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Incidence of Debt Interest Deduction in Computing Corporate Income Tax-CIT

Incidence de la déduction des intérêts de la dette dans le calcul de l'impôt sur les sociétés-IS

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Abstract

This paper focuses on tax incidence, looking for "real" loser or winner of debt interest deduction in computing CIT. The first sample is a case study of two identical firms, one indebted and the other unindebted, with the same profitable investment project over a period of time. The second sample contains 20 indebted firms in France over a 5-year period. The non-free cost and revenue assumption is used. The stylized case study of two hypothetical firms and the empirical analysis of 20 firms in France lead to the same result. In fact, Debt interest deduction in computing CIT, has as "true" losing the firm with zero financial leverage and as "true" winning the firm with non-zero financial leverage. This paper is one of the first to expand the literature by looking for the "real" loser or winner of debt interest deduction in computing CIT.

Keywords: Deduction of financial expenses; earnings before interest and tax-EBIT; debt-related tax savings; legal tax rate; effective tax rate; financial leverage.

Résumé

Ce papier s'intéresse à l'incidence fiscale, en cherchant le « vrai » perdant ou gagnant de la déduction des intérêts de la dette dans le calcul de l'IS. Le premier échantillon porte sur l'étude de cas de deux firmes identiques, l'une est endetté et l'autre est non endetté, et ayant le même projet d'investissement rentable sur une période. Le deuxième échantillon contient 20 firmes endettées en France sur une période de 5 ans. L'hypothèse de non-gratuité de coût et de revenu est utilisée. L'étude de cas stylisée de deux firmes hypothétiques et l'analyse empirique sur 20 firmes en France aboutissent au même résultat. En fait, la déduction des intérêts de la dette dans le calcul de l'IS, a comme « vrai » perdant la firme à levier financier nul et comme « vrai » gagnant la firme à levier financier non nul ; l'incidence fiscale s'annule au niveau de l'Etat. Ce papier est l'un des premiers à élargir la littérature en cherchant le « vrai » perdant ou gagnant de la déduction des intérêts de la dette dans le calcul de l'IS.

Mots clés : Déduction des frais financiers ; résultat avant intérêt, impôt et dividende-RAIID ; économie d'impôt liée la dette ; taux légal d'impôt, taux effectif d'impôt, levier financier.

Introduction

Borrowing from Simula et al. (2009), our interest in tax incidence means looking beyond appearances to find the "real" winner or loser from the introduction of a variation in tax or rate. The statutory impact is that the tax exemption is borne by the party authorizing it. The General Tax Code of Benin, as in most countries in the rest of the world, contains provisions which authorize the debt interest deduction in computing Corporate Income Tax-CIT. The question is who really benefits from these provisions? The general objective was to analyze the impact of deducting interest on debt when calculating corporate income tax. Two or even three levels of analysis were selected: non-zero leverage firms, zero leverage firms and the State. A case study and an empirical study made it possible to analyze the "real" loser or winner of these tax provisions favorable to interest on debt.

This article is structured in four paragraphs. Paragraph 1 is devoted to a critical review of the literature on the tax deduction of debt interest and the research hypotheses. Paragraph 2 outlines the methodology. Paragraph 3 presents the results and paragraph 4 the conclusion.

1. Critical literature review and research hypotheses

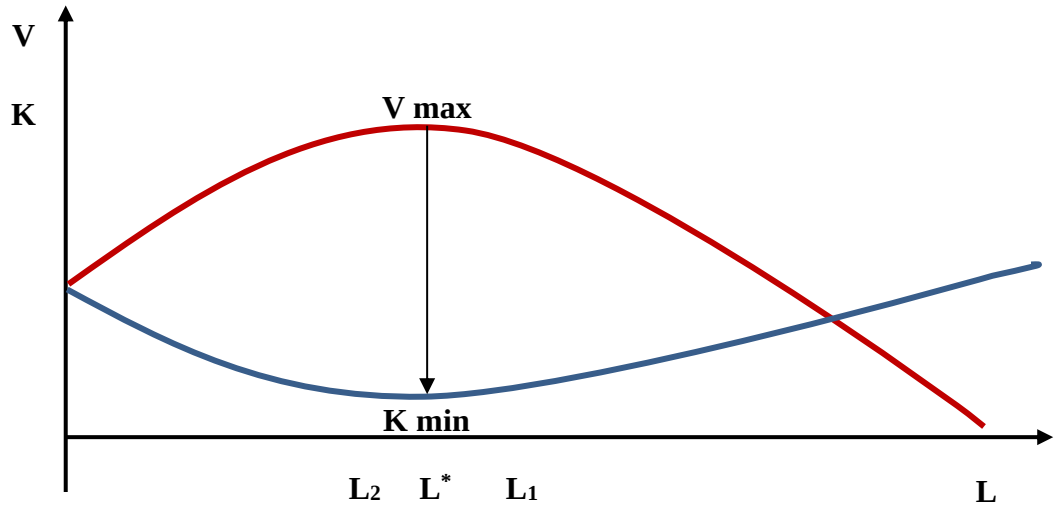
Theoretically, the deduction of debt interest in the computing corporate tax, certainly offers a corporate tax saving to the firm with non-zero "financial leverage"[1] to the detriment of the State. But is this tax saving offered by the State to the indebted firm really supported by the State? The answer to this question is not easily found in the related literature, which has focused more on the effect of the debt interest tax deduction on the firm's value and cost of capital than on the "true" loser or winner of this deduction. To this end, four theories on the effect of debt on the firm have been reviewed. These are the traditional theory, the theory of Durand (1952), the theory of Modigliani and Miller (1963) and the trade-off theory of Baxter (1967).

1.1. The traditional theory

According to the traditional theory advocated by Ezra Solomon and Fred Weston, debt financing provides a saving that increases the firm's financing value V and the firm's weighted average cost of capital K, up to an optimal point where the financial leverage L reaches the equilibrium point L*. This theory does not take into account the CT. Figure N. 1, illustrates the traditional theory of financial leverage.

[1] A firm's "financial leverage" is its debt-to-equity ratio.

Figure N. 1: The traditional theory of financial leverage L

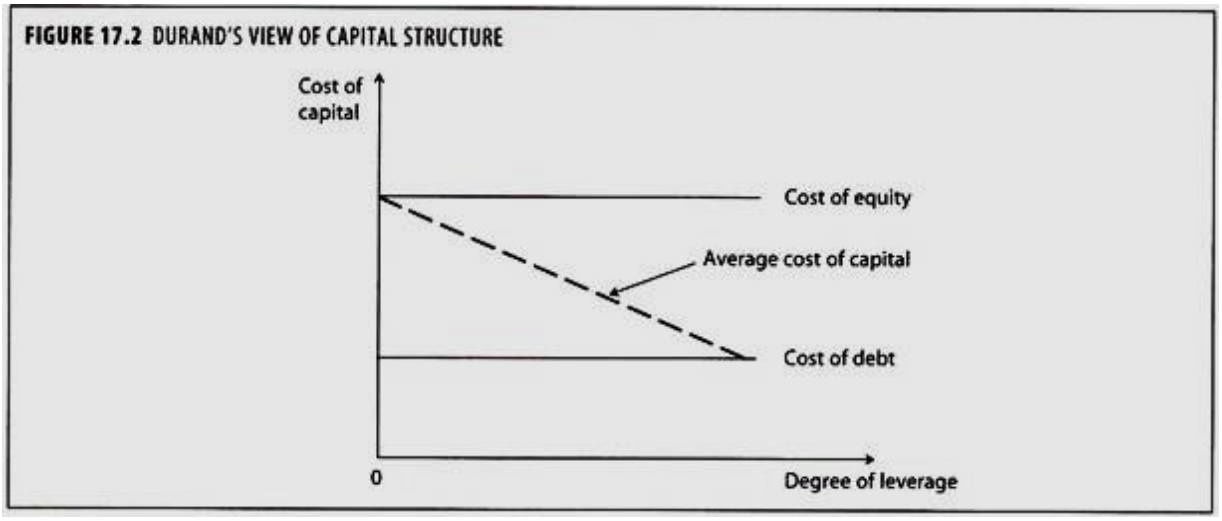


Source: Author's personal realization from the literature review (2023)

1.2. Durand (1952)'s Net Profit Theory

According to Durand (1952)'s Net Profit Theory, leverage provides savings that increase firm value and lower the weighted average cost of capital when leverage increases. This theory also does not take into account the CT. Figure N. 2 shows Durand's view of financial leverage.

Figure N. 2: The Net Benefit theory of financial leverage (view from Durand)



Source : https://www.businessmanagementideas.com/firms/capital-structure/capital-structure-of-a-firm-7-main-approaches-financial-management/16481

1.3. The theory of Modigliani and Miller (1963)

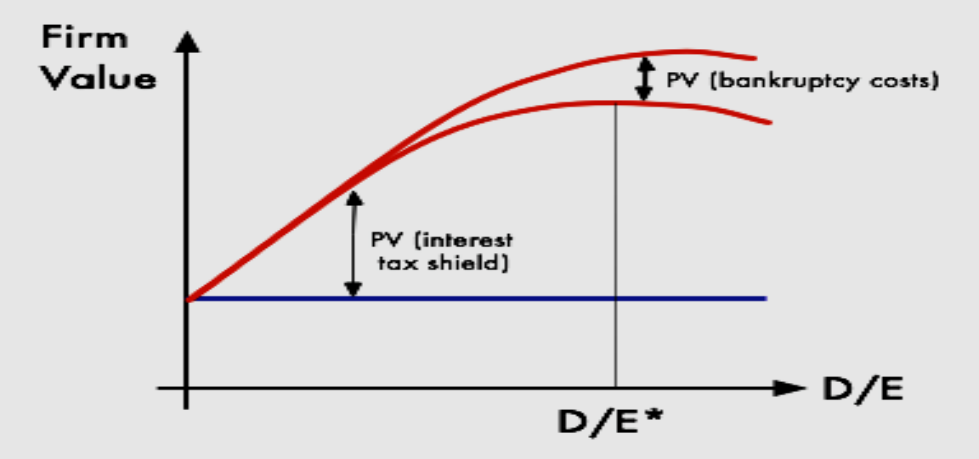
Modigliani and Miller (1963: 435-440) asserted that for two firms belonging to the same class of financing risk, in all respects identical, with the only difference that the financial liabilities of the firm $\mathbf{E_L}$ of value $\mathbf{V_L}$ include a certain quantity **D** of debt, while that of the $\mathbf{E_U}$ firm of $\mathbf{V_U}$

value is composed exclusively of equity S_U, the V_L value exceeds the V_U value by a premium equal to the capitalization value of the annual tax saving; let $V_L = V_U + \tau D$; where, τ represents the CIT rate. The theory of Modigliani and Miller (1963) shows that the debt always has a positive effect in the presence of CIT and that under these conditions, the optimum of the capital structure of the firm is the point where the indebtedness is maximum, that is to say, one hundred percent (100%) financial leverage.

1.4. Baxter's theory of Bankruptcy Costs (1967)

By restriction, certain authors such as Baxter (1967: 395), Stiglitz (1969: 784), Gruber and Warner (1977), Kraus and Litzenberger (1973: 911), Horne (1974) and Greenwald et al. (1984), proposed the Trade Off Theory -TOT- which takes into account the arbitration between the costs of bankruptcy and the tax advantages of indebtedness. In this context, the value of an indebted firm is equal to $V_L = V_U + \tau D - C_L$; where, D represents the amount of the debt; τ the CIT rate; C_L the present value of the costs of bankruptcy linked to non-zero financial leverage and V_U the value of a debt-free firm identical to the indebted firm. Figure N. 3 shows the TOT theory of financial leverage.

Figure N. 3: The Trade Off theory of financial leverage



Source: Brealey et al. (2007: 504)

It has to be said that all these theories have more or less analyzed the impact of the tax deduction of debt interest only at the level of the non-zero leverage firm. We have considered two identical firms, one with non-zero financial leverage and the other with zero financial leverage, not forgetting the State, in order to establish the research hypotheses. It has to be said that the deduction of debt interest in the calculation of corporation tax results in a corporation tax gain or subtax for the identical firm with debt, and a corporation tax loss or surtax for the identical

firm without debt. Given that subtax and surtax have the same absolute value, the four research hypotheses are as follows:

H1: "There is a positive relationship between the incidence of the interest deduction on debt at the level of the identical indebted firm and the subtax associated with this deduction".

H2: "There is a positive relationship between the incidence of the deduction of interest on debt at State level and the subtax associated with this deduction".

H3: "There is a negative relationship between the incidence of debt interest deduction at the level of the identical non-indebted firm and the surtax linked to this deduction".

H4: "There is a negative relationship between the impact of the deduction of interest on debt at State level and the surtax associated with this deduction".

2. Methodology

The methodology covers study design, sampling and modeling.

2.1. Study design

The study design is based on a numerical case study comprising two firms belonging to the same financing risk class, identical in all respects with the only difference that one is exclusively financed with equity and the other contains a fraction of debt in its financing structure. For reasons of tax equity between identical firms, these two firms are supposed to bear the same amount of corporate tax. The theoretical sample consists of a pair of firms (E_U; E_L) belonging to the same class of financing risk, identical in all respects with the only difference that the firm E_U has zero financial leverage and the firm E_L has non-zero financial leverage or non-zero "financial debt D to equity S_L" ratio, i.e., $\frac{\mathbf{D}}{\mathbf{S_L}} \neq \mathbf{0}$. The data (in billions of F.XOF for the amounts) of these two firms relating to the decision to invest over a one-year horizon are presented in Table N. 1.

Table N. 1: Investment Project of two identical Firms E_U and E_L

Elements	Firm E_U	Firm E_L
Equity S_U or S_L	**100**	**50**
Financial debts D	**-**	**50**
Investment I	**100**	**100**
Operating revenue (DR1)	**326**	**326**
Operating expenses (DD1)	**210**	**210**
Minimum cash flow required or EBITDA (DR1-DD1)	**116**	**116**
Reenactment of		
*** Equity capital S_U or S_L (to be recovered)**	**100**	**50**
*** Debt capital D (to be repaid)**	**-**	**50**
Depreciation allowance (DA)	**100**	**100**
EBIT	**16**	**16**
Remuneration		
*** Interest (of debt D at rate r = 8%)**	**-**	**4**
EBT	**16**	**12**
*** Corporation income tax (CIT) at rate τ = 50%**	**8**	**6**
*** Dividends (of equity S_U and S_L)**	**8**	**6**

Source: Adapted from Cobbaut (1997)

Given that there is neither free cost nor free income, the total revenue from CIT on behalf of the State is the same, before and after debt interest deduction. The approach used consists of a static analysis of data in a partial equilibrium.

2.2. Sampling

Our empirical sample comes from a source called Pappers[2], from which we consulted and downloaded firms' social accounts. In a given national economy, the deduction of interest on debt in the calculation of corporate income tax is granted by the State in favor of firms with non-zero financial leverage. The subject of this tax deduction for debt interest is therefore the State, the object is all non-zero leverage firms, and the alternative is all zero leverage firms. The study period runs from 2013 to 2022 and covers firms in the gas sector with between 20 and 500 employees (i.e., 4210 company-year observations). Excluded from the sample are

[2] *Pappers* is a French website providing legal and financial information on firms, from statutes to annual accounts: https://www.pappers.fr/

companies with missing information and years for which information is not available. Also excluded from the sample are companies whose earnings before interest and tax (EBIT) do not cover debt interest and corporate income tax. Since it is more convenient to determine the identical firm of an indebted firm than that of a firm with zero financial leverage, firms financed exclusively with equity are excluded from the sample. The final period examined runs from 2017 to 2021, and the final sample comprises 20 pairs of identical firms with 12 variables, for a total of 100 firm-year observations.

2.3. Model and variables

The main variable to be explained is the impact of the interest deduction on debt (INCID). However, this dependent variable was analyzed at three levels. The variable at the first level of analysis is the impact of the deduction of interest on debt on the identical firm with non-zero financial leverage (INCIDL), that at the second level is the impact of the deduction of interest on debt on the identical firm with zero financial leverage (INCIDU) and that at the third level is the impact of the deduction of interest on debt on the French State (INCIDN). This study examines the relationship between earnings before interest and tax (EBIT), interest on debt (INTEREST), and the impact of deducting interest on debt (INCID). More specifically, the model postulates that the impact of deducting interest on debt (INCID) is a function of earnings before interest and tax (EBIT) and interest on debt (INTEREST). The model also incorporates control variables relating to the three levels of analysis of the impact of the debt interest deduction.

The first level is that of the identical firm with non-zero financial leverage, where the control variables are: corporate income tax for leveraged firms (CITL), sub-tax (SUBTAX) and sub-tax rate (SUBTR). The empirical model corresponding to the first level of analysis for indebted identical firm i at time t is:

$$\mathrm{INCIDL}_{i,t} = \alpha_0 + \alpha_1 \mathrm{EBIT}_{i,t} + \alpha_2 \mathrm{INTEREST}_{i,t} + \alpha_3 \mathrm{CITL}_{i,t} + \alpha_4 \mathrm{SUBTAX}_{i,t} + \alpha_5 \mathrm{SUBTR}_{i,t} + \varepsilon_{it}$$

The second level is that of the identical firm with zero financial leverage, where the control variables are: corporate income tax (CITU) surtax (SURTAX) and surtax rate (SURTR).

The empirical model corresponding to the second level of analysis for unleveraged identical firm i at time t is:

$$\text{INCIDU}_{i,t} = \beta_0 + \beta_1 \text{EBIT}_{i,t} + \beta_2 \text{INTEREST}_{i,t} + \beta_3 \text{CITU}_{i,t} + \beta_4 \text{SURTAX}_{i,t} + \beta_5 \text{SURTR}_{i,t} + \varepsilon_{it}$$

The third level is that of the State, where the control variables are: corporate tax (CITN), sub-tax (SUBTAX) and sub-tax rate (SUBTR) on the side of the identical indebted firm, or corporate tax (CITN), surtax (SURTAX) and surtax rate (SURTR) on the side of the identical non-indebted firm. The empirical model corresponding to the third level of analysis for the State in relation to the identical indebted firm i at time t is:

$$INCIDN_{i,t} = \gamma_0 + \gamma_1 EBIT_{i,t} + \gamma_2 INTEREST_{i,t} + \gamma_3 CITN_{i,t} + \gamma_4 SUBTAX_{i,t} + \gamma_5 SUBTR_{i,t} + \varepsilon_{it}$$

The empirical model corresponding to the third level of analysis for the State in relation to the identical unleveraged firm i at time t is:

$$INCIDN_{i,t} = \theta_0 + \theta_1 EBIT_{i,t} + \theta_2 INTEREST_{i,t} + \theta_3 CITN_{i,t} + \theta_4 SURTAX_{i,t} + \theta_5 SURTR_{i,t} + \varepsilon_{it}$$

2.3.1. Dependent variables

In the literature, there are no specific measures of the impact of the interest deduction on debt. The measure of the impact of debt interest deduction used here for identical firms is the current effective tax rates (ETR) and, for the French State, the current legal tax rates (LTR) or the national effective tax rates (ETRN) of identical firms. ETR for a given firm, from the point of view of identical firms belonging to the same financing risk class, is the ratio of its corporate tax to its EBIT. For the State, LTR or ETRN is the ratio between the average of identical firms' CT and EBIT. Based on the assumption that costs or revenues are not free, the ETRN is neutral, since it remains the same with or without the deduction of debt interest. As a result, an ETR lower than ETRN represents a positive impact, characteristic of a capital gain in corporation tax due to the deduction of interest on debt, while an ETR higher than ETRN represents a negative impact, characteristic of a capital loss in corporation tax due to the deduction of interest on debt.

2.3.2. Main effects

Earnings before interest and tax (EBIT) is the operating income whose data are downloaded online from the firms' annual financial statements. The same applies to data on interest on debt (INTEREST). EBIT is the first cascade point for the deduction of debt interest, and INTEREST

the second. These two independent variables negatively affect the impact of debt interest deduction-INCID.

2.3.3. Control variables

Three control variables are included in the first model. The first control variable is corporate income tax for non-zero leverage firms (CITL), collected online from firms' annual corporate accounts. The second control variable is the tax exemption (SUBTAX), which characterizes the tax gain due to the deduction of debt interest and is equal to the difference between the indebted firm's corporate income tax (CITL) and the neutral corporate income tax (CITN). The third control variable is the subtax rate (SUBTR). The second model controls the corporate tax of the identical firm with zero financial leverage (CITU), the surtax (SURTAX) linked to the deduction of debt interest and the surtax rate (SURTR). According to the theory of identical firms à la Modigliani and Miller (1958), CITU is the ratio between CITL and the difference between EBIT and INTEREST. The third model controls the identical firm's neutral corporate tax (CITN) and the tax deduction (SUBTAX) or surtax (SURTAX) linked to the deduction of debt interest.

3. Results

A distinction must be made between theoretical and empirical results.

3.1. Theoretical results

The debt interest deduction in computing corporate tax constitutes a corporate tax saving for the firm E_L with non-zero financial leverage and a loss of corporate tax revenue for the State. Under normal conditions for identical firms and in order to ensure tax neutrality of the corporate income tax system, firms E_U and E_L should be taxed at the same corporate tax rate with the same tax base, given that they achieve the same earnings before interest and tax-EBIT. Table N. 2 presents CIT computation of the two identical firms E_U and E_L. According to Table N. 2, the legal corporate tax rate is **50%**, the corporate tax paid amounts to **F.XOF 8 billion** for the firm E_U and to **F.XOF 6 billion** for the firm E_L and the receipts from CIT amount to **F.XOF 14 billion** for the State. The CIT differential between the two identical firms amounts to **F.XOF 2 billion**.

Table N. 2: CIT computation of two identical Firms E_U and E_L

Elements	Firm E_U	Firm E_L	STATE
CIT rate	50%	50%	50%
EBIT	16 000 000 000	16 000 000 000	
Interests	-	4 000 000 000	
EBT	16 000 000 000	12 000 000 000	
Base	16 000 000 000	12 000 000 000	28 000 000 000
CIT	8 000 000 000	6 000 000 000	14 000 000 000
CIT Differential	2 000 000 000		
Net profit	8 000 000 000	10 000 000 000	

Source: Author's own computation based on table N. 1

3.1.1. Before deduction situation

For reasons of tax fairness with identical firms, each of them must pay the same amount of CIT, in order to ensure the neutrality of CIT and the standardization of the process of liquidation of CIT at the level of identical firms. Table N. 3 presents the analysis of CIT and debt interest deduction. According to table N. 3, there is a "**before deduction**" situation in which the legal tax rate is **43.75%** against **50%** in table N. 2, each firm pays the same amount of CIT equal to **F.XOF 7 billion** and receipts from CIT on behalf of the State remain unchanged and equal to **F.XOF 14 billion**.

Table N. 3: Analysis of CIT and debt interest deduction

	Elements	Firm E_U	Firm E_L	State
Before Deduction	**Legal rate**	43,75%	43,75%	43,75%
	Base	16 000 000 000	16 000 000 000	32 000 000 000
	CIT before	7 000 000 000	7 000 000 000	14 000 000 000
Deduction Phase 1/2	**Subtax rate**		-6,25%	
	Subtax		- 1 000 000 000	
	Effective rate of E_L		37,50%	
	CIT of E_L		6 000 000 000	13 000 000 000
	Subtax effect	None	Capital Gain	Capital Loss
Deduction Phase 2/2	**Surtax rate**	6,25%		
	Surtax	1 000 000 000		
	Effective rate of E_U	50,00%		
	CIT of E_U	8 000 000 000		14 000 000 000
	Surtax effect	Capital Loss	None	Capital Gain
After Deduction	**Effective rate**	50,00%	37,50%	
	CIT after	8 000 000 000	6 000 000 000	14 000 000 000
CIT Analysis	**CIT difference**	1 000 000 000	- 1 000 000 000	-
	Effect	Capital Loss	Capital Gain	Nil
	CIT Differential	2 000 000 000		
Rate Analysis	**Rate Spread**	6,25%	-6,25%	
	Effect	Negative	Positive	Nil
	Rate Differential	12,50%		

Source: Author's own computation based on table N. 1

This "non-deduction tax" situation of debt interest, highlights the tax neutrality in terms of CIT between the two identical firms and the tax equity between the State and the said firms. An analysis of debt interest deduction in computing CIT, made it possible to calculate, in a first phase, the "true" amount of this deduction which constitutes the tax exemption in favor of the firm E_L with non-zero financial leverage at detriment of the State. Unfortunately, in a second phase, this tax refund at the State level was arbitrarily transferred to the firm E_U with zero financial leverage, in the form of a surtax, in order to recover the amount of the tax deduction. In total, there follows a tax differential between the firm E_L with non-zero financial leverage and the firm E_U with zero financial leverage; the tax effect remaining nil at the State level.

3.1.2. Analysis of the "subtax"

According to Table N. 3, the analysis of debt interest deduction in computing CIT reveals that, for the firm E_L with non-zero financial leverage, the legal tax rate LTR is **43.75%**, the effective tax rate ETR is **37.50%**, the subtax amounts to **F.XOF 1 billion** for a rate of **6.25%** and the CIT amounts to **F.XOF 6 billion**.

Indeed, in its policy of encouraging private investment, the State decides to grant a debt interest deduction in computing CIT, to the firm with non-zero financial leverage. This tax deduction reduces the CIT burden at the level of the beneficiary firm and reduces its corresponding tax liability. Consequently, there is a capital gain characteristic of the subtax at the level of the firm with non-zero financial leverage and a capital loss at the state level which is opposite an imbalance temporary budget; the tax-free effect remains unchanged at the level of the firm with zero financial leverage. The subtax resulting from the tax deduction of debt interest corresponds to a subtractive variation of CIT rate called "**subtax rate**".

In short, the debt interest deduction in computing CIT, offers a CIT **gain** to the firm E_L with non-zero financial leverage and a CIT **loss** to the State. At this point, a first prediction can be written:

Prediction 1: "The debt interest deduction in computing CIT, arbitrarily creates in a first phase, a subtax for the benefit of the firm with non-zero financial leverage and to the detriment of the State. This subtax is equal to half the product of the corporate tax rate and the amount of debt interest, i.e., $\boldsymbol{SUBTAX = \frac{1}{2}(\tau \times r \times D)}$, where SUBTAX represents the subtax, τ the CIT rate, r the interest rate and D the debt. The rate of this subtax is equal to the ratio between said subtax and earnings before interest and tax-EBIT".

3.1.3. Analysis of the "surtax"

According to Table N. 3, the analysis of debt interest deduction in computing CIT, reveals that, for the firm E_U with zero financial leverage, the **legal tax rate** is **43 75%**, the **effective tax rate** is **50%**, the **surtax** amounts to **F.XOF 1 billion** for a rate of **6.25%** and the CIT amounts to **F.XOF 8 billion**.

Indeed, in its public investment policy, the State is confronted with a lack of financial resources due to temporary budgetary imbalance caused by the granting of the tax deduction of debt interest to the firm with non-zero financial leverage. To restore budgetary balance, the State decides to surtax the firm with zero financial leverage by transferring all of the burden resulting from the tax deduction of debt interest to the firm with non-zero financial leverage.

Consequently, there is a capital gain at the level of the State which has just restored its budget balance and a capital loss characteristic of the surtax at the level of the firm with zero financial leverage; the surtax effect remains unchanged at the level of the firm with non-zero financial leverage. The surtax resulting from the tax deduction of debt interest corresponds to an additional variation in the CIT rate called "**surtax rate**".

In short, the debt interest deduction in computing CIT, offers a CIT **loss** to the firm E_U with zero financial leverage and a CIT **gain** to the State. At this point, a second prediction can be written:

Prediction 2: "The debt interest deduction in computing CIT, arbitrarily creates in a second phase, a surtax to the detriment of the firm with non-zero financial leverage by full transfer of the subtax observed at the level of the State. This surtax and the said subtax have the same absolute value".

3.1.4. Analysis of the "tax differential"

According to Table N. 3, the analysis of debt interest deduction in computing CIT, reveals a "**tax differential**" which results from the surtax imposed on the firm E_U with zero financial leverage and the tax refund enjoyed by the firm E_L with non-zero financial leverage, and amounts to **F.XOF 2 billion** for a rate of **12.50%**; the effect remaining nil at the State level.

Indeed, in a first phase, the tax deduction of debt interest, creates a subtax in favor of the firm with non-zero leverage to the detriment of the State; the tax-free effect remains unchanged at the level of the firm with zero financial leverage. In a second phase, this tax deduction creates a surtax in favor of the State to the detriment of the firm with zero financial leverage; the surtax effect remains unchanged at the level of the firm with non-zero financial leverage. In short, this results in a tax differential resulting from the subtax and the surtax in favor of the firm with non-zero financial leverage to the detriment of the firm with zero financial leverage; the final effect of the tax deduction cancels out at the State level. The subtax and the surtax are equal in absolute value. The tax differential, generated by the tax deduction of debt interest, corresponds to a double variation (negative variation in a first phase compared to the firm with non-zero financial leverage and positive in a second phase compared to the firm with zero financial leverage) of the CIT rate, characteristic of the "**rate differential**".

In summary, the debt interest deduction in computing CIT, creates a CIT **loss** at the level of the firm E_U with zero financial leverage and a CIT **gain** at the level of the firm E_L with non-zero financial leverage; the tax effect cancels out at the State level. At this point, a third prediction can be written:

Prediction 3: "The deduction of debt interest in computing CIT arbitrarily creates a tax differential between the firm with zero financial leverage and the firm with non-zero financial leverage. The tax differential is equal either to the product of the CIT rate, the interest rate and the debt, i.e., $\boldsymbol{TAXDIF = \tau \times r \times D}$, where TAXDIF represents tax differential, τ the CIT rate, r the interest rate and D the debt, or to the sum in absolute value of the subtax and the surtax".

3.1.5. Analysis of the "real" loser or winner

The analysis of the incidence of the debt interest deduction in computing CIT, makes it possible to consider three cases where the two financial levers are zero or not.

3.1.5.1. Case where the two firms have zero and non-zero financial leverage.

For reasons of tax policy to encourage private investment, the State decides to help the firm E_L with non-zero financial leverage by granting it the debt interest deduction in computing CIT. The process of tax deduction of debt interest takes place in two phases. In a first phase, the State offers a debt bonus to the firm E_L with non-zero financial leverage, in the amount of **F.XOF 1 billion**, by reducing its CIT income from **F.XOF 14 billion** to **F.XOF 13 billion** and thereby creating a budgetary imbalance. The indebted firm E_L therefore benefits from a tax refund. There is a problem of tax refund differential between the two identical firms E_U and E_L. In a second phase, because of its policy of public investment-PIP, the State is confronted with an insufficiency of financial resources and decides to transfer entirely the load of this premium to the E_U firm with zero financial leverage, and this by an arbitration between the firm E_U and the State, until equilibrium is reached for the same amount of **F.XOF 1 billion**. The firm E_U with zero financial leverage is subject to a surtax from the State. There is another problem of surtax differential between the two identical firms E_U and E_L.

In short, the tax effect is nil at the State level in relation to its policy of encouraging debt to the detriment of shareholders, by granting debt interest deduction in computing CIT. The "**true**" **loser** of this deduction is the "**zero leverage firm E_U**" and the "**true**" **winner** is the "**non-zero leverage firm E_L**".

3.1.5.2. Case where the two firms have zero financial leverage.

In the event that the two firms are exclusively financed with equity, the first phase of the process of deducting interest from the debt in computing CIT, will not take place until further notice. But the second phase of this process takes place normally and each firm with zero financial leverage is burdened with a surtax in terms of CIT for the benefit of the State.

In summary, the "**real**" **loser** of the tax deduction of interest on debt includes the "**firms with zero financial leverage**" and the "**real**" **winner** is the **State**. It should be noted that this case does not exist or remains very rare in reality because, in a given national economy, there is always the presence of firms with zero and non-zero financial levers.

3.1.5.3. Case where the two firms have non-zero financial leverage.

In the case where the two firms have a fraction of debt in their financing structure, the first phase of the process of deducting debt interest in computing CIT, takes place normally and each firm benefits from a tax refund in terms of CIT to the detriment of the State. But the second phase of this process will not take place until further notice.

In summary, the "**real**" **loser** of the tax deduction of debt interest is the **State** and the "**real**" **winner** includes the "**firms with non-zero financial leverage**". It must also be said that this case does not exist or remains very rare in reality because, in a given national economy, there is always the presence of firms with zero and non-zero financial levers.

3.1.6. After deduction situation

According to Table N. 3, there is a situation "**after the deduction**" in which the **50%** rate is the **effective tax rate ETR** of the firm E_U with "zero financial leverage" and constitutes the **maximum tax rate MAXTR**, the **37.50%** rate is the **effective tax rate ETR** of the firm E_L "with non-zero financial leverage" and constitutes the **minimum tax rate MINTR** and the rate of **43.75%** is the real **legal tax rate LTR** and represents the **average effective tax rate AETR**. CIT amounts to **F.XOF 8 billion** for the firm E_U financed exclusively with equity and **F.XOF 6 billion** for the indebted firm E_L; revenue from CIT on behalf of the State remains unchanged and equal to **F.XOF 14 billion**. In total, in situation after debt interest deduction in computing CIT, the "**real**" **loser** the "**firm E_U with zero financial leverage**" and the "**real**" **winner** the "**firm E_L with non-zero financial leverage**". At this point, a fourth prediction can be written:

Prediction 4: "The debt interest deduction in computing CIT, arbitrarily multiplies the tax rates by fixing an effective tax rate of the firm with zero financial leverage, an effective tax rate of the firm with non-zero financial leverage and a statutory tax rate which is the average of the two effective tax rates".

3.2. Empirical results

Empirical results include Fisher and Hausman specification tests, model estimation results and descriptive analysis.

3.2.1. Specification test

In panel data studies, it appears necessary to ensure the homogeneous or heterogeneous specification of the data-generating process (Doucouré (2008)). This means testing the equality of the coefficients of the model studied in the individual dimension. The specification test makes it possible to determine whether the theoretical model is perfectly identical for all firms, or whether there are firm-specific features. Specification tests are carried out equation by equation, in order to select the most appropriate estimation method for the model as a whole. These specification tests and estimations will be carried out using EViews 13 software. The detailed results of the various tests and regressions are presented in Appendix N. 1. Only the summary of these results will be highlighted in the remainder of this document.

3.2.1.1. Fisher or Likelihood Ratio Test: test for the presence of fixed effects (MCO vs Within)

Let's consider the two models:

Model 1: $\boldsymbol{I_{it} = c + b_1 P_{it} + e_{it}}$ ... ...

Model 2: $\boldsymbol{I_{it} = a_i + b_1 P_{it} + e_{it}}$ ... ...

The test hypotheses are:

H0: No effects (Prob > 5% or $F_C < F_t$): retain Model 1

H1: Presence of fixed effects (Prob < 5% or $F_C > F_t$): retain Model 2

Under the H0 hypothesis, the calculated Fischer statistic follows a Fischer distribution. To this end, the hypothesis of the presence of fixed effects will not be rejected when the calculated statistic is greater than the critical value read from the Fisher table. Test results are summarized in Table N. 4.

Table N. 4: Summary table of Fisher specification test results

Equation of Effective Tax Rate at Leveraged level – ETRL		
	Statistic	Prob.
Fisher test	4.172749	0.0000
Equation of Effective Tax Rate at Unleveraged level - ETRU		
	Statistic	Prob.
Fisher test	4.172749	0.0000
Equation of Effective Tax Rate at National level for leverage – ETRN		
	Statistic	Prob.
Fisher test	4.172749	0.0000
Equation of Effective Tax Rate at National level for unleverage - ETRN		
	Statistic	Prob.
Fisher test	4.172749	0.0000

Source: Author's computation based on regression results

For the three endogenous variables, effective tax rate for non-zero leverage firms (ETRL), effective tax rate for zero leverage firms (ETRU) and national effective tax rate (ETRN), the p-values of Fisher's test of significance of the coefficients are less than 1%. The H0 hypothesis is therefore rejected, and the fixed-effects model is more appropriate.

3.2.1.2. Hausman test: test for the presence of random effects (GCM vs Within)

Hausman's test follows a Chi-square distribution with k-1 degrees of freedom, and allows us to choose between the fixed-effects model and the random-effects model, which takes into account the heterogeneity of the data. The former assumes that the specific effects can be correlated with the model's explanatory variables, while the latter assumes that the specific effects are orthogonal to the model's explanatory variables. When the probability of this test is below the chosen threshold, the fixed-effects model is preferred. Otherwise, the random-effects model is chosen, in which case the GCM method is adopted. The Hausman test is based on the following hypotheses (Kuma (2018)):

H0 : Presence of random effects (Prob > 5% or H < χ^2_k)

H1 : Presence of fixed effects (Prob < 5% or H > χ^2_k)

The results of the Hausman post estimation test are presented below. The test results are summarized in Table N. 5.

Table N. 5: Summary table of Hausman specification test results

Equation of Effective Tax Rate at Leveraged level – ETRL			
ETRL	**Coefficients**		**Difference (b-B)**
	Fixed effects (b)	Random effects (B)	
EBIT	-0.000000	-0.000000	0,000000
INTEREST	-0.000000	-0.000000	0,000000
CITL	0.000000	0.000000	0,000000
SUBTAX	0.000000	0.000000	0,000000
SUBTR	2.526152	2.225669	0,300483
	Chi-Sq. Statistic	Prob.	
	16.665148	0.0052	
Equation of Effective Tax Rate at Unleveraged level - ETRU			
ETRU	**Coefficients**		**Difference (b-B)**
	Fixed effects (b)	Random effects (B)	
EBIT	-0.000000	-0.000000	0,000000
INTEREST	-0.000000	-0.000000	0,000000
CITU	0.000000	0.000000	0,000000
SURTAX	-0.000000	-0.000000	0,000000
SURTR	-0.526152	-0.225669	-0,300483
	Chi-Sq. Statistic	Prob.	
	16.665148	0.0052	
Equation of Effective Tax Rate at National level for leverage – ETRN			
ETRN	**Coefficients**		**Difference (b-B)**
	Fixed effects (b)	Random effects (B)	
EBIT	-0.000000	-0.000000	0,000000
INTEREST	-0.000000	-0.000000	0,000000
CITL	0.000000	0.000000	0,000000
SUBTAX	0.000000	0.000000	0,000000
SUBTR	1.526152	1.225669	0,300483
	Chi-Sq. Statistic	Prob.	
	16.665148	0.0052	
Equation of Effective Tax Rate at National level for unleverage - ETRN			
ETRN	**Coefficients**		**Difference (b-B)**
	Fixed effects (b)	Random effects (B)	
EBIT	-0.000000	-0.000000	0,000000
INTEREST	-0.000000	-0.000000	0,000000
CITU	0.000000	0.000000	0,000000
SURTAX	-0.000000	-0.000000	0,000000
SURTR	-1.526152	-1.225669	-0,300483
	Chi-Sq. Statistic	Prob.	
	16.665148	0.0052	

Source: Author's computation based on regression results

The probability of the Hausman test is below the 1% threshold for all equations. The fixed-effects model is therefore preferable to the random-effects model, and the Within estimator is retained.

3.2.2. Econometric estimation results and interpretation of results

This section presents the econometric results used to identify the determinants of firms' effective tax rates and the legal tax rate or national effective tax rate, and their interpretations. The detailed results of the EViews 13 regressions are presented in Appendix N. 2.

3.2.2.1. ETRL estimation results

The factors involved in explaining the effective tax rate of non-zero leverage firms (ETRL) in France are essentially internal to our model. Estimation of the determinants of ETRL yields the results shown in Table N. 6.

Table N. 6: Summary of ETRL estimation

$$\mathbf{ETRL = f(EBIT, INTEREST, CITL, SUBTAX, SUBTR)}$$

Variable	Coefficient	Prob.
EBIT	-1.90E-08	0.0000***
INTEREST	-4.86E-08	0.0000***
CITL	6.26E-08	0.0000***
SUBTAX	1.62E-07	0.0000***
SUBTR	2.526152	0.0000***
C	0.265471	0.0000
F-statistic	14.01190	
Prob(F-statistic)	0.000000***	
R-squared	0.817645	
Observations	100	

NB: (***), (**) and (*) denote significant variables at 1%, 5% and 10% respectively.

Source: Author's computation based on regression results

The characteristic equation of the endogenous variable ETRL is:

ETRL = -1.90431819322e-08*EBIT - 4.86187080395e-08*INTEREST + 6.26123125301e-08*CITL + 1.62198510176e-07*SUBTAX + 2.5261516102*SUBTR + 0.265470734817 + [CX=F, ESTSMPL="2017 2021"]

3.2.2.1.1. Econometric interpretations of ETRL

The p-value associated with the Fisher statistic for the overall significance test of the regression is close to zero, reflecting a good overall fit of the model. In other words, the variables selected do indeed explain the effective tax rate of non-zero leverage firms (ETRL) in France. As for the individual significance of the parameters, the test decision will be made by comparing the

p-value (Prob>z) with the different α thresholds (1% or 5% or 10%). If the p-value is below the test threshold, then the hypothesis that the coefficient under test is significantly different from zero cannot be rejected. Table N. 6 shows that the variables EBIT, INTEREST, CITL, SUBTAX and SUBTR are all significant at the 1% level. Moreover, the R2 is equal to 0.817645, which shows that the explanatory power of the variables is 81.76%.

3.2.2.1.2. Economic interpretations of ETRL

The effective tax rate of non-zero leverage firms (ETRL) in France is negatively affected by the variables EBIT and INTEREST, and positively by the variables CITL, SUBTAX and SUBTR. Thus, an increase in the tax-free rate (SUBTR) of one point (100%), is associated with an increase in ETRL of 2.5261516102 points at the 1% threshold.

3.2.2.2. ETRU estimation results

The factors involved in explaining the effective tax rate (ETRU) of zero-leverage firms in France are essentially internal to our model. Estimation of the determinants of ETRU yields the results shown in Table N. 7.

Table N. 7: Summary of ETRU estimation

$$\mathbf{ETRU = f(EBIT, INTEREST, CITU, SURTAX, SURTR)}$$

Variable	Coefficient	Prob.
EBIT	-1.90E-08	0.0000***
INTEREST	-4.86E-08	0.0000***
CITU	6.26E-08	0.0000***
SURTAX	-2.87E-07	0.0000***
SURTR	-0.526152	0.1223
C	0.265471	0.0000
F-statistic	9.854475	
Prob(F-statistic)	0.000000***	
R-squared	0.759235	
Observations	100	

NB: (***), (**) and (*) denote significant variables at 1%, 5% and 10% respectively.

Source: Author's computation based on regression results

The characteristic equation of the endogenous variable ETRU is:

ETRU = -1.90431819322e-08*EBIT - 4.86187080395e-08*INTEREST + 6.26123125301e-08*CITU - 2.87423135236e-07*SURTAX - 0.526151610204*SURTR + 0.265470734817 + [CX=F]

3.2.2.2.1. Econometric interpretations of ETRU

The p-value associated with the Fisher statistic for the overall significance test of the regression is close to zero, reflecting a good overall model fit. In other words, the variables selected really do explain the effective tax rate of zero leverage firms (ETRU) in France. Table N. 7 shows that the variables EBIT, INTEREST, CITU and SURTAX are all significant at the 1% level. Moreover, the R2 is equal to 0.759235, which shows that the explanatory power of the variables is 75.92%.

3.2.2.2.2. Economic interpretations

The effective tax rate of zero leverage firms (ETRU) in France is negatively affected by the variables EBIT, INTEREST, SURTAX and SURTR, and positively by the variable CITU.

3.2.2.3. Results of ETRN estimation linked to subtax

Estimation of the determinants of ETRN gives the results shown in Table N. 8.

Table N. 8: Summary of ETRN estimation linked to subtax

$$\mathbf{ETRN = f(EBIT, INTEREST, CITL, SUBTAX, SUBTR)}$$

Variable	Coefficient	Prob.
EBIT	-1.90E-08	0.0000***
INTEREST	-4.86E-08	0.0000***
CITN	6.26E-08	0.0000***
SUBTAX	2.25E-07	0.0000***
SUBTR	1.526152	0.0000***
C	0.265471	0.0000
F-statistic	10.34522	
Prob(F-statistic)	0.000000***	
R-squared	0.768007	
Observations	100	

NB: (***), (**) and (*) denote significant variables at 1%, 5% and 10% respectively.

Source: Author's computation based on regression results

The characteristic equation of the endogenous variable ETRN linked to subtax is:

ETRN = -1.90431819322e-08*EBIT - 4.86187080395e-08*INTEREST + 6.26123125301e-08*CITN + 2.24810822706e-07*SUBTAX + 1.5261516102*SUBTR + 0.265470734817 + [CX=F]

3.2.2.3.1. Econometric interpretation of ETRN linked to subtax

The p-value associated with the Fisher statistic for the overall significance test of the regression is close to zero, reflecting a good overall fit of the model. In other words, the variables selected really do explain the effective national tax rate linked to tax-free sales in France. Table N. 8 shows that the variables EBIT, INTEREST, CITN, SUBTAX and SUBTR are all significant at the 1% level. Moreover, the R2 is equal to 0.768007, which shows that the explanatory power of the variables is 76.80%.

3.2.2.3.2. Economic interpretations of ETRN linked to subtax

The effective national tax rate linked to subtax in France is negatively affected by the variables EBIT and INTEREST, and positively by the variables CITN, SUBTAX and SUBTR. Thus, an increase in the subtax rate (SUBTR) of one point (100%) is associated with an increase in ETRN of 1.5261516102 points at the 1% threshold.

3.2.2.4. Results of ETRN estimation linked to surtax

The factors involved in explaining the surtax-related national effective tax rate (ETRN) in France, are essentially internal to our model. Estimation of the determinants of the surtax-related ETRN yields the results shown in Table N. 9.

Table N. 9: Summary of ETRN estimation linked to the surtax

$$\mathbf{ETRN = f(EBIT, INTEREST, CITL, SURTAX, SURTR)}$$

Variable	Coefficient	Prob.
EBIT	-1.90E-08	0.0000***
INTEREST	-4.86E-08	0.0000***
CITN	6.26E-08	0.0000***
SURTAX	-2.25E-07	0.0000***
SURTR	-1.526152	0.0000***
C	0.265471	0.0000
F-statistic	10.34522	
Prob(F-statistic)	0.000000***	
R-squared	0.768007	
Observations	100	

NB: (***), (**) and (*) denote significant variables at 1%, 5% and 10% respectively.

Source: Author's computation based on regression results

The characteristic equation of the endogenous variable ETRN is:

ETRN = -1.90431819322e-08*EBIT - 4.86187080395e-08*INTEREST + 6.26123125301e-08*CITN - 2.24810822706e-07*SURTAX - 1.5261516102*SURTR + 0.265470734817 + [CX=F]

3.2.2.4.1. Econometric interpretations of ETRN linked to surtax

Table N. 9 shows that EBIT, INTEREST, CITN, SUBTAX and SUBTR are all significant at the 1% level. Moreover, the R2 is equal to 0.768007, which shows that the explanatory power of the variables is 76.80%.

3.2.2.4.2. Economic interpretations of ETRN linked to surtax

The effective national tax rate linked to the surtax in France is negatively affected by the variables EBIT, INTEREST, SUBTAX and SUBTR, and positively by the variable CITN. Thus, an increase in the surtax rate (SURTR) of one point (100%) is associated with a decrease in ETRN of 1.5261516102 points at the 1% threshold.

3.2.3. Descriptive analysis

Descriptive statistics for the twelve variables are presented in Table N. 10.

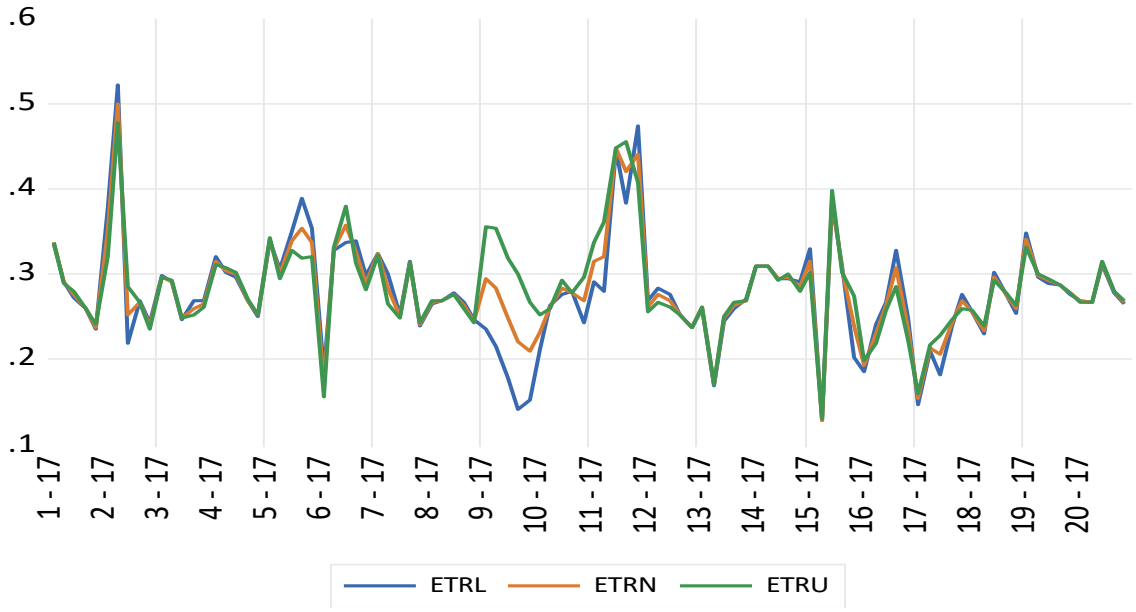
Table N. 10: Descriptive statistics

	ETRL	ETRN	ETRU	EBIT	INTEREST	CITL	CITN	CITU	SUBTAX	SURTAX	SUBTR	SURTR
Mean	0.277990	0.281244	0.284497	15165270	-3738344.	3586925.	4183762.	4780598.	-596836.7	596836.7	-0.003253	0.003253
Median	0.273934	0.276127	0.277777	1435953.	-618.5000	417413.0	421073.5	424734.1	-89.90169	89.90169	-0.000189	0.000189
Maximum	0.521975	0.499251	0.476526	2.05E+08	7920044.	48306468	60581167	72855866	1265665.	13116385	0.035692	0.078659
Minimum	0.128153	0.129491	0.130828	61565.00	-83220465	11251.00	12651.10	14051.20	-13116385	-1265665.	-0.078659	-0.035692
Std. Dev.	0.062863	0.055733	0.054708	39871826	16535337	8260171.	10531191	12940183	2633135.	2633135.	0.019136	0.019136
Skewness	0.708244	0.827784	0.683911	3.657412	-4.128882	3.493536	3.702831	3.852920	-4.159892	4.159892	-1.885438	1.885438
Kurtosis	5.535428	5.945130	5.566240	15.46863	18.37651	15.48040	16.67589	17.44661	18.65048	18.65048	7.775233	7.775233
Jarque-Bera	35.14514	47.56122	35.23553	870.7224	1269.282	852.4147	1007.807	1117.019	1308.985	1308.985	154.2598	154.2598
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	27.79901	28.12435	28.44970	1.52E+09	-3.74E+08	3.59E+08	4.18E+08	4.78E+08	-59683673	59683673	-0.325347	0.325347
Sum Sq. Dev	0.391219	0.307512	0.296309	1.57E+17	2.71E+16	6.75E+15	1.10E+16	1.66E+16	6.86E+14	6.86E+14	0.036252	0.036252
Observations	100	100	100	100	100	100	100	100	100	100	100	100

Source: Author's computation based on corporate financial statements

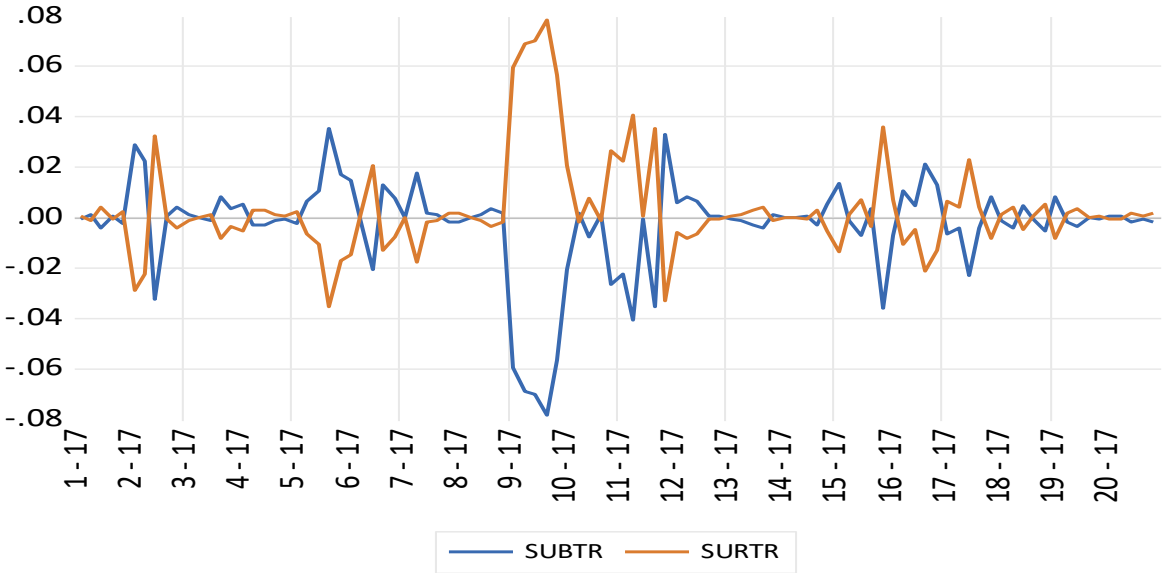
According to Table N. 10, the average legal tax rate or national effective tax rate (ETRN) is 28.1244% and, due to the deduction of debt interest, indebted firms have an average effective tax rate of 27.7990% versus 28.4479% for identical non-indebted firms. Figure N. 4 shows the effective tax rate graphs, while Figure N. 5 shows the subtax and surtax rate graphs linked to the debt interest deduction.

Figure N. 4: Effective tax rate graphs



Source: Author's realization based on regression results

Figure N. 5: Subtax and surtax rate graphs



Source: Author's realization based on regression results

According to Table N. 10, the average national legal tax rate or effective tax rate is 28.1244% in France over the period 2017 to 2021. This rate is close to the French tax reality, since from 2017 to 2021, the respective values of the legal tax rate for companies are: 28%; 28%; 31%; 28% and 26.50%, i.e., an average of 28.30%. Figure N. 5 shows that the effective tax rate curve for firms with zero financial leverage is generally above the effective tax rate curve for identical

firms with non-zero financial leverage. Figure N. 5 thus expresses the duality of the impact of deducting interest on debt in the calculation of corporate income tax.

Conclusion

All the research hypotheses are confirmed, subject to the inclusion of inflation. The debt interest deduction in computing CIT, has no incidence at the level of the State which grants it, but negatively affects the firm with "zero financial leverage" and positively the firm with "non-zero financial leverage". Unlike traditional theory, Durand (1952)'s Net Profit theory, Modigliani and Miller (1963)'s theory and Baxter (1967)'s bankruptcy cost theory, debt and debt interest deduction, have no effect on the financial value or the cost of capital of the firm. The incidence of this tax deduction is the diversion of profits from firms financed exclusively with equity to indebted firms. The State must take appropriate measures to eliminate in the short-term debt interest deduction in computing CIT. A Meeting of Shareholders of all "zero financial leverage" firms will have to be set up to take action to recover stolen dividends when deducting debt interest in computing CIT. This tax deduction constitutes a "debt interest versus equity dividend bias" which the related literature calls the "debt bias" which causes enormous economic damage to the firm. The "debt bias" is one of the biases in CIT whose analysis will be the subject of another article.

APPENDIX N. 1

Model of ETRL

Test of Fisher :

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	4.172749	(19,75)	0.0000
Cross-section Chi-square	72.129554	19	0.0000

Cross-section fixed effects test equation:
Dependent Variable: ETRL
Method: Panel Least Squares
Date: 08/22/23 Time: 07:00
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EBIT	-2.00E-08	2.32E-09	-8.650007	0.0000
INTEREST	-4.81E-08	6.26E-09	-7.687418	0.0000
CITL	6.69E-08	7.42E-09	9.019042	0.0000
SUBTAX	1.86E-07	2.75E-08	6.782049	0.0000
SUBTR	2.149573	0.350322	6.135990	0.0000
C	0.279962	0.004464	62.71354	0.0000

R-squared	0.624878	Mean dependent var	0.277990
Adjusted R-squared	0.604925	S.D. dependent var	0.062863
S.E. of regression	0.039512	Akaike info criterion	-3.566285
Sum squared resid	0.146755	Schwarz criterion	-3.409975
Log likelihood	184.3143	Hannan-Quinn criter.	-3.503024
F-statistic	31.31704	Durbin-Watson stat	1.101989
Prob(F-statistic)	0.000000		

Test of Hausman :

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	16.665148	5	0.0052

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EBIT	-0.000000	-0.000000	0.000000	0.7396
INTEREST	-0.000000	-0.000000	0.000000	0.2841
CITL	0.000000	0.000000	0.000000	0.8490
SUBTAX	0.000000	0.000000	0.000000	0.3242
SUBTR	2.526152	2.225669	0.026019	0.0625

Cross-section random effects test equation:
Dependent Variable: ETRL
Method: Panel Least Squares
Date: 08/22/23 Time: 07:10
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.265471	0.010539	25.19023	0.0000
EBIT	-1.90E-08	2.10E-09	-9.061869	0.0000
INTEREST	-4.86E-08	6.07E-09	-8.016266	0.0000
CITL	6.26E-08	6.77E-09	9.252443	0.0000
SUBTAX	1.62E-07	2.40E-08	6.768679	0.0000
SUBTR	2.526152	0.336671	7.503314	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.817645	Mean dependent var	0.277990
Adjusted R-squared	0.759291	S.D. dependent var	0.062863
S.E. of regression	0.030842	Akaike info criterion	-3.907581
Sum squared resid	0.071341	Schwarz criterion	-3.256288
Log likelihood	220.3791	Hannan-Quinn criter.	-3.643991
F-statistic	14.01190	Durbin-Watson stat	2.141672
Prob(F-statistic)	0.000000		

Model of ETRU

Test of Fisher :

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	4.172749	(19,75)	0.0000
Cross-section Chi-square	72.129554	19	0.0000

Cross-section fixed effects test equation:
Dependent Variable: ETRU
Method: Panel Least Squares
Date: 08/22/23 Time: 07:24
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EBIT	-2.00E-08	2.32E-09	-8.650007	0.0000
INTEREST	-4.81E-08	6.26E-09	-7.687418	0.0000
CITU	6.69E-08	7.42E-09	9.019042	0.0000
SURTAX	-3.20E-07	4.06E-08	-7.883412	0.0000
SURTR	-0.149573	0.350322	-0.426959	0.6704
C	0.279962	0.004464	62.71354	0.0000

R-squared	0.504724	Mean dependent var	0.284497
Adjusted R-squared	0.478379	S.D. dependent var	0.054708
S.E. of regression	0.039512	Akaike info criterion	-3.566285
Sum squared resid	0.146755	Schwarz criterion	-3.409975
Log likelihood	184.3143	Hannan-Quinn criter.	-3.503024
F-statistic	19.15861	Durbin-Watson stat	1.101989
Prob(F-statistic)	0.000000		

Test of Hausman :

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	16.665148	5	0.0052

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EBIT	-0.000000	-0.000000	0.000000	0.7396
INTEREST	-0.000000	-0.000000	0.000000	0.2841
CITU	0.000000	0.000000	0.000000	0.8490
SURTAX	-0.000000	-0.000000	0.000000	0.5012
SURTR	-0.526152	-0.225669	0.026019	0.0625

Cross-section random effects test equation:
Dependent Variable: ETRU
Method: Panel Least Squares
Date: 08/22/23 Time: 06:16
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.265471	0.010539	25.19023	0.0000
EBIT	-1.90E-08	2.10E-09	-9.061869	0.0000
INTEREST	-4.86E-08	6.07E-09	-8.016266	0.0000
CITU	6.26E-08	6.77E-09	9.252443	0.0000
SURTAX	-2.87E-07	3.62E-08	-7.929917	0.0000
SURTR	-0.526152	0.336671	-1.562804	0.1223

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.759235	Mean dependent var	0.284497
Adjusted R-squared	0.682191	S.D. dependent var	0.054708
S.E. of regression	0.030842	Akaike info criterion	-3.907581
Sum squared resid	0.071341	Schwarz criterion	-3.256288
Log likelihood	220.3791	Hannan-Quinn criter.	-3.643991
F-statistic	9.854475	Durbin-Watson stat	2.141672
Prob(F-statistic)	0.000000		

Model of ETRN -Leverage

Test of Fisher :

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	4.172749	(19,75)	0.0000
Cross-section Chi-square	72.129554	19	0.0000

Cross-section fixed effects test equation:
Dependent Variable: ETRN
Method: Panel Least Squares
Date: 08/22/23 Time: 13:43
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EBIT	-2.00E-08	2.32E-09	-8.650007	0.0000
INTEREST	-4.81E-08	6.26E-09	-7.687418	0.0000
CITN	6.69E-08	7.42E-09	9.019042	0.0000
SUBTAX	2.53E-07	3.39E-08	7.477541	0.0000
SUBTR	1.149573	0.350322	3.281475	0.0014
C	0.279962	0.004464	62.71354	0.0000

R-squared	0.522767	Mean dependent var	0.281244
Adjusted R-squared	0.497383	S.D. dependent var	0.055733
S.E. of regression	0.039512	Akaike info criterion	-3.566285
Sum squared resid	0.146755	Schwarz criterion	-3.409975
Log likelihood	184.3143	Hannan-Quinn criter.	-3.503024
F-statistic	20.59379	Durbin-Watson stat	1.101989
Prob(F-statistic)	0.000000		

Test of Hausman :

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	16.665148	5	0.0052

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EBIT	-0.000000	-0.000000	0.000000	0.7396
INTEREST	-0.000000	-0.000000	0.000000	0.2841
CITN	0.000000	0.000000	0.000000	0.8490
SUBTAX	0.000000	0.000000	0.000000	0.4286
SUBTR	1.526152	1.225669	0.026019	0.0625

Cross-section random effects test equation:
Dependent Variable: ETRN
Method: Panel Least Squares
Date: 08/22/23 Time: 13:47
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.265471	0.010539	25.19023	0.0000
EBIT	-1.90E-08	2.10E-09	-9.061869	0.0000
INTEREST	-4.86E-08	6.07E-09	-8.016266	0.0000
CITN	6.26E-08	6.77E-09	9.252443	0.0000
SUBTAX	2.25E-07	3.00E-08	7.501256	0.0000
SUBTR	1.526152	0.336671	4.533059	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.768007	Mean dependent var	0.281244
Adjusted R-squared	0.693769	S.D. dependent var	0.055733
S.E. of regression	0.030842	Akaike info criterion	-3.907581
Sum squared resid	0.071341	Schwarz criterion	-3.256288
Log likelihood	220.3791	Hannan-Quinn criter.	-3.643991
F-statistic	10.34522	Durbin-Watson stat	2.141672
Prob(F-statistic)	0.000000		

Model of ETRN – Unleverage

Test of Fisher :

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	4.172749	(19,75)	0.0000
Cross-section Chi-square	72.129554	19	0.0000

Cross-section fixed effects test equation:
Dependent Variable: ETRN
Method: Panel Least Squares
Date: 08/22/23 Time: 13:59
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EBIT	-2.00E-08	2.32E-09	-8.650007	0.0000
INTEREST	-4.81E-08	6.26E-09	-7.687418	0.0000
CITN	6.69E-08	7.42E-09	9.019042	0.0000
SURTAX	-2.53E-07	3.39E-08	-7.477541	0.0000
SURTR	-1.149573	0.350322	-3.281475	0.0014
C	0.279962	0.004464	62.71354	0.0000

R-squared	0.522767	Mean dependent var	0.281244
Adjusted R-squared	0.497383	S.D. dependent var	0.055733
S.E. of regression	0.039512	Akaike info criterion	-3.566285
Sum squared resid	0.146755	Schwarz criterion	-3.409975
Log likelihood	184.3143	Hannan-Quinn criter.	-3.503024
F-statistic	20.59379	Durbin-Watson stat	1.101989
Prob(F-statistic)	0.000000		

Test of Hausman :

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	16.665148	5	0.0052

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EBIT	-0.000000	-0.000000	0.000000	0.7396
INTEREST	-0.000000	-0.000000	0.000000	0.2841
CITN	0.000000	0.000000	0.000000	0.8490
SURTAX	-0.000000	-0.000000	0.000000	0.4286
SURTR	-1.526152	-1.225669	0.026019	0.0625

Cross-section random effects test equation:
Dependent Variable: ETRN
Method: Panel Least Squares
Date: 08/22/23 Time: 14:03
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.265471	0.010539	25.19023	0.0000
EBIT	-1.90E-08	2.10E-09	-9.061869	0.0000
INTEREST	-4.86E-08	6.07E-09	-8.016266	0.0000
CITN	6.26E-08	6.77E-09	9.252443	0.0000
SURTAX	-2.25E-07	3.00E-08	-7.501256	0.0000
SURTR	-1.526152	0.336671	-4.533059	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.768007	Mean dependent var	0.281244
Adjusted R-squared	0.693769	S.D. dependent var	0.055733
S.E. of regression	0.030842	Akaike info criterion	-3.907581
Sum squared resid	0.071341	Schwarz criterion	-3.256288
Log likelihood	220.3791	Hannan-Quinn criter.	-3.643991
F-statistic	10.34522	Durbin-Watson stat	2.141672
Prob(F-statistic)	0.000000		

APPENDIX N. 2

Estimation results:

Estimation of ETRL model

Dependent Variable: ETRL
Method: Panel Least Squares
Date: 08/22/23 Time: 07:15
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EBIT	-1.90E-08	2.10E-09	-9.061869	0.0000
INTEREST	-4.86E-08	6.07E-09	-8.016266	0.0000
CITL	6.26E-08	6.77E-09	9.252443	0.0000
SUBTAX	1.62E-07	2.40E-08	6.768679	0.0000
SUBTR	2.526152	0.336671	7.503314	0.0000
C	0.265471	0.010539	25.19023	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.817645	Mean dependent var	0.277990
Adjusted R-squared	0.759291	S.D. dependent var	0.062863
S.E. of regression	0.030842	Akaike info criterion	-3.907581
Sum squared resid	0.071341	Schwarz criterion	-3.256288
Log likelihood	220.3791	Hannan-Quinn criter.	-3.643991
F-statistic	14.01190	Durbin-Watson stat	2.141672
Prob(F-statistic)	0.000000		

Estimation of ETRU model

Dependent Variable: ETRU
Method: Panel Least Squares
Date: 08/22/23 Time: 07:52
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EBIT	-1.90E-08	2.10E-09	-9.061869	0.0000
INTEREST	-4.86E-08	6.07E-09	-8.016266	0.0000
CITU	6.26E-08	6.77E-09	9.252443	0.0000
SURTAX	-2.87E-07	3.62E-08	-7.929917	0.0000
SURTR	-0.526152	0.336671	-1.562804	0.1223

C	0.265471	0.010539	25.19023	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.759235	Mean dependent var	0.284497
Adjusted R-squared	0.682191	S.D. dependent var	0.054708
S.E. of regression	0.030842	Akaike info criterion	-3.907581
Sum squared resid	0.071341	Schwarz criterion	-3.256288
Log likelihood	220.3791	Hannan-Quinn criter.	-3.643991
F-statistic	9.854475	Durbin-Watson stat	2.141672
Prob(F-statistic)	0.000000		

Estimation of ETRN – Leverage model

Dependent Variable: ETRN
Method: Panel Least Squares
Date: 08/22/23 Time: 13:49
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EBIT	-1.90E-08	2.10E-09	-9.061869	0.0000
INTEREST	-4.86E-08	6.07E-09	-8.016266	0.0000
CITN	6.26E-08	6.77E-09	9.252443	0.0000
SUBTAX	2.25E-07	3.00E-08	7.501256	0.0000
SUBTR	1.526152	0.336671	4.533059	0.0000
C	0.265471	0.010539	25.19023	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.768007	Mean dependent var	0.281244
Adjusted R-squared	0.693769	S.D. dependent var	0.055733
S.E. of regression	0.030842	Akaike info criterion	-3.907581
Sum squared resid	0.071341	Schwarz criterion	-3.256288
Log likelihood	220.3791	Hannan-Quinn criter.	-3.643991
F-statistic	10.34522	Durbin-Watson stat	2.141672
Prob(F-statistic)	0.000000		

Estimation of ETRN – Unleverage model

Dependent Variable: ETRN
Method: Panel Least Squares
Date: 08/26/23 Time: 11:43
Sample: 2017 2021
Periods included: 5
Cross-sections included: 20
Total panel (balanced) observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EBIT	-1.90E-08	2.10E-09	-9.061869	0.0000
INTEREST	-4.86E-08	6.07E-09	-8.016266	0.0000
CITN	6.26E-08	6.77E-09	9.252443	0.0000
SURTAX	-2.25E-07	3.00E-08	-7.501256	0.0000
SURTR	-1.526152	0.336671	-4.533059	0.0000
C	0.265471	0.010539	25.19023	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.768007	Mean dependent var	0.281244
Adjusted R-squared	0.693769	S.D. dependent var	0.055733
S.E. of regression	0.030842	Akaike info criterion	-3.907581
Sum squared resid	0.071341	Schwarz criterion	-3.256288
Log likelihood	220.3791	Hannan-Quinn criter.	-3.643991
F-statistic	10.34522	Durbin-Watson stat	2.141672
Prob(F-statistic)	0.000000		

Fixed effects of ETRL, ETRU and ETRN models:

	Firms	Effect
1	1	0.027649
2	2	0.045821
3	3	0.004422
4	4	0.035125
5	5	0.052944
6	6	0.049629
7	7	0.022255
8	8	0.003467
9	9	-0.320156
10	10	0.015999
11	11	0.065729
12	12	-0.010296
13	13	-0.019500
14	14	0.032749
15	15	0.012110
16	16	-0.031865
17	17	-0.039090
18	18	0.004142
19	19	0.033106
20	20	0.015759

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