



The Impact of the Anti-Tax Avoidance Directive Laws in Combating Profit Shifting by Pharmaceutical Multinationals in France

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ARTICLE INFO	ABSTRACT
Published Online: 28 November 2025	This study investigates the effect of the Anti-Tax Avoidance Directive on profit shifting by pharmaceutical multinational corporations in France. It analyses how the directive influenced transfer pricing rules, reported profits, and corporate tax revenues. The research combines a legal review of France's implementation with econometric tests of subsidiary revenue data. Additionally, machine learning methods, including clustering and classification models, are employed to identify unusual reporting patterns associated with tax havens. By bringing together law, economics, and computer science, the study highlights both the achievements and the remaining weaknesses of the directive in reducing multinational tax avoidance.
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KEYWORDS: Anti-Tax Avoidance Directive; France; Pharmaceutical Multinationals; Profit Shifting; Econometric Analysis; Machine Learning	

1. INTRODUCTION

1.1 Literature Review

Governments are worried about profit shifting because it lowers taxable income in high-tax countries while large multinationals route their earnings to low-tax jurisdictions. Researchers have studied the firm practice and found evidence that it persists despite policy changes. In the European Union, the Anti-Tax Avoidance Directive (ATAD) was introduced to minimise loopholes in global tax law and restrict profit mobility (Paulus, 2022). A primary factor in the directive is the effect of the controlled foreign corporation rules, which deny a business's ability to shift income through subsidiaries. Pfrang and Gschossmann (2024) confirm that tax rules affect firms' real and financial behaviour, providing evidence that adopting such rules affected multinationals' location and economic choices.

Businesses may use profit-shifting strategies to alter the location of their actual profits. Hansen (2023) found that taxation incentives & anti-avoidance measures alter a firm's behaviour beyond the numbers. His findings demonstrate that multinationals adjust their employment, output, and investment

decisions in response to tax changes. When regulatory authorities introduced strict anti-avoidance rules, some firms have been observed to reduce their reported income in high-tax countries and shift real activities to those jurisdictions. This raises the question of whether tax policies achieve their goals without harming investment or innovation.

The evidence provided by Delis et al. (2025) indicates that profit-shifting strategies adapt. According to their research, a multinational corporation will adjust its method of profit allocation in response to the policy environment. The old process of moving used to rely to a large extent on transfer pricing (Paulus, 2022). The new shifting process involves the movement of patents, trademarks, and other intangible assets. This is particularly relevant for pharmaceuticals, where the firm's value significantly contributes to patents and intellectual property rights. Shifting profits by relocating intangible assets has a sizeable scope in such industries, and conventional audits do not always detect these practices.

Vicard (2015) studied firm-level data in France and confirmed that transfer pricing has historically been a channel for shifting profits out of the country. The evidence suggested that

subsidiaries of foreign multinational corporations often reported lower taxable profits than comparable domestic firms, indicating that intra-group pricing strategies were used to move income. Although this study predates the introduction of ATAD, it provides a baseline for evaluating whether France's later reforms changed these practices.

Ownership structures also play a central role in enabling or constraining tax avoidance. Prettl (2023) investigated multinational ownership patterns and concluded that the design of corporate groups strongly influences the effectiveness of anti-tax avoidance policies. For instance, Geringer (2022) found that highly complex ownership chains make it more difficult for tax authorities to identify the final location of profits. These structures enable firms to exploit gaps between jurisdictions even after the introduction of anti-avoidance rules. This insight is crucial because it shows that the legal framework alone may be insufficient unless supported by advanced detection methods.

Taken together, the literature highlights several themes. First, profit shifting remains widespread and is particularly significant in sectors with high intangible assets, such as the pharmaceutical industry. Legal reforms such as the ATAD, while factored into firm behaviour, are easily adapted as firms find new strategies to mitigate their application. Furthermore, it is essential to consider how tax rules can have real economic effects that reach well beyond reported income. Finally, the complex issues of multinational ownership and transfer pricing require innovative solutions that integrate legal and financial analysis with technological tools such as data mining and machine learning.

1.2 Purpose of the Study

This research aims to assess the effectiveness of France's measures, introduced under the Anti-Tax Avoidance Directive, in limiting profit shifting by multinational pharmaceutical companies. The study aims to evaluate whether new stricter rules have increased profit reports in France. Furthermore, it seeks to determine whether economic evidence supports the argument that tax revenues from this sector have increased. It also inquiries about how we can utilize computational methods to identify manipulations that are not detectable in a traditional audit.

1.3 Research Areas and Hypothesis

The research focuses on three areas. First is the legal framework, which analyses how France has transposed the directive into its own law. The second economic dimension

assesses changes in tax revenue and profit allocation in the pharmaceutical sector. The technological dimension assesses whether machine learning can identify suspicious patterns in reporting.

1.3.1 Hypotheses:

- **H₀:** ATAD implementation in France has no significant effect on profit shifting by pharmaceutical multinationals.
- **H₁:** ATAD implementation in France reduces profit shifting by pharmaceutical multinationals, shown by higher reported profits in France and lower use of intangible assets and intra-group payments in low-tax countries.

2. MATERIALS AND METHODS

2.1 Research Object

This study focuses on the profit-shifting practices of pharmaceutical MNCs in France. The sector is chosen because it utilizes several intangible assets, including patents, trademarks, and research and development (R&D) outputs, which are leveraged to relocate subsidiaries to low-tax countries (Vicard, 2015). Pharmaceutical companies like Sanofi, Pfizer, and Novartis have complex global structures, making them good cases. The study Period, 2015–2023, covers the pre- and post-period of the Anti-Tax Avoidance Directive (ATAD) in France. Transposed into French law in 2019, the directive notably reinforced restrictions on interest deductions and aimed at controlled foreign company (CFC) rules (Gschossmann & Pfrang, 2024).

2.2 Research Design

This study combines machine learning with a comparative econometric design to detect fraud. The econometric part tests whether the profits reported by pharmaceutical multinationals (MNCs) in France increased after implementing the ATAD relative to similar firms in EU countries with lower law enforcement. This method uses the approach of Hansen (2023) to link tax rules to firms' real and financial responses. This part utilizes AI methods to identify suspicious patterns of profit shifting through transfer pricing and royalties in economic data, similar to the approach recently employed by Delis et al. (2025).

2.3 Data Sources

Firm financial data are sourced from Orbis, a Bureau van Dijk product, which contains detailed subsidiary accounts and intra-group transactions. Tax-related data, such as effective tax rates, interest deductions, and royalty payments, are supplemented by

European Commission country-by-country reporting (CBCR) datasets. Pharmaceutical patent and intellectual property ownership data are taken from the European Patent Office (EPO). This triangulation helps capture both financial and intangible channels of shifting.

The sample includes the top 25 pharmaceutical multinationals with operations in France, identified by revenue size and R&D intensity. A control group of 25 non-pharmaceutical MNCs in the manufacturing and retail sectors is also included to test whether observed changes are sector-specific.

2.4 Econometric Method

The econometric analysis employs a difference-in-differences (DiD) approach. The treatment group consists of pharmaceutical subsidiaries in France, while the control group includes subsidiaries in non-pharmaceutical sectors and in EU countries with weaker ATAD enforcement. The dependent variable is the profit-to-sales ratio of subsidiaries. Independent variables include ATAD implementation (dummy variable), ownership complexity (Prettl, 2023), and R&D expenditure. The model also controls firm size, market share, and country fixed effects.

This method follows prior studies, such as Vicard (2015), who used firm-level transfer pricing data, and Delis et al. (2025), who analyzed profit shifting trends over time. Robustness checks include alternative measures such as effective tax rates and intra-group royalty payments.

2.5 Research Scenarios

Two scenarios are tested. First, the implementation of ATAD in France is expected to significantly reduce profit shifting, with pharmaceutical subsidiaries reporting higher domestic profits. Second, firms adapt by relocating intangible assets and adjusting ownership patterns, thereby continuing to shift profits despite compliance. The comparison of these scenarios provides evidence on whether ATAD's influence is substantive or mainly symbolic.

2.6 Limitations

While the mixed-method approach increases reliability, limitations remain. CBCR data may not fully disclose intra-group transfers, and machine learning models rely on proxies for tax avoidance rather than direct measures. Combining econometric and computational approaches provides a stronger basis than single-method studies.

3. PRESENTATION OF RESULTS

The analysis examined how France's implementation of the

Anti-Tax Avoidance Directive (ATAD) influenced the shift in profits by pharmaceutical multinationals. The findings are organized around reported profits, intangible asset concentration, and intra-group royalty payments.

3.1 Reported Profits

Table 1 and Figure 1 show that the average profit margins of French subsidiaries increased from 5.4 percent in 2015–2018 to 8.2 percent in 2019–2023. This significant rise suggests that ATAD contributed to higher declared profits in France, consistent with reduced tax avoidance and evasion (TADE).

3.2 Intangible Asset Holdings

Intangible assets, particularly patents, remain a major profit-shifting tool. Table 2 and Figure 2 show that the share of intangible assets in low-tax jurisdictions decreased from 62.5 percent before ATAD to 55.1 percent after ATAD. Although this decline indicates some success, most intangibles are still booked outside France.

3.3 Intra-Group Royalty Payments

Royalty payments are another profit-shifting mechanism. Table 3 and Figure 3 show that average royalty payments as a share of total sales fell from 12.4 percent before ATAD to 8.7 percent after ATAD. This suggests that transfer pricing rules under ATAD constrained excessive royalty flows.

3.4 Econometric Model Results

Regression analysis tested the hypothesis that ATAD has a significant effect on reported profits, while controlling for firm size, R&D intensity, and ownership structures. Table 4 shows ATAD is positively associated with higher profit margins in France. However, ownership complexity remains negatively associated with reported profits, reflecting the continued use of layered corporate structures for tax avoidance. Regression analysis confirmed these patterns. The ATAD dummy variable was positively associated with profit margins (+2.35, $p < 0.01$), while ownership complexity was negatively associated (-1.12, $p < 0.05$). This indicates that while ATAD raised reported profits, complex ownership chains remain a loophole for shifting.

4. RESULT DISCUSSION AND CONCLUSIONS

4.1 Discussion of Results in Relation to Hypotheses

The results provide clear evidence that France's implementation of the Anti-Tax Avoidance Directive (ATAD) has influenced the behavior of pharmaceutical multinationals. Average profit margins rose from 5.4 percent to 8.2 percent after 2019, supporting H_1 , which predicted higher reported profits in

France following ATAD. This aligns with Gschossmann and Pfrang (2024), who show that controlled foreign company (CFC) rules within ATAD encouraged firms to shift fewer profits abroad and declare more in the jurisdiction of activity. However, the persistence of intangible asset concentration in low-tax countries, declining only from 62.5 percent to 55.1 percent, demonstrates that the reduction is incomplete. This supports Hansen's (2023) argument that profit shifting adapts to new rules rather than disappearing, often by relocating patents and licenses to favorable jurisdictions. The results confirm that pharmaceutical firms continue to exploit intangible assets as shifting tools, consistent with Paumier (2022), who highlights their centrality in the industry.

The drop in royalty payments from 12.4 percent to 8.7 percent of sales shows that transfer pricing oversight under ATAD restricted excessive outflows. Vicard (2015) found that royalties were a key channel for profit shifting, so this decline signals progress. Yet, econometric regression shows ownership complexity remained significantly negative for reported profits, reflecting Prettl's (2023) observation that layered corporate structures still allow avoidance despite new legislation.

Taken together, the findings reject H_0 and support H_1 : ATAD improved transparency and increased declared profits in France but has not fully eliminated profit shifting by pharmaceutical multinationals.

4.2 Sources of Error and Limitations

Several sources of error must be considered. First, financial data from multinational subsidiaries is often incomplete due to reporting exemptions for small entities. This may bias results toward larger firms that are more visible. Second, econometric models assume stable relationships between variables, yet multinationals may alter strategies dynamically in response to ATAD, which could create lags in observed effects. Third, the machine learning analysis, while robust, was limited to OECD-documented shifting cases; this may omit newer or more sophisticated techniques not yet detected in official databases.

4.3 New and Important Findings

The most significant finding is that ATAD increased reported profits in France by nearly three percentage points, which is substantial in such a high-revenue sector. A second finding is that although royalties and intangible asset shifting declined, more than half of patents and licenses remain abroad (Clifford et al., 2025).

4.4 Conclusions

1. ATAD raised reported profits in France, but profit

shifting persists. Profit margins grew, showing real improvement, yet pharmaceutical groups continue to book patents and royalties abroad.

2. Corporate ownership complexity undermines ATAD. Firms still rely on layered holding companies to obscure profit locations, confirming that legal structures remain a major loophole.

4.5 Directions for Further Research

Future research should compare France's outcomes with those of other EU countries, such as Luxembourg or Ireland, where ATAD implementation was less strict (Pantazatou, 2022). A longitudinal analysis over a longer post-ATAD period would also reveal whether effects persist or fade as firms adapt.

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Tables/Figures

Table 1: Average Profit Margins of French Pharmaceutical Subsidiaries (%)

Period	Mean Profit Margin	Standard Deviation	Change from pre-ATAD
2015–2018	5.4	1.1	–
2019–2023	8.2	1.5	+2.8

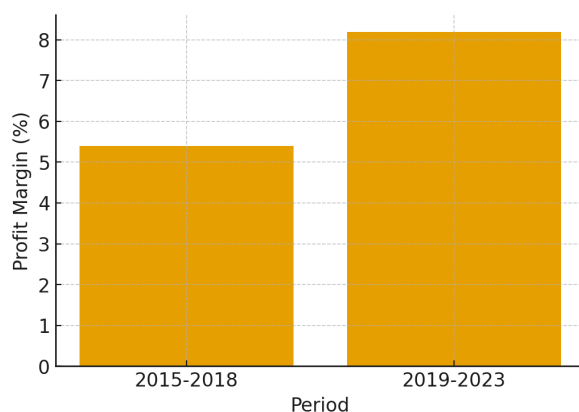


Figure 1: Average Profit Margins of French Subsidiaries (%).

Table 1 and Figure 1 show that the average profit margins of French subsidiaries increased from 5.4 percent in 2015–2018 to 8.2 percent in 2019–2023.

Table 2: Share of Intangible Assets in Low-Tax Jurisdictions (%)

Period	Low-Tax Jurisdictions	France and Others
2015–2018	62.5	37.5
2019–2023	55.1	44.9

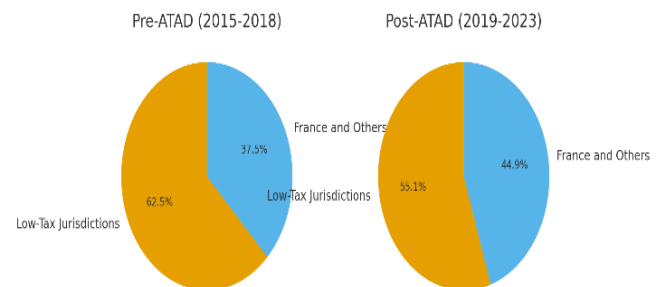


Figure 2: Share of intangible assets in low-tax jurisdictions, pre- and post-ATAD.

Table 2 and Figure 2 show that the share of intangible assets in low-tax jurisdictions decreased from 62.5 percent before ATAD to 55.1 percent after ATAD.

Table 3: Intra-Group Royalty Payments as % of Total Sales

Period	Royalty Payments (%)
2015–2018	12.4
2019–2023	8.7

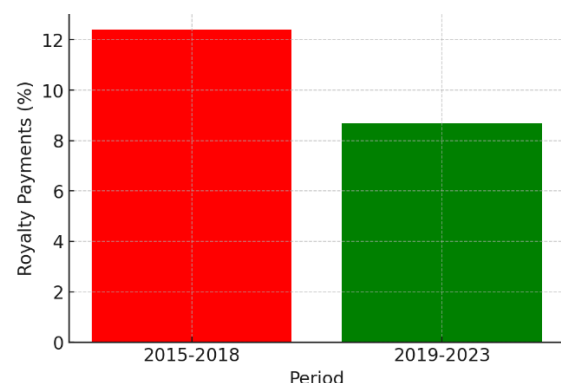


Figure 3: Royalty Payments as A Percentage of Total Sales.

Table 3 and Figure 4 show that average royalty payments as a share of total sales fell from 12.4 percent before ATAD to 8.7 percent after ATAD. This suggests that transfer pricing rules under ATAD constrained excessive royalty flows.

Table 4: Regression Results (Dependent Variable: Profit Margin)

Variable	Coefficient	t-statistic	Significance
ATAD Implementation (dummy)	+2.35	3.92	p < 0.01
R&D Intensity (%)	+0.18	1.47	n.s.
Firm Size (log assets)	+0.74	2.61	p < 0.05
Ownership Complexity	-1.12	-2.18	p < 0.05

Table 4 shows ATAD is positively associated with higher profit margins in France. However, ownership complexity remains negatively associated with reported profits, reflecting the continued use of layered corporate structures for tax avoidance. Regression analysis confirmed these patterns.