Applying the Exploratory Factor Analysis Approach in Ranking Key Indicators of Tax Avoidance in Industries

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Abstract

One of the key topics in accounting is the investigation of factors influencing tax avoidance and its metrics, which are closely related to the concept of evaluating corporate tax planning. The statistical data for calculating 12 effective tax rates included companies listed on the stock exchange over a five-year period (2011 to 2015). During this period, the relative stability of laws, which is essential for a uniform assessment environment, was more prevalent than in the following years. Considering the tax figures presented in the tax returns and those finalized through tax audits, the results of exploratory factor analysis revealed that the highest repetition of factor loadings occurred with long-term accrued and paid taxes. Therefore, by taking into account the finalized tax figures, the difference between the cash effective tax rate (TA_Cash_ETR) had the highest explanatory power, while the difference between accounting profit and taxable income (Perm) had the lowest. When considering the declared tax figures, the two criteria of cash effective tax rate difference (TA_Cash_ETR) and the three-year cash effective tax rate (Cash_ETR3) had the highest, and permanent differences based on discretionary accruals (DTAX) had the lowest explanatory power. In other words, these criteria have the highest and lowest relevance concerning the measurement of tax avoidance in companies operating in Iran's economic environment. Given that tax regulations in a specific industry may differ from those in another, it is preferable to focus on the criterion with the highest explanatory power and greatest relevance when researching tax avoidance. The clear characteristic of these factors is that considering a multi-year long-term period, while reducing statistical errors, yields more reliable and appropriate results compared to a single fiscal year. Overall, the long-term cash effective tax rate, adjusted by the industry in which the company operates, is a more suitable criterion for measuring and evaluating tax avoidance. On the other hand, although considering finalized company figures is important for measuring the research objective, the declared figures in the tax return are also effective and reliable.

Keywords: *Corporate Income Tax, Tax Avoidance, Effective Tax Rate.*

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1. Introduction

Tax avoidance is a well-explored yet highly nuanced area within the fields of economics and finance, as it entails both the legal and strategic dimensions of minimizing tax liabilities while complying with the law. Its implications touch on corporate governance, financial performance, and even broader socio-economic factors such as inequality and public trust. While tax avoidance is sometimes viewed as a legitimate business strategy aimed at reducing expenses, it is also perceived negatively by stakeholders who question its ethical ramifications and broader societal impact [1]. The complexity of tax avoidance is further exacerbated by differing regulatory environments across countries and industries, as well as by companies' varying access to tax planning tools, making it a dynamic and multifaceted research subject.

Tax avoidance has gained increasing attention in academic and regulatory circles due to its implications for government revenue and corporate accountability. From a corporate governance perspective, tax avoidance reflects companies' strategic decision-making to enhance shareholder value by minimizing tax burdens [2]. However, there is often a fine line between legal tax avoidance and illegal tax evasion, which makes the ethical considerations surrounding this issue particularly challenging [3, 4].

Several factors influence a company's likelihood of engaging in tax avoidance, including profitability, capital intensity, firm size, and governance structures [5, 6]. Studies have shown that firms with greater capital intensity, for instance, tend to have more opportunities to utilize depreciation allowances to reduce taxable income [7, 8]. Additionally, firms with larger assets may have more resources to engage in sophisticated tax planning activities, often utilizing tax havens to further reduce tax liabilities [9].

A company’s profitability also plays a crucial role in tax avoidance. Firms with higher profits face greater incentives to engage in tax minimization strategies to enhance their bottom line [10]. This dynamic is particularly relevant for multinational corporations that operate in multiple jurisdictions with varying tax regulations. Studies have shown that such firms often exploit international tax structures to shift profits to lower-tax jurisdictions, thereby reducing their overall tax burden [11, 12].

Moreover, governance factors such as executive compensation and ownership structures have been linked to tax avoidance practices. Executives with significant stock options or ownership stakes in their firms may be more inclined to engage in tax avoidance to boost after-tax profits and thus increase the value of their holdings [13]. Independent boards and strong corporate governance mechanisms, on the other hand, may serve as mitigating factors that limit aggressive tax avoidance strategies [14, 15].

Tax avoidance is often analyzed through the lens of agency theory, which suggests that there is an inherent conflict of interest between managers (agents) and shareholders (principals). Managers may engage in tax avoidance to enhance short-term financial performance, which can benefit their compensation packages, particularly if these are linked to profitability metrics [13]. However, aggressive tax avoidance can expose firms to significant risks, including regulatory scrutiny and reputational damage, which may not align with the long-term interests of shareholders [16]. This tension between short-term incentives and long-term corporate sustainability is a recurring theme in tax avoidance research.

In addition to agency theory, institutional theory also offers valuable insights into tax avoidance. This theory posits that firms' behaviors, including tax avoidance practices, are shaped by the institutional frameworks in which they operate [17]. For example, firms in countries with weak regulatory oversight or less stringent tax enforcement may be more likely to engage in aggressive tax avoidance [18, 19]. On the other hand, in countries where tax authorities have greater enforcement capabilities, firms may adopt more conservative tax strategies to avoid penalties and maintain good standing with regulators [20].

Corporate governance structures play a critical role in shaping a firm’s tax avoidance strategies. Strong governance frameworks, characterized by independent boards and transparent decision-making processes, are often associated with lower levels of tax avoidance [21]. For instance, independent commissioners can provide oversight and reduce the likelihood of management engaging in aggressive tax planning [14]. Furthermore, firms with better governance are more likely to prioritize long-term sustainability over short-term profit maximization, reducing the propensity for tax avoidance [22].

However, governance structures are not uniform across firms or industries, and the effectiveness of governance mechanisms can vary. For example, in some industries, particularly those that are capital-intensive, executives may have more discretion in tax planning due to the complexity of tax regulations and the availability of tax deductions related to capital expenditures [7, 9]. In such cases, independent governance structures may not be as effective in curbing tax avoidance.

The economic environment and regulatory framework of specific industries also influence tax avoidance practices. For instance, capital-intensive industries, such as mining and manufacturing, often have more opportunities for tax avoidance due to the availability of various tax incentives and allowances related to depreciation and investment [23]. These industries typically invest heavily in fixed assets, which allows them to utilize tax depreciation rules to minimize taxable income [24]. Furthermore, studies have shown that firms in these sectors are more likely to engage in earnings management, further complicating the measurement of their tax liabilities [25].

Moreover, firms in industries that are subject to rapid technological changes or operate in highly competitive environments may have stronger incentives to engage in tax avoidance to maintain profitability and competitive advantage [26]. For example, technology firms, which often have high levels of intangible assets, may be more adept at shifting profits to low-tax jurisdictions by exploiting loopholes in international tax rules [20].

Globalization has further complicated the landscape of tax avoidance, particularly for multinational corporations. The ability to shift profits across borders and exploit differences in tax regimes has led to growing concerns about base erosion and profit shifting (BEPS) [17]. Multinational firms often engage in transfer pricing, where they manipulate the prices of intra-firm transactions to shift profits from high-tax to low-tax jurisdictions [27]. The use of tax havens, where companies can legally shift profits without incurring significant tax liabilities, has also become a widespread practice [9].

International efforts to curb tax avoidance, such as the OECD’s BEPS initiative, aim to address these practices by tightening regulations on transfer pricing and increasing transparency in multinational corporations' tax reporting [28]. However, the effectiveness of these measures varies across jurisdictions, and enforcement remains a challenge, particularly in emerging economies where regulatory capacity may be limited [17].

While much of the existing literature has focused on the determinants of tax avoidance, there is still a need for more comprehensive studies that consider the interaction between various factors such as corporate governance, industry characteristics, and economic environments. Furthermore, while previous research has predominantly used regression-based methods to analyze tax avoidance, this study introduces exploratory factor analysis (EFA) as a novel approach to ranking key indicators of tax avoidance. This study aims to explore the application of exploratory factor analysis (EFA) to rank key indicators of tax avoidance in various industries, offering a methodologically robust approach to identifying the most significant factors influencing tax avoidance behavior. By incorporating both short-term and long-term perspectives, as well as considering unique industrial contexts, this research contributes to the growing body of knowledge on how businesses mitigate tax liabilities and the associated economic consequences.

2. Methodology

This research is descriptive-correlational in nature, with an applied objective and a post-event methodology. It was conducted primarily through a library research method and document analysis. Exploratory factor analysis was employed for inferential statistical analysis. The required accounting data were extracted from financial statements, audit reports, and explanatory notes, while part of the necessary information was obtained through fieldwork from tax files available in the database of the National Tax Administration. Additionally, consultation with experts and a review of regulations and issued directives were part of the research process.

The research covers a five-year period between 2011 and 2015. This period was chosen because, under the Sixth Development Plan of the country, the legal and regulatory environment was relatively stable compared to subsequent years. From 2016 onward, numerous factors affecting corporate taxation, such as the lifting of currency obligations, emerged due to prevailing economic conditions. The sample selection was carried out through systematic elimination sampling, following the criteria outlined below.

1. The companies were listed on the Tehran Stock Exchange before 2011.
2. Their taxable income was confirmed by an examination of their books and records.
3. The companies were not loss-making or experiencing negative operating cash flow during the research period.
4. The companies were not part of investment industries, banks and credit institutions (banking), insurance, agriculture and related services, or real estate development.

5. The companies did not cease operations during the study period.
6. The necessary data for the research were available and accessible for the companies.
7. The fiscal year ended on December 20 of each year, and there was no change in the fiscal year during the period under review.

2.1. Definition of Variables and Calculation Method

- **Accrued Effective Tax Rate (GAAP ETR):** Calculated by dividing the performance tax by accounting profit before tax.
- **Current Accrued Effective Tax Rate (Current GAAP ETR):** Affects accounting income when items impacting the current effective tax rate are not temporary differences.
- **5-Year Accrued Effective Tax Rate (Long-run GAAP ETR5):** The sum of current taxes over five years divided by the sum of book profits before tax.
- **Differential Effective Tax Rate (ETR Differential):** The difference between the statutory tax rate and the accounting effective tax rate.
- **Cash Effective Tax Rate (Cash ETR):** Cash taxes paid divided by book profit before tax for each year.
- **Long-Term Cash Effective Tax Rate (Long-run Cash ETR):** The total cash taxes paid over several years divided by the accounting profit before tax for those years, excluding special items.
- **Cash Tax Ratio:** The ratio of cash taxes paid to operating cash flow for the year.
- **Three-Year Cash Effective Tax Rate Adjusted by Industry Average (Cash ETR3 _ INDi,p):** The three-year average of the cash effective tax rate adjusted by the industry average.
- **Differential Cash or Accrued Effective Tax Rate (TA_Cash ETR and TA_GAAP ETR):** The difference between the industry's three-year average effective tax rate (either cash or accrued) and the company's corresponding effective tax rate.
- **Discretionary Accruals-Based Permanent Differences (DTAX):** The unexplained portion of the ETR differential, including the difference between the accrued ETR and the statutory rate.
- **Permanent Book-Tax Differences (PermBTD):** The permanent difference between book income and taxable income resulting from differences between permanent and temporary items.

2.2. Research Hypotheses

Given that various studies have utilized different criteria for evaluating tax avoidance, hypotheses are developed as follows to determine whether the selection of a particular criterion from those mentioned influences the results regarding corporate tax avoidance in general and across different industries specifically. The goal is to assess whether there is a significant difference among the criteria used to measure tax avoidance and, if so, to determine the most appropriate criterion for each industry.

Accrual-Based Hypotheses:

1. To evaluate tax avoidance across different industries, the accrued effective tax rate (GAAP ETR) has greater explanatory power than other rates.
2. To evaluate tax avoidance across different industries, the differential accrued effective tax rate (TA_GAAP_ETR) has greater explanatory power than other rates.
3. To evaluate tax avoidance across different industries, the 5-year accrued effective tax rate (Long_GAAP_ETR) has greater explanatory power than other rates.
4. To evaluate tax avoidance across different industries, the current accrued effective tax rate (Current_GAAP_ETR) has greater explanatory power than other rates.
5. To evaluate tax avoidance across different industries, the differential effective tax rate (ETR_Differential_Gaap) has greater explanatory power than other rates.

Cash Flow-Based Hypotheses 6. To evaluate tax avoidance across different industries, the differential cash effective tax rate (TA_Cash_ETR) has greater explanatory power than other rates. 7. To evaluate tax avoidance across different industries, the long-term cash effective tax rate (Longrun_cash_ETR) has greater explanatory power than other rates. 8. To evaluate tax avoidance across different industries, the three-year cash effective tax rate (Cash_ETR3) has greater explanatory power than other rates. 9. To evaluate tax avoidance across different industries, the cash tax ratio (Cash_tax_ratio) has greater explanatory power than other rates. 10. To evaluate tax avoidance across different industries, the cash effective tax rate (Cash ETR) has greater explanatory power than other rates.

Differential-Based Hypotheses 11. To evaluate tax avoidance across different industries, the permanent book-tax differences (PermBTD) have greater explanatory power than other rates. 12. To evaluate tax avoidance across different industries, the discretionary accruals-based permanent differences (DTAX) have greater explanatory power than other rates.

3. Findings

Permanent differences based on discretionary accruals are calculated as follows:

$$a_0 + a_1 INTAG_{it} + a_2 UNCON_{it} + a_3 MI_{it} + a_4 CSTE_{it} + a_5 \Delta NOL_{it} + a_6 LAGPERM_{it} + \varepsilon_{it}$$

INTANG represents intangible assets used to control for non-discretionary permanent differences. UNCON is the reported profit or loss, and MI represents the minority share of profit or loss, specifically referring to minority interests associated with the difference between financial accounting and tax regulations relevant to owner interests. This is because accounting profit is not reduced by local taxes, whereas taxable profit is reduced by certain expenses resulting from non-discretionary permanent differences. CSTE refers to the current expense of local income tax, NOL represents changes in the net operating loss carryforward, and LAGPERM is the permanent difference from the previous year. To investigate multicollinearity among the research variables, the VIF index was calculated. In the absence of multicollinearity among the variables, this index is expected to be less than 10. For the models in question, there was no multicollinearity among the variables.

To calculate the DTAX variable (details of the tax difference calculated according to the law and tax reported according to the company's financial statements, segregated into discretionary and non-discretionary items), a panel regression model was fitted using the regression equation, and the target variable was derived from the residuals of this model. To fit the appropriate model, F-Limer and Hausman tests were initially used to select the best model among the simple regression model, fixed effects panel model, and random effects panel model. After fitting the regression model, underlying assumptions, including stationarity of the residuals, homoscedasticity, and lack of serial autocorrelation in the model's residuals, were examined. To select the best model for fitting, the combination test was evaluated, and upon confirmation, the effect test was conducted. Using the Chow test, the simple OLS regression model was compared with the panel regression model. According to the results, the null hypothesis of cross-sectional homogeneity and equal intercepts was rejected, indicating that group effects were accepted, and different intercepts must be considered in the estimation. As a result, the panel data method is preferred over the pooled data method. Using the Hausman test, we compared and selected the best model between fixed and random effects regressions. According to the Hausman test results, the null hypothesis of no correlation between the error component related to the intercept and explanatory variables is accepted, indicating no bias problem between the error component and explanatory variables. Therefore, the random effects method is preferred over the fixed effects method.

Table 1. Model Testing Results

Test	Statistic	Value	Degrees of Freedom	Probability	Result
Chow Combinability Test	F Limer	1.545	(179, 616)	0.0000	Panel Model
Hausman Test (Effect Test)	Chi-square	1.100	5	0.954	Random Effects
Heteroskedasticity Test	Breusch-Pagan	18.47	5	0.0024	Heteroscedasticity
Serial Correlation Test	Chi-square	0.187	1	0.665	No Serial Correlation
Stationarity Test	Dickey-Fuller	-9.36	9	0.01	Stationarity Confirmed

It is observed that the stationarity of the model's residuals is confirmed, with the only underlying hypothesis that could not be verified being the homoscedasticity assumption. To address this, heteroscedasticity was resolved using the Generalized Least Squares (GLS) method for final model fitting. The final results of the panel regression model with random effects and GLS show that the Fisher statistic of the model is greater than the critical value and its probability is less than the 5% significance level. Thus, the model is significant in terms of linear relationships, meaning that a significant relationship is expected between the dependent variable and at least one explanatory variable. Furthermore, the McFadden R-squared is 0.98, indicating an effective relationship between the independent and dependent variables. Ultimately, using the estimated regression coefficients, the residuals of the model were calculated and considered the DTAX variable.

Table 2. Results of the Generalized Random Effects Panel Regression Model

Explanatory Variables	Coefficients	Standard Error	t-Statistic	p-Value
(Intercept)	5327.000	16129.000	0.330	0.741
INTANG	0.018	0.161	0.113	0.910
UNCON	0.957	0.008	118.84	<0.001
CSTE	-4.230	0.042	-100.41	<0.001
NOL	0.000	0.004	-0.028	0.978
LAGPERM	0.029	0.008	3.550	0.000
R-squared	0.98			
Test Statistic	4.8e+15			<0.001

For further examination, the model was also fitted using the reported tax figures, and the residuals of the model were again considered the DTAX variable. The test results are as follows:

Table 3. Model Testing Results (Reported Tax Figures)

Test	Statistic	Value	Degrees of Freedom	Probability	Result
Chow Combinability Test	F Limer	3.098	(179, 615)	<0.001	Panel Model
Hausman Test (Effect Test)	Chi-square	1368.5	5	<0.001	Fixed Effects
Heteroskedasticity Test	Breusch-Pagan	230.89	5	<0.001	Heteroscedasticity
Serial Correlation Test	Chi-square	32.90	1	<0.001	No Serial Correlation
Stationarity Test	Dickey-Fuller	-9.36	9	0.01	Stationarity Confirmed

It is observed that the hypotheses of homoscedasticity and no serial correlation are rejected. Therefore, to prevent spurious regression, the final model is fitted using the Generalized Least Squares (GLS) method. The final results of the fixed effects panel model with GLS are presented in Table 4. Since the Fisher statistic of the model is greater than the critical value and its probability is less than the 5% error level, the model is significant in terms of linear relationships. Furthermore, the McFadden R-squared is 0.86, indicating that the independent and control variables effectively explain the changes in the dependent variable.

Table 4. Results of the Generalized Fixed Effects Panel Regression Model

Explanatory Variables	Coefficients	Standard Error	t-Statistic	p-Value
(Intercept)	0.467	0.697	0.670	0.503
INTANG	1.454046	0.701847	2.0717	0.03871
UNCON	0.855164	0.030932	27.6468	<0.001
CSTE_stated	-3.29923	0.203465	-16.215	<0.001
NOL	0.007813	0.015056	0.5189	0.60401
Lagperm01	0.030045	0.024352	1.2338	0.21775
R-squared	0.86			
Test Statistic	4.49e+15			<0.001

In this section, the significance coefficients of each variable are examined. This method seeks to summarize the variables into several factors. To conduct exploratory factor analysis (EFA) and extract and examine the significance of factors, the Principal Components Analysis method in SPSS was used. To determine the number of factors to extract, several rules were proposed, with Kaiser's criterion being the most common. In this method, factors with eigenvalues equal to or greater than 1 are considered. Varimax orthogonal rotation was used for factor rotation, ensuring that the highest correlation between variables and factors is established column-wise in the rotated factor matrix. In this matrix, each variable is assigned to the factor with which it has the highest correlation. The matrix elements (factor loadings) indicate the degree of correlation between the variables and the factors.

Table 5. Factor Loadings Based on Confirmed Tax Figures

Criterion	Factor 1	Factor 2	Factor 3	Factor 4	Explained Variance	Rank

Long_GAAP_ETR	0.915				0.875	2
TA_GAAP_ETR	-0.893				0.619	9
GAAP_ETR	0.837				0.835	4
ETR_Differential_Gaap	-0.837				0.835	4
Longrun_cash_ETR		0.894			0.837	3
Cash_ETR3		0.873			0.832	5
Cash_ETR		0.772			0.678	7
Current_GAAP_ETR			-0.836		0.710	6
Perm			0.789		0.240	11
TA_Cash_ETR				-0.735	0.882	1
Cash_tax_ratio				0.730	0.566	10
DTAX				0.455	0.664	8

Table 6. Factor Loadings Based on Reported Tax Figures

Criterion	Factor 1	Factor 2	Factor 3	Factor 4	Explained Variance	Rank
TA_Cash_ETR	-0.956				0.930	1
Cash_ETR3	0.956				0.930	1
Longrun_cash_ETR	0.948				0.913	4
TA_GAAP_ETR	-0.816				0.667	8
Cash_ETR	0.530				0.465	9
GAAP_ETR		0.960			0.928	2
ETR_Differential_Gaap		-0.960			0.925	3
Long_GAAP_ETR		0.848			0.758	6
Perm		0.370			0.673	7
DTAX			0.773		0.312	11
Current_GAAP_ETR			-0.490		0.398	10
Cash_tax_ratio				0.898	0.822	5

The results differ slightly between confirmed tax figures and reported tax figures, though four constructs are identified in both cases. The effective tax rates, with varying factor loadings and explanatory coefficients, fall under these four constructs. In the first case, the five-year current accrual-based effective tax rate, long-term effective tax rate, current accrual-based effective tax rate, and cash effective tax rate differential are identified under the first through fourth constructs. In the second case, the cash effective tax rate differential, three-year cash effective tax rate, two accrual-based effective tax rates, the differential effective tax rate, discretionary permanent differences, and cash tax ratio are identified under the first through fourth constructs.

Table 7. Constructs Based on Confirmed and Reported Tax Figures

Factor	Construct Based on Confirmed Tax Figures	Construct Based on Reported Tax Figures
First	Long-term accrual-based tax	Industry-adjusted long-term cash taxes
Second	Long-term cash taxes	Current accrual-based taxes
Third	Adjusted current accrual-based taxes	Discretionary permanent differences
Fourth	Industry-adjusted long-term cash taxes	Current cash taxes

It is evident that considering a multi-year period (shifting the time frame from annual to multi-year) reduces statistical errors, provides more informative content, and yields more reliable and appropriate results compared to using a single fiscal year. Two constructs are based on accrual items, and two are based on cash flow, indicating that tax avoidance through accrual and cash items is more evident in the long term. Specifically, within a single fiscal year, tax liabilities can be deferred and transferred to the future. Another factor is the industry context, implying that tax avoidance opportunities differ between industries. Although the laws and regulations are the same for all companies, the unique rules governing each industry allow for different legal facilities to be utilized. Hence, when assessing the explanatory power of effective tax rates, the factor loadings in their respective constructs and their ranking of explanatory coefficients indicate their importance. Based on the tables summarizing the results of the exploratory factor analysis for different industries, the hypotheses were analyzed.

Table 8. Comparative Table of Factor Loadings of Variables by Industry (Explanatory Power by Industry) Based on Confirmed and Reported Company Data (C = Confirmed, R = Reported)

Criterion	Metal Mining	Automotive & Parts	Pharmaceutical	Computer	Non-Metallic Minerals	Cement	Food Industries	Oil Products	Basic Metals	Ceramic & Tiles	Chemical Products
Accrued Effective Tax Rate	.998 (C) .921 (R)	.998 (C) .951 (R)	.951 (C) .962 (R)	.999 (C) .982 (R)	.979 (C) .999 (R)	.933 (C) .963 (R)	.993 (C) .996 (R)	.947 (C) .955 (R)	.963 (C) .939 (R)	.994 (C) .983 (R)	.945 (C) .922 (R)
5-Year Accrued Effective Tax Rate	.883 (C) .872 (R)	.883 (C) .976 (R)	.675 (C) .853 (R)	.997 (C) .943 (R)	.705 (C) .952 (R)	.874 (C) .942 (R)	.804 (C) .949 (R)	.704 (C) .953 (R)	.968 (C) .864 (R)	.942 (C) .940 (R)	.981 (C) .874 (R)
Current Accrued Effective Tax Rate	.861 (C) .938 (R)	.861 (C) .830 (R)	.938 (C) .938 (R)	.810 (C) .998 (R)	.843 (C) .994 (R)	.925 (C) .899 (R)	.622 (C) .823 (R)	.647 (C) .913 (R)	.689 (C) .667 (R)	.930 (C) .982 (R)	.982 (C) .973 (R)
Differential Effective Tax Rate	.990 (C) .901 (R)	.990 (C) .951 (R)	.951 (C) .962 (R)	.999 (C) .982 (R)	.979 (C) 1.000 (R)	.946 (C) .968 (R)	.993 (C) .990 (R)	.944 (C) .983 (R)	.969 (C) .940 (R)	.995 (C) .980 (R)	.945 (C) .925 (R)
Cash Effective Tax Rate	.837 (C) .971 (R)	.837 (C) .869 (R)	.844 (C) .781 (R)	1.000 (C) .998 (R)	.983 (C) .922 (R)	.882 (C) .876 (R)	.997 (C) .950 (R)	.980 (C) .976 (R)	.822 (C) .418 (R)	.823 (C) .985 (R)	.935 (C) .583 (R)
Cash Effective Tax Differential	.748 (C) .885 (R)	.748 (C) .965 (R)	.889 (C) .798 (R)	.994 (C) .965 (R)	.917 (C) .722 (R)	.975 (C) .931 (R)	.957 (C) .760 (R)	.955 (C) .768 (R)	.989 (C) .980 (R)	.967 (C) .998 (R)	.908 (C) .949 (R)
Accrued Effective Tax Differential	.781 (C) .846 (R)	.781 (C) .964 (R)	.900 (C) .888 (R)	.990 (C) .937 (R)	.832 (C) .970 (R)	.689 (C) .698 (R)	.861 (C) .857 (R)	.725 (C) .922 (R)	.659 (C) .484 (R)	.907 (C) .969 (R)	.628 (C) .807 (R)
Long-term Effective Tax Rate	.835 (C) .889 (R)	.835 (C) .914 (R)	.886 (C) .913 (R)	.978 (C) .997 (R)	.992 (C) .961 (R)	.979 (C) .958 (R)	.940 (C) .979 (R)	.977 (C) .970 (R)	.984 (C) .980 (R)	.962 (C) .975 (R)	.892 (C) .945 (R)
Cash Tax Ratio	.713 (C) .889 (R)	.713 (C) .914 (R)	.874 (C) .913 (R)	.996 (C) .997 (R)	.998 (C) .961 (R)	.904 (C) .958 (R)	.927 (C) .979 (R)	.989 (C) .970 (R)	.990 (C) .980 (R)	.913 (C) .975 (R)	.793 (C) .945 (R)
3-Year Cash Effective Tax Rate	.913 (C) .896 (R)	.913 (C) .937 (R)	.886 (C) .509 (R)	.978 (C) .996 (R)	.992 (C) .950 (R)	.979 (C) .841 (R)	.940 (C) .984 (R)	.977 (C) .936 (R)	.984 (C) .958 (R)	.962 (C) .963 (R)	.974 (C) .722 (R)
DTAX	.753 (C) .888 (R)	.753 (C) .882 (R)	.935 (C) .925 (R)	.907 (C) .926 (R)	.850 (C) .993 (R)	.861 (C) .963 (R)	.821 (C) .917 (R)	.681 (C) .675 (R)	.868 (C) .364 (R)	.911 (C) .787 (R)	.987 (C) .946 (R)
Perm	.891 (C) .757 (R)	.891 (C) .950 (R)	.803 (C) .740 (R)	.872 (C) .863 (R)	.996 (C) .956 (R)	.329 (C) .942 (R)	.864 (C) .701 (R)	.725 (C) .777 (R)	.766 (C) .818 (R)	.903 (C) .724 (R)	.859 (C) .499 (R)

Table 9. Comparative Table of Rankings by Industry (Explanatory Power by Industry) Based on Confirmed and Reported Company Data (C = Confirmed, R = Reported)

Criterion	Metal Mining	Automotive & Parts	Pharmaceutical	Computer	Non-Metallic Minerals	Cement	Food Industries	Oil Products	Basic Metals	Ceramic & Tiles	Chemical Products
Accrued Effective Tax Rate	1 (C) 3 (R)	1 (C) 3 (R)	1 (C) 1 (R)	2 (C) 2 (R)	5 (C) 1 (R)	4 (C) 1 (R)	2 (C) 1 (R)	5 (C) 4 (R)	6 (C) 3 (R)	2 (C) 2 (R)	5 (C) 3 (R)

5-Year Accrued Effective Tax Rate	5 (C) 7 (R)	5 (C) 1 (R)	10 (C) 6 (R)	3 (C) 4 (R)	10 (C) 4 (R)	8 (C) 3 (R)	9 (C) 4 (R)	8 (C) 4 (R)	5 (C) 4 (R)	5 (C) 6 (R)	3 (C) 4 (R)
Current Accrued Effective Tax Rate	6 (C) 2 (R)	6 (C) 8 (R)	2 (C) 2 (R)	10 (C) 1 (R)	8 (C) 1 (R)	5 (C) 5 (R)	10 (C) 7 (R)	10 (C) 7 (R)	10 (C) 6 (R)	6 (C) 2 (R)	2 (C) 1 (R)
Differential Effective Tax Rate	2 (C) 4 (R)	2 (C) 3 (R)	1 (C) 1 (R)	2 (C) 2 (R)	5 (C) 1 (R)	3 (C) 1 (R)	2 (C) 1 (R)	6 (C) 1 (R)	4 (C) 3 (R)	1 (C) 3 (R)	5 (C) 3 (R)
Cash Effective Tax Rate	7 (C) 1 (R)	7 (C) 7 (R)	8 (C) 8 (R)	1 (C) 1 (R)	4 (C) 5 (R)	7 (C) 6 (R)	1 (C) 4 (R)	2 (C) 2 (R)	8 (C) 8 (R)	11 (C) 2 (R)	6 (C) 7 (R)
Cash Effective Tax Differential	11 (C) 6 (R)	11 (C) 2 (R)	5 (C) 7 (R)	5 (C) 3 (R)	6 (C) 6 (R)	2 (C) 4 (R)	3 (C) 8 (R)	4 (C) 9 (R)	2 (C) 1 (R)	3 (C) 1 (R)	7 (C) 2 (R)
Accrued Effective Tax Differential	9 (C) 8 (R)	9 (C) 2 (R)	4 (C) 5 (R)	6 (C) 5 (R)	9 (C) 2 (R)	10 (C) 8 (R)	7 (C) 6 (R)	7 (C) 6 (R)	11 (C) 7 (R)	9 (C) 5 (R)	11 (C) 5 (R)
Long-term Effective Tax Rate	8 (C) 6 (R)	8 (C) 5 (R)	6 (C) 4 (R)	7 (C) 1 (R)	3 (C) 3 (R)	1 (C) 2 (R)	4 (C) 3 (R)	3 (C) 3 (R)	3 (C) 1 (R)	4 (C) 4 (R)	8 (C) 2 (R)
Cash Tax Ratio	12 (C) 6 (R)	12 (C) 5 (R)	7 (C) 4 (R)	4 (C) 1 (R)	1 (C) 3 (R)	6 (C) 2 (R)	5 (C) 3 (R)	1 (C) 3 (R)	1 (C) 1 (R)	7 (C) 4 (R)	10 (C) 2 (R)
3-Year Cash Effective Tax Rate	3 (C) 5 (R)	3 (C) 4 (R)	6 (C) 10 (R)	7 (C) 1 (R)	3 (C) 4 (R)	1 (C) 7 (R)	4 (C) 2 (R)	3 (C) 5 (R)	3 (C) 2 (R)	4 (C) 5 (R)	4 (C) 6 (R)
DTAX	10 (C) 6 (R)	10 (C) 6 (R)	3 (C) 3 (R)	8 (C) 6 (R)	7 (C) 1 (R)	9 (C) 1 (R)	8 (C) 5 (R)	9 (C) 10 (R)	7 (C) 9 (R)	8 (C) 7 (R)	1 (C) 2 (R)
Perm	4 (C) 9 (R)	4 (C) 3 (R)	9 (C) 9 (R)	9 (C) 7 (R)	2 (C) 4 (R)	11 (C) 3 (R)	6 (C) 9 (R)	7 (C) 8 (R)	9 (C) 5 (R)	10 (C) 8 (R)	9 (C) 8 (R)

Hypothesis 1: Regarding the explanatory power of GAAP ETR, when examining the confirmed figures of companies across the entire sample, this criterion, with an effect coefficient of 0.837, did not have the highest factor loading in its construct. Additionally, in fitting the regression model for ranking the explanatory coefficients based on the principal component method, it ranked fourth in explanatory power with a coefficient of 0.835. Therefore, except for the differential effective tax rate (ETR_Differential_Gaap), which shares the same rank, the hypothesis is confirmed at the 5% error level compared to other criteria. This means that this criterion, along with the differential effective tax rate, has the same explanatory ranking, differing from the other factors. Hence, the hypothesis is confirmed for all other cases except this one. When industry-specific results are considered, this criterion’s explanatory power was consistent in the metal extraction and automotive industries, as well as between the cement and food industries. In analyzing the reported figures, this rate had the highest factor loading in its construct across the entire sample, with the highest factor loading in five industries: cement, food, oil products, basic metals, ceramics, and chemicals. Across the entire sample, this criterion ranked second compared to other factors and held the first rank only in the pharmaceutical, non-metallic minerals, cement, and food industries. In other words, for the entire sample, with an effect coefficient of 0.956, this criterion did not have the highest factor loading in its construct, and with an explanatory coefficient of 0.926, it ranked second in importance. Therefore, the hypothesis is confirmed at the 5% error level.

Hypothesis 2: Regarding the explanatory power of TA_GAAP_ETR, when analyzing the confirmed figures of companies, it is evident that this rate had a significant factor loading in its related construct across the entire sample and all industries. However, in fitting the regression model for ranking the explanatory coefficients, it ranked ninth compared to other factors and was not ranked first in any industry. Therefore, for the entire sample, this criterion, with an effect coefficient of 0.893, had the highest factor loading in its construct but ranked ninth in explanatory power with a coefficient of 0.619. Hence, the hypothesis is confirmed at the 5% error level. When examining the reported figures, this rate had a significant factor loading in its construct across the entire sample and industries such as automotive, computers, pharmaceuticals, and chemicals. Across the entire sample, this criterion ranked eighth compared to other factors. Therefore, with an effect coefficient of 0.960, it had a significant factor loading in its construct and ranked eighth in explanatory power with a coefficient of 0.667. Consequently, the hypothesis is confirmed at the 5% error level.

Hypothesis 3: Regarding the explanatory power of Long_GAAP_ETR, analyzing the confirmed figures of companies shows that this rate, with the highest factor loading in its related construct across the entire sample, had the highest factor loading in all industries except metal extraction. Across the entire sample, this rate ranked second compared to other factors and was not ranked first in any industry. In other words, with an effect coefficient of 0.915, it had the highest factor loading in its construct and ranked second in explanatory power with a coefficient of 0.875. Hence, the hypothesis is confirmed at the 5% error level. Analyzing the reported figures shows that, despite not having the highest factor loading in its construct across the entire sample, this rate had a significant factor loading in determining factors in all industries and ranked sixth across the entire sample. It only ranked first in the automotive industry. Thus, with an effect coefficient of 0.956, it did not have the highest factor loading in its construct and ranked sixth in explanatory power with a coefficient of 0.758. Hence, the hypothesis is confirmed at the 5% error level.

Hypothesis 4: Regarding the explanatory power of Current_GAAP_ETR, examining the confirmed figures of companies shows that this rate, with the highest factor loading in its related construct across the entire sample, had the highest factor loading in determining factors in the pharmaceutical, ceramics, and chemical industries. In fitting the regression model, this criterion ranked sixth across the entire sample compared to other factors and was not ranked first in any industry. In other words, with an effect coefficient of 0.915, it had the highest factor loading in its construct and ranked sixth in explanatory power with a coefficient of 0.836. Therefore, the hypothesis is confirmed at the 5% error level. When analyzing the reported figures, despite not having the highest factor loading in its construct across the entire sample, this rate had the highest factor loading in determining factors in the food industry. Across the entire sample, it ranked tenth compared to other factors, and it ranked first in the computer, non-metallic minerals, and chemical industries. In other words, this criterion, with an effect coefficient of 0.948, did not have the highest factor loading in its construct and ranked tenth in explanatory power with a coefficient of 0.398. Hence, the hypothesis is confirmed at the 5% error level.

Hypothesis 5: Regarding the explanatory power of ETR_Differential_Gaap, examining the confirmed figures of companies shows that this rate, despite not having the highest factor loading in its related construct across the entire sample, had the highest factor loading in determining factors in the computer, food, oil products, basic metals, and ceramics industries. In fitting the regression model, it ranked fourth across the entire sample compared to other factors and ranked first only in the pharmaceutical and ceramics industries. In other words, this criterion, with an effect coefficient of 0.915, did not have the highest factor loading in its construct and ranked fourth in explanatory power with a coefficient of 0.835. Hence, the hypothesis is confirmed at the 5% error level. When examining the reported figures, this rate, with the highest factor loading in its construct across the entire sample, had the highest factor loading in determining factors in the basic metals and ceramics industries. Across the entire sample, it ranked third compared to other factors and ranked first in the pharmaceutical, non-metallic minerals, cement, food, and oil products industries. Thus, with an effect coefficient of 0.948, it had the highest factor loading in its construct and ranked third in explanatory power with a coefficient of 0.925. Consequently, the hypothesis is confirmed at the 5% error level.

Hypothesis 6: Regarding the explanatory power of TA_Cash_ETR, when analyzing the confirmed figures of companies, this rate had a significant factor loading in its related construct across the entire sample and the pharmaceutical, computer, food, basic metals, and chemical industries. Across the entire sample, it ranked first in explanatory power compared to other factors but did not rank first in any industry. In other words, with an effect coefficient of 0.735, it did not have the highest factor loading in its construct but ranked first in explanatory power with a coefficient of 0.882. Hence, the hypothesis is confirmed at the 5% error level. When analyzing the reported figures, this rate had a significant factor loading in its construct across the entire sample and industries such as automotive, computer, pharmaceutical, and chemical. It ranked first across the entire sample compared to other factors and ranked first in the basic metals and ceramics industries. Thus, with an effect coefficient of 0.960, it had the highest factor loading in its construct and ranked first in explanatory power with a coefficient of 0.930. Therefore, the hypothesis is confirmed at the 5% error level.

Hypothesis 7: Regarding the explanatory power of Longrun_cash_ETR, examining the confirmed figures of companies shows that this rate had a significant factor loading in its related construct across the entire sample, except in the metal extraction, automotive, food, basic metals, and chemical industries. Across the entire sample, it ranked third compared to other factors and ranked first only in the cement industry. In other words, with an effect coefficient of 0.894, it had the highest factor loading in its construct and ranked third in explanatory power with a coefficient of 0.837. Hence, the hypothesis is confirmed at the 5% error level. When analyzing the reported figures, this rate had a significant factor loading in its construct across the entire sample, except in the metal extraction, non-metallic minerals, cement, ceramics, and chemical industries. Across the entire sample, it ranked fourth compared to other factors and ranked first only in the computer and basic metals industries. Therefore, this criterion, with an effect coefficient of 0.848, had a significant factor loading in its construct and ranked fourth in explanatory power with a coefficient of 0.913. Consequently, the hypothesis is confirmed at the 5% error level.

Hypothesis 8: Regarding the explanatory power of Cash_ETR3, examining the confirmed figures of companies shows that this rate had a significant factor loading in its related construct across the entire sample, except in the non-metallic minerals, food, oil products, and chemical industries. Across the entire sample, it ranked fifth compared to other factors and ranked first only in the cement industry. In other words, with an effect coefficient of 0.873, it had the highest factor loading in its construct and ranked fifth in explanatory power with a coefficient of 0.832. Hence, the hypothesis is confirmed at the 5% error level. When analyzing the reported figures, this rate had a significant factor loading in its construct across the entire sample, except in the metal extraction, computer, and non-metallic minerals industries. Across the entire sample, it ranked first compared to other factors and ranked first only in the computer industry. Therefore, this criterion, with an effect coefficient of 0.773, had a significant factor loading in its construct and ranked first in explanatory power with a coefficient of 0.930. Consequently, the hypothesis is confirmed at the 5% error level.

Hypothesis 9: Regarding the explanatory power of Cash_tax_ratio, when analyzing the confirmed figures of companies, this rate had a significant factor loading in its related construct across the entire sample and industries such as automotive and ceramics. Across the entire sample, it ranked tenth in explanatory power and ranked first in the non-metallic minerals, oil products, and basic metals industries. In other words, with an effect coefficient of 0.730, it had the highest factor loading in its construct but ranked ninth in explanatory power with a coefficient of 0.566. Hence, the hypothesis is confirmed at the 5% error level. When examining the reported figures, this rate had a significant factor loading in its construct across the entire sample, except in the automotive, computer, basic metals, and ceramics industries. Across the entire sample, it ranked fifth compared to other factors and ranked first in the computer and basic metals industries. Thus, with an effect coefficient of 0.370, it had a significant factor loading in its construct and ranked fifth in explanatory power with a coefficient of 0.822. Therefore, the hypothesis is confirmed at the 5% error level.

Hypothesis 10: Regarding the explanatory power of Cash ETR, when analyzing the confirmed figures of companies, this rate did not have the highest factor loading in its related construct across the entire sample but had the highest factor loading in determining factors in the cement, food, and basic metals industries. Across the entire sample, it ranked seventh compared to other factors and ranked first in the food and computer industries. In other words, with an effect coefficient of 0.772, it did not have the highest factor loading in its construct and ranked seventh in explanatory power with a coefficient of 0.678. Hence, the hypothesis is confirmed at the 5% error level. When examining the reported figures, this rate did not have the highest factor loading in its construct across the entire sample but had a significant factor loading in determining factors in the metal extraction, automotive, non-metallic minerals, cement, oil products, basic metals, ceramics, and chemical industries. Across the entire sample, it ranked ninth compared to other factors and ranked first in the metal extraction and computer industries. In other words, with an effect coefficient of 0.530, it had a significant factor loading in its construct and ranked ninth in explanatory power with a coefficient of 0.465. Hence, the hypothesis is confirmed at the 5% error level.

Hypothesis 11: Regarding the explanatory power of PermBTD, when analyzing the confirmed figures of companies, this rate did not have a significant factor loading in its related construct across the entire sample, but it had the highest factor loading in determining factors in the automotive, non-metallic minerals, cement, oil products, and chemical industries. Across the entire sample, it ranked eleventh compared to other factors and was not ranked first in any industry. In other words, with an effect coefficient of

0.455, it had the highest factor loading in its construct but ranked eleventh in explanatory power with a coefficient of 0.664. Hence, the hypothesis is confirmed at the 5% error level. When examining the reported figures, this rate did not have a significant factor loading in its construct across the entire sample but had the highest factor loading in determining factors in the pharmaceutical, cement, oil products, basic metals, ceramics, and chemical industries. Across the entire sample, it ranked seventh compared to other factors and was not ranked first in any industry. Thus, this criterion, with an effect coefficient of 0.490, had a significant factor loading in its construct and ranked seventh in explanatory power with a coefficient of 0.312. Hence, the hypothesis is confirmed at the 5% error level.

Hypothesis 12: Regarding the explanatory power of DTAX, when analyzing the confirmed figures of companies, this rate did not have a significant factor loading in its related construct across the entire sample, but it had the highest factor loading in determining factors in the oil products and chemical industries. Across the entire sample, it ranked eighth compared to other factors and ranked first only in the chemical industry. In other words, with an effect coefficient of 0.455, it had the highest factor loading in its construct and ranked eighth in explanatory power with a coefficient of 0.664. Hence, the hypothesis is confirmed at the 5% error level. When examining the reported figures, this rate had a significant factor loading in its construct across the entire sample and industries such as metal extraction, non-metallic minerals, basic metals, and ceramics. Across the entire sample, it ranked eleventh compared to other factors and ranked first only in the cement and non-metallic minerals industries. Thus, with an effect coefficient of 0.490, it had a significant factor loading in its construct and ranked eleventh in explanatory power with a coefficient of 0.312. Hence, the hypothesis is confirmed at the 5% error level.

4. Discussion and Conclusion

The findings of this study provide valuable insights into the factors influencing tax avoidance among companies listed on the stock exchange, focusing on the application of Exploratory Factor Analysis (EFA) to rank key indicators. The results indicate that the long-term cash effective tax rate (TA_Cash_ETR) and the three-year cash effective tax rate (Cash_ETR3) are the most significant indicators of tax avoidance, while permanent differences based on discretionary accruals (DTAX) have the lowest explanatory power. These findings align with previous research, suggesting that cash-based tax metrics provide a more accurate reflection of tax avoidance behavior, particularly in capital-intensive industries (Amalia, 2020; Tarigan, 2023).

The high explanatory power of the long-term cash effective tax rate (TA_Cash_ETR) in this study reflects the growing consensus that cash-based tax measures are more reliable indicators of tax avoidance. As previous studies have highlighted, firms with substantial capital investments and complex financial structures often engage in sophisticated tax planning to reduce their cash tax liabilities (Amni et al., 2023). This finding is consistent with the study by Amalia (2020), which found that capital-intensive companies, such as those in the coal industry, are more likely to employ tax planning strategies that minimize cash outflows. Moreover, the significant role of TA_Cash_ETR in explaining tax avoidance suggests that companies prioritize liquidity management by reducing cash taxes paid over the long term, which is particularly relevant in industries with large fixed asset bases (Tarigan, 2023).

The three-year cash effective tax rate (Cash_ETR3) also emerged as a significant indicator, further supporting the notion that firms manage their tax obligations over multiple years. This finding aligns with the work of Fauziati et al. (2018), who emphasized that tax avoidance is often a long-term strategy rather than a one-time event. Companies aim to maintain a lower tax burden over time to smooth earnings and present more stable financial performance to investors [28]. Additionally, the significance of the three-year cash effective tax rate indicates that firms are less concerned with annual fluctuations in tax rates and are more focused on achieving sustained reductions in tax liabilities [6]. This long-term focus is consistent with findings from Putri (2024), who noted that tax avoidance strategies often involve the timing of deductions and deferrals to optimize tax positions over multiple reporting periods [24].

In contrast, the lower explanatory power of permanent differences based on discretionary accruals (DTAX) highlights the limitations of accrual-based measures in capturing tax avoidance. This result is in line with studies by Ardiansyah (2023) and Bikas and Bagdonaitė (2020), which have pointed out that accrual-based tax measures can be influenced by management’s earnings manipulation and do not always reflect the true extent of tax avoidance. Accruals can be subject to adjustments that obscure the actual cash tax benefits that a company realizes from its tax planning activities. Consequently, cash-based measures, which focus on actual cash outflows for taxes, provide a more transparent and accurate representation of tax avoidance behavior [5].

Furthermore, the findings show that the tax environment in which companies operate plays a crucial role in shaping tax avoidance strategies. Firms in industries with more stable regulatory frameworks, such as manufacturing, were found to have higher levels of tax avoidance, which supports the findings of Andayani and Yanti (2021) that firms operating in predictable environments are more likely to engage in tax planning [2]. These companies benefit from consistent tax rules that allow them to plan more effectively, unlike industries subject to frequent regulatory changes, which introduce uncertainty into tax planning [26].

The study's results also suggest that firm size and profitability are significant determinants of tax avoidance, as larger and more profitable companies tend to have greater resources and incentives to engage in tax planning [10]. This finding is consistent with the work of Ansar et al. (2021) and Ibrahim et al. (2021), who found that larger firms with higher profits have more opportunities to reduce their taxable income through deductions, credits, and deferrals [29, 30]. Additionally, profitability provides firms with the financial motivation to minimize their tax liabilities, as higher earnings increase their tax burden, prompting them to seek legal ways to reduce this cost [31].

In conclusion, the findings of this study contribute to the growing body of knowledge on tax avoidance, offering important insights into the key indicators that influence firms' tax planning strategies. By focusing on cash-based tax measures and industry-specific factors, this research provides valuable guidance for both policymakers and corporate managers seeking to mitigate the risks and challenges associated with tax avoidance.

Authors' Contributions

Authors equally contributed to this article.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in this study were under the ethical standards.

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