reach $2.53 trillion, an 8.3% increase from 2022. This growth reflects a rising R&D-to-GDP ratio in various economies, signalling that technological in-

novation remains the centre of economic policy and sustainable growth. Industrialized nations, such as the United States – where the industrial sector accounts for 75% of R&D investments – serve as prime examples of how fostering innovation can catalyse macroeconomic growth.

From a Portuguese perspective, several studies have explored the link between R&D investment and economic growth, both at the macroeconomic level and within the corporate context. The 'OECD Review of Higher Education, Research and Innovation: Portugal' examined how R&D incentive policies, such as the SIFIDE programme, have fostered innovation and competitiveness (Organisation for Economic Co-operation and Development (OECD) 2019). It concluded that promoting R&D is vital for enhancing productivity and sustaining long-term growth in Portugal.

Rosário and Costa (2018) investigated how technological innovation indicators impacted national economic growth between 2000 and 2013. Using GDP and real GDP growth rates to measure economic performance, they found that technological innovation significantly contributed to economic growth, surpassing the impact of research in other areas such as social sciences. Additionally, they highlighted that higher percentages of engineers among researchers and a focus on applied research were particularly effective in driving GDP growth.

Evidence from Businesses

R&D investment has increasingly become a critical success factor for businesses, enabling them to gain competitive advantages through differentiation strategies and the creation of new and improved products and services (Chan et al. 1990; Doukas and Switzer 1992).

Jiménez-Jiménez and Sanz-Valle (2011) examined the relationship between innovation and the performance of approximately 1,600 Spanish companies (55% manufacturing; 45% services). They found a positive correlation between innovation and overall performance. Factors such as company size and industry – particularly within manufacturing – positively influenced this relationship.

Gök and Peker (2017) examined how innovation impacts firms across two dimensions: financial performance and market performance. Drawing on existing literature, the authors identified three categories of studies addressing the relationship between innovation and firm performance. The first category focuses on the interaction between innovation and a

firm's strategic orientations, such as market strategy, learning strategy, and overall performance. These studies primarily emphasize the relationship between innovation and firm performance (e.g. Han et al. 1998). The second category encompasses research investigating the link between firm performance and various innovation domains, including administrative innovation, production processes, technological advancements, and more (e.g. Subramanian and Nilakanta 1996; Damanpour et al. 1989). The third category includes studies that explore the connection between innovation and firms' market value, often measured through stock prices. This line of research focuses on the impact of product innovation on a firm's profitability indicators.

The study targets the largest manufacturing and service firms in Turkey's industrial sector in 2015, spanning various market segments, including marketing, accounting, procurement, sales, and manufacturing. The findings demonstrate that innovation has a positive overall impact on firm performance. However, a more nuanced analysis reveals that while the effect on financial performance is negative, it is offset by a positive impact on market performance. This highlights the critical role of the market in translating firms' innovation efforts into financial gains over the medium to long term. Innovation is an inherently costly activity that exposes firms to greater market risk, often resulting in short-term negative impacts on financial performance. Nevertheless, innovation serves as a key driver of firm performance and should occupy a central role in a firm's market strategy.

The level of innovation is a critical factor in a highly competitive global economy characterized by increasingly globalized companies, offering a clear perspective on the opportunities the future may hold (Rajapathirana and Hui 2018).

The literature provides various definitions of the concept of innovation. According to the OECD and Eurostat, the *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data* defines innovation as: 'the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations' (Organisation for Economic Co-operation and Development (OECD) and Eurostat 2005, 46).

This definition encompasses all scientific, technological, organizational, financial, and commercial stages necessary to develop new products and processes that are commercially viable. In this context, the Oslo

Manual identifies four distinct types of innovation: product innovation, process innovation, marketing innovation, and organizational innovation. Product innovation refers to the 'introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses' (OECD and Eurostat 2005, 48). Process innovation focuses on the 'implementation of a new or significantly improved production or delivery method' (p. 49). Marketing innovation involves the 'implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing' (p. 49). Finally, organizational innovation is defined as the 'the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations' (p. 51).

Innovation is therefore expected to positively impact firm performance and drive economic growth. From a business perspective, innovation creates competitive advantages, boosts productivity, and enables the development of new and improved products and services. This underscores the necessity for firms to innovate to ensure competitiveness and technological progress, leading to sustainable economic growth.

At the macroeconomic level, economic growth is closely linked to firm-level performance. When firms invest in R&D and engage in innovation, they contribute to increased national productivity and, consequently, to the country's economic growth. Hence, implementing public policies that support the creation of resources necessary for firms to invest in innovation is of critical importance.

Additionally, the interaction between public policies and private initiatives is a key determinant of successful R&D investment. Well-designed government policies – such as those that promote fiscal incentives, foster collaborations with academic institutions, and encourage the development of innovation networks – are essential for establishing a robust innovation ecosystem.

INCENTIVES FOR R&D ACTIVITIES

The Importance of Tax Incentives and R&D Activities

According to the Frascati Manual, R&D activities are critical drivers of innovation, which in turn fosters wealth creation. These activities encompass systematic creative work aimed at expanding knowledge, including human, cultural, and societal understanding, and applying this knowledge to create or significantly improve applications (Organisation

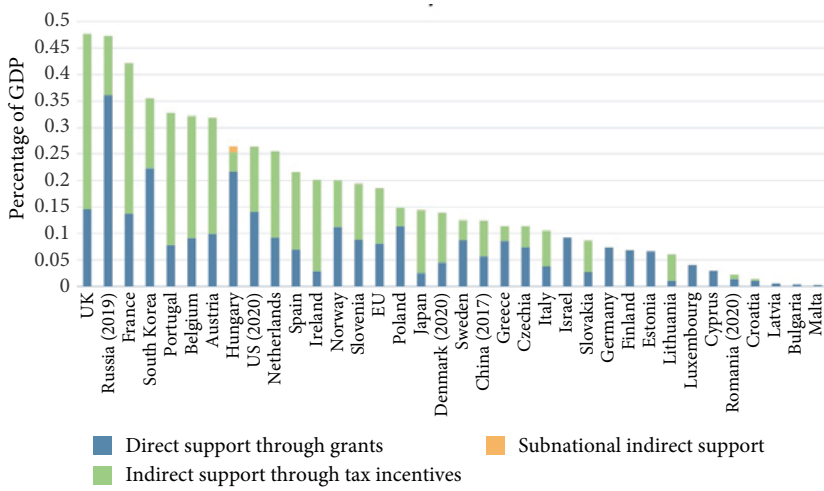


FIGURE 1 Direct Government Funding and Tax Support for Business R&D, 2021 or Latest Year Available (adapted from European Commission (2024, 68))

for Economic Co-operation and Development 2015). Investing in R&D promotes the pursuit of new knowledge, which directly influences innovation (Carvalho 2006). Innovation serves as a key differentiator for businesses, enabling them to achieve sustainable competitive advantages (Porter 1985). In this context, countries have developed economic measures and policies to attract and encourage investments in R&D. These measures primarily include tax incentives and financial support.

Figure 1 illustrates how countries structure their R&D support policies, highlighting the predominance of tax benefits, which constitute the largest share of resources allocated to R&D promotion. Over the last decade, the number of companies benefitting from such tax incentives has significantly increased, underscoring their growing importance in fostering R&D activities (Organisation for Economic Co-operation and Development 2024). Tax relief and fiscal support targeted at R&D investments are effective mechanisms for encouraging corporate R&D initiatives (Appelt et al. 2016; Hall 2019; Hall and Van Reenen 2000).

In Portugal, tax benefits play a significant role in supporting private investments, including R&D activities. As shown in figure 1, approximately 0.33% of the national GDP is allocated to R&D promotion policies, with 76% of this amount directed to tax benefits.

Government concerns about economic growth and the business environment have led to the creation of tax benefits for corporate investments (Peixoto 2016).

The OECD's 'Corporate Tax Statistics' report (Organisation for Economic Co-operation and Development 2024) indicates that in 2023, Portugal, Poland, and France had the lowest capital costs for R&D, reflecting robust tax-based incentives in these jurisdictions to boost R&D investments.

From a corporate perspective, tax benefits create fiscal savings associated with R&D investments. Faria (1995) defines tax benefits as measures designed to reduce or eliminate the tax burden that would otherwise be imposed on specific taxpayers, groups, or activities. These benefits, codified in article 2 of the Portuguese Tax Benefits Statute (TBS, Portuguese acronym: EBF), allow companies to reduce their tax expenses through deductions, exemptions, and rate reductions. They serve as instruments for achieving state objectives related to economic growth, technological innovation, modernization, support for underdeveloped regions, and social goals.

Most of these benefits apply to direct taxes, specifically personal income tax (PIT, Portuguese acronym: IRS) and corporate income tax (CIT, Portuguese acronym: IRC). Additionally, tax benefits are categorized by function (Employment creation; Industry; Investment; Savings; Tourism, among others), with nine targeted specifically at promoting R&D (Oliveira et al. 2019). Among the various tax benefits for R&D promotion, the Portuguese tax system includes specific measures like the Corporate R&D Tax Incentive System (SIFIDE).

Tax benefits serve as a critical tool enabling companies to optimize their fiscal planning. When such benefits are specifically tied to R&D activities, it raises an important question: are companies investing heavily in R&D also engaging in higher levels of fiscal planning?

The Portuguese Investment Tax Code (ITC), introduced by Decree-Law n.º 249/09 of September 23 (Decreto-Lei n.º 249/2009, de 23 de setembro), aims to reflect a new competitive philosophy in the Portuguese economy, promoting national economic growth and strengthening the business sector. Revised by Decree-Law n.º 162/14 of October 31 (Decreto-Lei n.º 162/2014, de 31 de outubro), the ITC aligns with European legislative standards and enhances tax benefits for investment. Among its provisions, the ITC includes a specific tax benefit exclusively dedicated to R&D activities. This benefit will be explored in the following section to assess its role in fostering investment and promoting R&D activities in Portugal.

The Corporate R&D Tax Incentive System (SIFIDE)

The Corporate R&D Tax Incentive System (SIFIDE) is a fiscal benefit designed to enhance business competitiveness by supporting R&D efforts. It allows companies to deduct a percentage of eligible R&D expenses from assessed corporate income tax in an economic period.

Initially introduced in Portugal in 1997 (Decree-Law n.º 292/97 of October 22 (Decreto-Lei n.º 292/97, de 22 de outubro)), SIFIDE was suspended in 2004 and 2005, and reintroduced from 2006 to 2010. In 2011, it was replaced by SIFIDE II, which is in effect from 2011 to 2025.

The preamble of Decree-Law n.º 292/97 states that the productivity and competitiveness of companies significantly depend on their capacity for innovation, which in turn largely relies on the outcomes of scientific research and experimental development (R&D). In Portugal, the business sector's contribution to overall R&D efforts has been notably low, requiring efforts to support and stimulate such activities. This need is amplified by Portugal's position as one of the few OECD countries lacking a fiscal incentive framework for business-driven R&D, which places the country at a disadvantage in attracting qualified investments, especially compared to neighbouring Spain. Recognizing this context, the government aims to address the current state of R&D activities in businesses by employing a well-established short-term instrument with potential for immediate results: fiscal incentives.

According to Oliveira et al. (2019), the extra fiscal objectives of SIFIDE include fostering innovation and competitiveness in companies through increased R&D investment, boosting the number of qualified personnel within businesses, and contributing to the national goal of achieving 2% of GDP in private R&D investment by 2030.

Article 37 of the ITC outlines eligible expenses under the R&D tax incentive scheme, provided they qualify as research and development activities. These include, for example, acquisition of tangible fixed assets, excluding buildings and land, provided they are newly created or acquired and proportionally allocated to R&D activities; personnel expenses for staff with minimum educational qualifications and directly involved in R&D tasks; expenses for executives and managers involved in overseeing R&D institutions; operating expenses up to 55% of personnel costs directly associated with R&D, covering salaries and remuneration; contracted R&D activities conducted by public entities, entities with public utility status, or those with certified R&D expertise; equity participation in R&D institutions or contributions to public or private

investment funds that invest primarily in R&D-focused companies, including the commercialization of R&D results, with certification from the National Innovation Agency; and patent registration and maintenance costs, among others.

Certain restrictions apply: some enhanced incentives apply specifically to micro, small, and medium enterprises (SME) and expenses are eligible only if pre-approved by the National Innovation Agency. To qualify for the incentive, entities must obtain certification of competence to carry out R&D in specific areas. This certification, stipulated under article 37-A of the ITC, remains valid for 12 fiscal years, after which the National Innovation Agency reviews its validity.

Corporate income taxpayers can deduct a percentage of R&D expenditures incurred between 1 January 2014 and 31 December 2025. Each year's deduction is calculated by applying a 32.5% rate to total R&D costs and an additional 50% rate to any increase in R&D spending compared with the average of the previous two years, up to a maximum of €1.5 million. SMEs that have not completed two fiscal years and have not benefitted from the incremental rate are eligible for a 15% enhancement to the base rate.

If expenses cannot be deducted due to insufficient tax liability, they may be carried forward and deducted over the next 12 fiscal years.

To better understand the impact of the SIFIDE incentive, consider the following example:

- Year 0: Company X incurs €100,000 in R&D expenses. Since the average R&D spending for the previous two years is €0, the incremental expenditure is €100,000. Assuming compliance with the CFI requirements, Company X can benefit from a SIFIDE allocation of €32,500 (base rate) plus €50,000 (incremental rate).
- Year 1: Company X spends the same amount (€100,000) on R&D. However, the average spending for the previous two years is now €50,000. The incremental expenditure is therefore reduced to €50,000. Consequently, Company X can receive €32,500 (base rate) and €25,000 (incremental rate).

This example demonstrates that the company can recover between 32.5% and 82.5% of its R&D investment through SIFIDE.

Following the legal framework overview, it is pertinent to analyse the historical development of SIFIDE, particularly since 2006. As illustrated in figure 2, the number of applications has shown a consistently positive trend over the years.

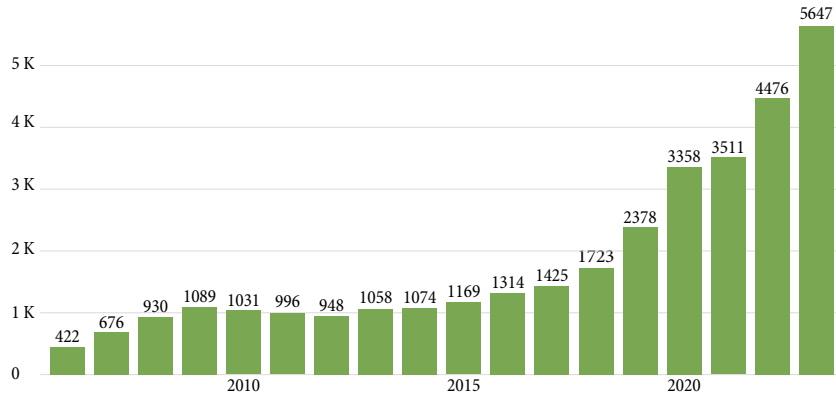


FIGURE 2 SIFIDE Applications Over Time (based on data from Agência Nacional de Inovação (https://ani.pt/sifide-sistema-de-incentivos-fiscais-a-ied-empresarial/))

Over the 2006–2023 period, 33,245 applications were filed to SIFIDE tax benefit, of which 25,492 were approved. Aggregate R&D expenditure associated with approved projects totaled €10.1 billion, while the corresponding amount of tax credits granted reached €5.1 billion. In total, 7,971 firms benefited from the program. The mean approval rate was 69.8%, and the average effective support rate was 50.8%.

There has been a consistent growth trend in R&D investment over the years. This indicates the increasing engagement of private entities in R&D activities, supported by public incentives like SIFIDE.

Additionally, data from the Survey of National Scientific and Technological Potential (Direção-Geral de Estatísticas da Educação e Ciência 2023) further reinforces this trend. In 2022, the business sector accounted for 62% of the national R&D expenditure, amounting to over €2.5 billion. Among the 200 top-spending companies in R&D, 80 were classified as SMEs (40% of the total), underscoring the crucial role of R&D in driving both large-scale enterprises and smaller firms.

TAX PLANNING

In the global economic landscape, optimized tax management enables companies to enhance their profitability by leveraging fiscal benefits. As a result, tax planning has become an increasingly critical factor for organizational leaders (Fernandes 2013).

According to Silva (2008), tax planning involves the arrangement of a taxpayer's actions in compliance with tax laws to achieve non-payment, lower payment, or deferred payment of taxes. It always presupposes ad-

herence to the law, thereby distinguishing it from tax evasion, which entails fraudulent practices to avoid tax obligations. This process relies on the taxpayer's legal knowledge to identify solutions that are most favourable to them.

Tax planning can be categorized into legitimate and illegitimate practices. Illegitimate tax planning involves activities that contravene legal principles or tax regulations, resulting in improper reductions in tax obligations (Sanches 2006). This includes practices such as tax avoidance or evasion, which rely on actions beyond or against the law. These are often premeditated and involve activities not foreseen by legal statutes. Legitimate tax planning, on the other hand, refers to the lawful reduction of tax burdens by opting for choices permitted within the legal framework (Sanches 2006). This approach can serve as a strategic management tool, reducing fiscal burdens and potentially contributing to value creation within companies.

Tax planning mechanisms can lead to fiscal savings through strategies such as Tax Exemptions and Exclusions. Exemptions occur when laws explicitly relieve entities or individuals from paying taxes, either partially or entirely, as an incentive to achieve economic or social objectives. Exclusions refer to non-taxable scenarios where tax liability does not arise, differing from exemptions in that the underlying taxable event does not occur. Fiscal alternatives involve selecting the most tax-favourable option among legally provided choices. Tax benefits represent relief measures granted by the state. These benefits may be structural or temporary and include categories such as investment in R&D, corporate capitalization, savings, real estate, and social programmes.

Empirical studies on tax planning used several proxies to measure this variable. Two of the most common are the Book-Tax Difference (BTD) and Effective Tax Rate (ETR). Book-Tax Difference (BTD) measures discrepancies between accounting and fiscal frameworks, reflecting strategies like tax benefits (Hanlon 2005). Positive BTD values indicate lower taxable income than accounting income, correlating with lower ETRs, while negative BTD values result in higher ETR (Jackson 2015).

Effective Tax Rate is a widely recognized measure of fiscal planning, defined as tax expense divided by pre-tax income (Rego 2003). It provides aggregated insights into corporate tax burdens, highlighting managerial efficiency in reducing payable taxes (Dyreng et al. 2008). Variants like Cash ETR utilize cash flow data, representing actual taxes paid relative to pre-tax earnings (Dyreng et al. 2008).

R&D INVESTMENT AND TAX PLANNING

International studies have examined the interplay between R&D and tax planning. Gao et al. (2016) investigated the impact of innovation and R&D investments on corporate tax avoidance in a sample of U.S.-based firms from 1987 to 2010. Metrics such as Cash Effective Tax Rate (CASH_ETR), BTD, and ETR adjusted for deferred taxes were employed to measure tax avoidance, while R&D investment was assessed through the number of patents registered by each company. Control variables included return on equity, leverage, firm size, the value of intangible and tangible assets, and foreign income. The study concluded that R&D investments are associated with lower tax burdens, suggesting a link between innovation and tax avoidance strategies.

Pfeiffer and Spengel (2017) explored the role of fiscal incentives for R&D in the tax planning strategies of multinational corporations across 32 countries. Using OECD data from 1995 and 2012, the authors conducted linear regression analyses incorporating country-level control variables such as GDP per capita, population size, and average R&D expenditures. Effective Tax Rate was used to measure tax planning, with comparisons made between ETR values with and without R&D fiscal incentives. The number of patents was used as a proxy for R&D activities. Their findings indicated that R&D tax incentives significantly reduced the ETR of companies.

Cheng et al. (2021) studied the impact of innovation on corporate tax planning and economic performance, focusing on U.S. firms from 1987 to 2012. Tax planning, the dependent variable, was measured using CASH_ETR, while innovation, the independent variable, was assessed through the number of patents registered annually and their citation frequency in subsequent years. A linear regression model was employed, incorporating control variables such as return on assets, liquidity, return on equity, leverage, the value of intangible assets, depreciation and amortization, foreign income, and firm market value. The study concluded that firms with higher patent counts, resulting from R&D investments, engage in more sophisticated tax planning. This effect is driven by two mechanisms: income shifting derived from patent revenues and the use of government-granted R&D tax incentives, which offer credits and deductions.

Bayraktar and Tütüncü (2022) examined the relationship between tax planning and R&D expenditures. Using indicators such as CASH_ETR and ETR to measure tax planning, the study analysed a sample of

564 firms between 2008 and 2019. Control variables included return on assets, leverage, firm size, capital intensity, and inventory intensity. The authors found that firms increase R&D expenditures to reduce their tax liabilities, leveraging fiscal incentives associated with these expenses.

Further studies have focused on the Portuguese context. Santos (2021) analysed the SIFIDE tax benefit, investigating its practical impact on Portuguese businesses and proposing improvements. A literature review and qualitative analysis, based on questionnaires administered to SIFIDE beneficiaries and non-beneficiaries, revealed that only a limited number of companies utilize SIFIDE, and most beneficiaries use it only once. Ferreira (2017) similarly evaluated the SIFIDE programme, focusing on its practical implementation and proposing measures to make it more appealing and functional for Portuguese firms. These measures included allowing tax credits to offset other taxes beyond corporate income tax, enabling early receipt of credits, permitting the use of credits as collateral for financing, and implementing early approval mechanisms for projects.

Grave (2023) analysed the impact of SIFIDE on the R&D performance of Portuguese companies between 2018 and 2020. The sample was divided into beneficiary and non-beneficiary firms. Using linear regression models, the study assessed SIFIDE's contribution to increased R&D investment, innovation, competitiveness, and innovation quality. R&D investment was measured through the natural logarithm of R&D expenditures, while innovation and competitiveness were evaluated using dummy variables based on the introduction of new or improved products, services, and processes. Innovation quality was measured by the revenue generated from new or improved products introduced during the study period. The findings indicated that SIFIDE significantly increases R&D investment, but its impact on innovation quality and competitiveness remains statistically insignificant.

Abrunhosa (2021) investigated the use of corporate income tax benefits as tax planning tools by Portuguese publicly traded companies between 2017 and 2019. Using quantitative methods, the study analysed financial data related to several tax benefits. The findings revealed substantial tax savings for firms using these benefits, with SIFIDE being the most widely adopted.

These studies collectively underscore the limited focus on the impact of R&D investments on corporate tax planning levels in the Portuguese

context. While Abrunhosa (2021) addresses tax savings, the scope is restricted to firms listed on Euronext Lisbon. Therefore, this research aims to contribute to the literature by analysing the understudied relationship between R&D investment and tax planning in the Portuguese corporate environment.

Methodology

Th e research methodology adopted in this study involves a mixed-methods approach combining both qualitative and quantitative components. In the qualitative component, the literature review examines the concepts of SIFIDE, innovation, economic growth, and R&D activities, analysing their relationships through various empirical studies. In the quantitative study, the goal is to analyse the impact of R&D activities on corporate tax planning through the development of a multiple linear regression model.

HYPOTHESIS The level of corporate tax planning is positively influenced by investment in R&D activities.

SAMPLE DEFINITION

The information sources utilized consist of secondary data of a documentary nature, including financial and related information for companies within the sample. All necessary data for generating the model variables were obtained from the Tax Authority database and the SABI database.

Through the Portuguese Tax Authority available data, we obtained a total of 50,737 observations from companies that received SIFIDE allocations between 2020 and 2022, as well as companies without any tax benefits deductible from their corporate tax in those years. After gathering the necessary data from the SABI database for calculating each variable, 20,553 observations were excluded due to missing information. Among the 30,184 remaining observations, we further excluded those with negative ETR values and outliers, yielding a total of 12,333 observations, of which 1,992 had a positive SIFIDE value. To achieve a more balanced sample, we randomly selected 1,992 observations with zero benefit deductions. After removing observations with negative R&D values, the final sample included 3,965 observations.

VARIABLE DEFINITION

The variables are as follows:

1. Dependent Variable: Tax Planning (TP) – The dependent variable considered is operationalized through the Effective Tax Rate (ETR), calculated as follows: ETR = Income Tax / Profit Before Taxes.
2. Independent Variable: R&D Investment (R&D) – The R&D variable is operationalized as the amount approved for SIFIDE, corresponding to the allocation approved by ANI for each year in the study.
3. Control Variables – Based on the literature, five control variables are included: company size (SIZE), leverage (LEV), return on assets (ROA), capital intensity (CAPITALINT), and inventory intensity (INVENTINT).

    - Company Size (SIZE): Measured as the natural logarithm of total assets. The impact of this variable on tax planning is non-linear, with some authors reporting a positive relationship (Kraft 2014; Noor et al. 2010) and others reporting a negative one (Stamatopoulos et al. 2016).
    - Leverage (LEV): Calculated as the ratio of total liabilities to equity. Studies on this indicator's influence on tax planning show mixed results, with some reporting that higher leverage correlates with a higher ETR (Fernández-Rodríguez and Martínez-Arias 2014), while others find a negative relationship (Nomura 2017).
    - Return on Assets (ROA): Calculated as the ratio of net income to total assets, reflecting a company's efficiency in converting asset investments into earnings. Some studies report a positive relationship between ROA and ETR (Salaudeen and Eze 2018), while others report a negative relationship (Pratama 2017).
    - Capital Intensity (CAPITALINT): Relates the amount invested in fixed assets to total assets. Studies generally show a negative relationship between this indicator and ETR (Nugrahadi and Rinaldi 2021).
    - Inventory Intensity (INVENTINT): Relates inventory investment to total assets. Studies on the effect of this indicator on ETR are inconclusive. While Costa et al. (2012) report a positive relationship, Andreas and Savitri (2017) conclude that higher inventory investment negatively affects ETR.

LINEAR REGRESSION MODEL

To test the influence of R&D investment on tax planning, we develop a multiple linear regression model as follows:

$$TPi = \beta_0 + \beta_1\, R\&Di + \beta 2\, SIZEi + \beta_3\, LEVi + \beta 4\, ROAi + \beta_5\, CAPITALINTi + \beta_6\, INVENTINTi + \varepsilon i, \quad (1)$$

where TP*i*: tax planning of company *i*; βo: Intercept; βj (j = 1, …, 6): partial slopes, representing the change in tax planning level for each unit change in the independent variables; R&D*i*: R&D investment of company *i*; SIZE*i*: company size of company *i*; LEV*i*: leverage of company *i*; ROA*i*: return on assets of company *i*; CAPITALINT*i*: capital intensity of company *i*; INVENTINT*i*: inventory intensity of company *i*; εi: model error.

Results

The 3,965 observations in the sample are divided into two groups: one with 1,973 observations that received SIFIDE allocations during the period under study, and the other consisting of the remaining 1,992 observations from companies without SIFIDE allocations. This study assumes that companies without any SIFIDE allocation did not invest in R&D during the examined periods.

On average, the sample companies with SIFIDE allocations exhibit a lower ETR (9.88%) than those without any fiscal benefit deductions (ETR = 16.66%). This potentially indicates that companies investing in R&D engage in more tax planning. Notably, the average ETR (13.29%) is considerably below Portugal's nominal tax rate of 21%. This discrepancy may be due to other tax-saving instruments not examined in this study, such as the reduced 17% tax rate on the first €50,000 of taxable income for SMEs and Small Mid-Caps. Despite this, the possible effect of R&D investments is clearly visible.

For descriptive statistics, we characterized the sample using dispersion measures (standard deviation), central tendency (mean), and non-central tendency (maximum and minimum), as presented in table 1.

The Pearson Correlation Coefficient measures the strength and direction of the linear association between two variables. To examine the correlations among the variables considered in this study, we present the Pearson correlation coefficients in table 2.

The independent variable, R&D (indicative of R&D investment levels), shows a moderate negative and statistically significant correlation with the

TABLE 1 Descriptive Statistics

	Minimum		Maximum		Mean		Std. Dev.	
	SIFIDE = 0	SIFIDE > 0	SIFIDE = 0	SIFIDE > 0	SIFIDE = 0	SIFIDE > 0	SIFIDE = 0	SIFIDE > 0
ETR	0.000	0.000	0.348	0.350	0.167	0.099	0.078	0.087
R&D	0.000	0.001	0.000	9.341	0.000	3.989	0.000	1.493
SIZE	2.887	3.670	15.358	15.400	7.269	8.562	2.130	1.573
LEV	0.000	0.001	73.519	1.830	0.446	0.443	1.752	0.239
ROA	0.001	0.001	8.170	1.082	0.173	0.142	0.342	0.149
CAPITALINT	0.000	0.000	1.000	0.998	0.321	0.354	0.299	0.247
INVENTINT	0.000	0.000	1.020	0.967	0.133	0.127	0.214	0.164

NOTES SIFIDE = 0 represents the group of companies that has no tax benefit approved for the period under analysis. SIFIDE > 0 represents the group of companies that has tax benefit approved for the period under analysis.

dependent variable, ETR. Other moderate relationships include the positive correlation between R&D and the control variable SIZE, which aligns with the expectation that larger companies have greater capacity for R&D investment.

Analysing table 2 reveals that no strong correlations exist between independent variables that could bias the results obtained.

The multiple linear regression model was estimated using the least squares method and the Enter method for variable selection, given that the objective was to include all variables.

After calculating the model, we assessed whether the independent variable or any control variable could influence the effective tax rate and whether the models fit the data significantly.

TABLE 2 Pearson Correlation Coefficients

	ETR	R&D	SIZE	LEV	ROA	CAPITALINT	INVENTINT
ETR	1.000						
R&D	−0.381**	1.000					
SIZE	−0.011	0.448**	1.000				
LEV	0.019	0.104**	0.194**	1.000			
ROA	−0.170**	0.086**	−0.400**	−0.260**	1.000		
CAPITALINT	−0.154**	0.121**	0.284**	0.019	−0.241**	1.000	
INVENTINT	0.108**	0.127**	0.322**	0.205**	−0.274**	−0.140**	1.000

NOTE ** Significant at level 0.05.

Based on the F-test (Coefficient: 164.930; p-value < 0.01), at least the independent variable or one of the control variables has a significant effect on the variation in the effective tax rate, given that the associated p-value is less than the significance level of 1%.

Regression coefficients for each independent variable are presented in table 3, along with values and significance levels.

For the sample studied, we validate that R&D investments reduce the effective tax rate, positively impacting companies' tax planning levels. Evidence suggests that R&D investment and the SIFIDE tax benefit contribute significantly to a lower ETR.

Regarding control variables, SIZE, ROA, and CAPITALINT also influence the effective tax rate. Large firms may exhibit a higher ETR due to factors such as increased transparency and control, reduced relative benefit from tax incentives, and limited capacity to leverage exemptions and deductions (Appelt et al. 2020).

The positive impact of asset profitability on tax planning level (ETR negative sign) suggests that companies with greater profitability not only have more resources but also focus on optimizing their tax management to reduce tax burdens. Capital intensity positively impacts tax planning, and since debt does not affect this variable, firms primarily funded through equity appear more likely to engage in tax planning and have fewer opportunities to lower ETR through interest deductions.

Lastly, inventory intensity does not appear to influence tax planning, implying that industry sector may not be a major factor in fiscal management practices.

The coefficient of determination (R^2) measures the effect size of independent variables on the dependent variable and the proportion of

TABLE 3 Model Coefficients

	Coefficient	*p-value*
C	0.111 ***	0.000
R&D	−0.018 ***	0.000
SIZE	0.010 ***	0.000
LEV	0.001	0.477
ROA	−0.020 ***	0.000
CAPITALINT	−0.063 ***	0.000
INVENTINT	−0.009	0.218

NOTE *** Significant at level 0.001.

total variability explained by the regression model. The adjusted determination coefficient indicates that 19.99% of the total variability in the effective tax rate is explained by the independent variables in the linear regression model.

The empirical results provide clear evidence that investment in R&D activities, measured through SIFIDE-approved amounts, is associated with a statistically significant reduction in the effective tax rate of Portuguese companies. This finding supports Hypothesis and suggests that firms investing in R&D tend to engage in higher levels of tax planning, partly due to the direct effect of fiscal incentives and potentially reflecting more sophisticated tax management practices associated with innovation-intensive firms.

These results are consistent with international evidence showing that R&D activities and innovation are linked to lower corporate tax burdens. Studies such as Gao et al. (2016), Pfeiffer and Spengel (2017), and Cheng et al. (2021) demonstrate that innovation-intensive firms benefit from both explicit R&D tax incentives and enhanced opportunities for tax planning strategies. The present study extends this literature by confirming that similar mechanisms operate within the Portuguese institutional framework, where SIFIDE plays a central role in supporting private R&D investment.

The negative relationship between R&D investment and the ETR can be interpreted through two complementary mechanisms. First, the mechanical effect of the SIFIDE tax credit directly reduces corporate income tax liabilities, leading to lower observed ETRs. Second, firms engaged in R&D activities are more likely to adopt forward-looking and strategic approaches to tax planning, integrating fiscal considerations into their broader innovation and investment decisions. This interpretation aligns with the view that innovative firms tend to develop greater managerial and organizational capacities, including in financial and tax management.

Regarding the control variables, the positive association between firm size and the effective tax rate suggests that larger firms may be subject to greater regulatory and political scrutiny, which can limit their ability to reduce effective tax rates. This interpretation is consistent with the political cost hypothesis, although prior empirical evidence on the relationship between firm size and effective taxation remains mixed. The negative effect of return on assets indicates that more profitable firms place greater emphasis on optimizing their tax position, while the significant impact

of capital intensity reflects the role of investment structure in shaping effective taxation. These findings are broadly in line with previous empirical studies and reinforce the robustness of the estimated model.

Overall, the results highlight the importance of R&D tax incentives not only as tools for promoting innovation but also as key elements influencing corporate tax planning behaviour. In the Portuguese case, SIFIDE emerges as a decisive factor shaping firms' effective tax rates and financial strategies.

Conclusion

Investment in R&D is a cornerstone for economic growth and business success, driving innovation at both macroeconomic and microeconomic levels. Policies such as SIFIDE in Portugal play a critical role by supporting companies in developing new technologies and innovations. At the macroeconomic level, these incentives promote long-term growth, enhance national competitiveness, and drive technological progress. At the microeconomic level, they enable companies to take greater risks, become more competitive, and thrive in an increasingly knowledge-driven global economy.

SIFIDE has proven to be an effective mechanism for stimulating R&D investment in the Portuguese business sector. By providing a deduction in assessed corporate income tax (CIT), it alleviates the financial burden on companies, empowering them to undertake riskier, long-term innovative projects. This is particularly beneficial for small and medium-sized enterprises (SMEs), which often face greater challenges in securing funding for innovation. By lowering the effective cost of R&D, SIFIDE enhances the competitiveness of Portuguese companies, encouraging innovation and investment in activities that generate new products, services, and production processes.

At the macro level, tax benefits like SIFIDE increase total R&D investment in the country, improving aggregate productivity and driving sustainable economic growth. Consistent with studies such as Hall and Van Reenen (2000), tax benefits are shown to positively influence R&D intensity, which is strongly correlated with higher productivity and economic development. At the micro level, companies leveraging these benefits are better positioned to develop new technologies, increase efficiency, and strengthen their market positions. For example, Portugal's technology sector has experienced significant growth, partially due to the strategic use of tax benefits to support technological innovation.

This study reinforces the importance of fostering R&D activities and highlights the role of fiscal incentives such as SIFIDE in shaping corporate tax outcomes. The findings indicate that R&D activities are associated with lower effective tax rates, supporting the view that investment in innovation can enhance corporate tax planning through SIFIDE´s mechanism. In addition, firm size, return on assets, and capital intensity significantly influence the effective tax rate, whereas no conclusive evidence is found for the effects of leverage and inventory intensity.

By focusing on the Portuguese context, this study contributes to the literature by providing empirical evidence on the interaction between innovation incentives, corporate taxation, and economic outcomes, offering a basis for future comparative research.

Implications for Companies: From a business perspective, the findings indicate that R&D investment supported by fiscal incentives such as SIFIDE should be viewed not only as a driver of innovation but also as a strategic component of corporate tax planning. Companies that integrate innovation, financial management, and tax planning decisions are better positioned to reduce their effective tax burden while simultaneously enhancing long-term competitiveness. This is particularly relevant for small and medium-sized enterprises, for which tax incentives can significantly reduce the cost and risk associated with R&D activities.

Implications for Policymakers: For policymakers, the results provide empirical evidence of the effectiveness of SIFIDE in stimulating private R&D investment and influencing corporate tax outcomes. However, the strong fiscal impact of this incentive also highlights the importance of complementing ex ante approval mechanisms with ex post evaluation frameworks. Monitoring the actual outcomes of approved R&D projects – in terms of innovation outputs, productivity gains, and economic impact – may help ensure that public resources are effectively allocated and that tax incentives achieve their intended objectives beyond tax savings alone.

Implications for Research: From an academic standpoint, this study contributes to the literature by linking R&D investment and tax planning within a unified empirical framework and by providing evidence from a country-specific institutional setting.

Despite its contributions, the study presents limitations that should be acknowledged. The analysis focuses exclusively on Portugal and the SIFIDE programme, which may limit the generalizability of its findings. The time period examined (2020–2022) coincides with the COVID-19

pandemic, potentially affecting the values of the variables and companies' R&D investment decisions. Furthermore, the tax planning metric, the effective tax rate, includes deferred taxes and other elements, which could influence the results. Finally, the inclusion of companies from diverse sectors may introduce variability in R&D investment behaviour.

Future research could extend this analysis by comparing fiscal incentive regimes across countries to identify international best practices. A longitudinal approach could provide deeper insights into the long-term impacts of fiscal incentives on innovation, business productivity, and sustainable economic growth. By addressing these gaps, future studies can further advance understanding of the complex interplay between R&D investment, fiscal policies, and economic development.

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Data Availability Statement

The data presented in this study is available on the website of the Portuguese Tax Authority and on the SABI database.

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