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Tax Avoidance and Transfer Pricing: A VECM Regression Model

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Abstract:

Purpose: *The study examines the tax incentives related to pricing decisions between affiliated companies which are tax residents of Greece and focuses on the pricing behavior of intra-group transactions among related parties.*
Design/methodology/approach: *In the context of the empirical analysis, a panel data regression analysis was performed, using a vector error correction model (VECM) with two lags. The data used in the analysis were retrieved from the AMADEUS (**A**nalyze **MA**jor **D**atabases from **EU**ropean **S**ources) Tp-Catalyst (TP 96, March 2018 edition) database and consists of 2,131 companies from most Greek economy sectors, of which 971 are independent and 1,160 are affiliated with other companies. The total sample consists of 17,048 observations, of which 7,768 refer to independent companies and 9,280 to affiliated companies. The research span is from 2010 to 2017 and a two-lag VECM regression model was implemented.*
Findings: *The results of the study are generally in compliance with the international literature. According to the study, affiliated companies appear to have lower profit margins, lower tax burden and a lower Berry ratio than independent companies.*
Practical implications: *The study elaborates on the positive effects of the new Income Tax Code and the new Tax Procedure Code, according to which companies operating in Greece and conducting intra-group transactions, are obliged to document such transactions in the context of a price documentation file.*
Originality value: *The empirical research of the present paper is unprecedented in Greece. The size of the sample in terms of number of companies, number of available ratios and time depth, allowed the analysis through a VECM model to examine the possible use of transfer pricing by affiliated companies to decrease their tax burden. A similar lagged model of autoregressive vectors has not been identified in the relevant literature. The results provide the authorities a benchmark for future audits, since indicate that the manipulation is significant both in short, as well as in a long-term time frame. The use of a VECM model with*

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two lags revealed that the manipulation is not limited within one financial year and the authorities should inspect data from a wider time range when conducting their audits.

Keywords: *Transfer pricing, tax evasion, tax administration, tax audits, Greece, affiliated companies, independent companies, VECM model.*

JEL codes: *H26, H25, H22, H21*

Paper type: *Research article.*

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1. Introduction

Due to the recent financial crisis, which in many countries including Greece turned into a fiscal crisis, taxation issues and more specifically taxation of Multi-National Companies (MNCs) attracted the attention of the international economic community. Corporate taxation practices and more specifically the reduction of tax evasion, has acquired an unprecedented degree of political importance and has attracted the interest of tax administrations. The major objective of the respective authorities is to establish an approach to evaluate and prevent corporate tax evasion as reflected by the proposals formulated by official bodies such as the OECD (OECD, 2015).

The monetary impact of transfer pricing is significant in modern economies, as multinationals account for more than 60% of global trade. Therefore, the respective tax administrations enact laws and enforce regulations on the documentation of intra-group transactions and the control of the profit transfers, to comply with the "Arm's Length Principle". According to this principle the price of each transaction should be regulated as if the companies involved were in fact independent as opposed to adjusting prices for the benefit of the same corporate structure (Sun, Li, and Zheng, 2017).

Individual companies defend themselves by emphasizing that they fully comply with the tax legislation of their host countries and that it is the role of the legislator to define the legal framework for conducting intra-group transactions, to prevent multinational tax evasion activities. In fact, data collected from relevant tax audits revealed significant legislative gaps in the existing legal frameworks. Apparently, multinational corporations create complex international tax structures to transfer their profits from high-tax to low-tax areas through subsidiaries operating in countries with low tax rates, using transfer prices or capital lending to substantially reduce their profits in the high-tax areas.

Although transfer pricing has been an issue in the spotlight, there is no specific methodology to calculate and record the potential gains of the companies which employ such practices. For this reason, many different approaches have been proposed

in the international literature, which even though they utilize similar elements and variables, they usually focus on different aspects of the issue.

In the model we used in this paper, we have chosen to perform regression analysis, using many different variables which are available from the business balance sheets and are published in the Amadeus TP Catalyst data base. The purpose of the empirical analysis is to examine whether affiliated companies manipulate their results and operating expenses to reduce their profits or generate higher profit rates in subsidiaries operating in countries with favorable tax treatment. Therefore, we created VAR regression models defining as dependent variables the profit margin before taxes and interest EBIT (%) and the Berry ratio (BR: Index defined as Gross profit / Operating expenses %).

2. Literature Review

Investigating profits to assess the effects of intra-group transactions is a common practice according to the international literature. The stated transaction price has been used as dependent variable in many publications, such as those of Amerighi (2013), Gupta (2012), Gao and Zhao (2015), and Merle, Al-Gamrh, and Ahsan (2019).

The price of the product is causally related to the profits of the company, because the higher the prices, the higher the profits, given the costs of the production process. Consequently, the above papers are in line with relevant research that place the company's profits as the dependent variable of a regression model. The examination of profits as a means of combating tax evasion is part of the Action Plan against Erosion of the Tax Base and Transfer of Profits prepared by the OECD (2015) and is known as BEPS (Base Erosion and Profit Shifting). In this direction there are many papers that use business profits as dependent variables. One of the first approaches that introduced profits as a dependent variable was that of Mutti and Grubert (2009) and Hines and Rice (1994), which are considered particularly important and comprise a reference point for many contemporary relevant studies in this field. Using a similar approach, McDonald (2008) took into account the ratio of operating profits to sales of US multinationals and concluded that these firms present lower profits from their subsidiaries operating in higher tax areas and higher profits in the subsidiaries operating in areas with low taxation, thus indicating the existence of a profit transfer in order to avoid taxation.

In a similar study, Lo, Wong, and Firth (2010) examined data from listed Chinese companies in 2004, using the ratio of gross profits to sales of these companies as a dependent variable, comparing the results of transactions between affiliated and independent companies. A ratio greater than one, indicates that the company's management increases the declared profits through intragroup transactions. According to their results, companies tend to increase their reported profits as the corporate tax rate decreases. Moreover, companies that associate their executives' salaries with

corporate profits show significantly higher profits and the higher the percentage of ownership by the Chinese government, the lower the level of declared profitability.

Sun, Li, and Zheng (2017) used official statistics to determine whether there is a difference in profitability between multinational companies operating in China and domestic companies. In their analysis, they used corporate profits as a dependent variable and found that multinational corporations operating in China made an estimated profit transfer of 21% of their total profits. The analysis also shows that this percentage is declining, which means that the actions of the Chinese government have had a positive effect on the issue of profit transfer.

Kramarova (2021), examined the correlation between transfer pricing and controlled transactions with profit management and tax avoidance in Slovakia. The model of the empirical research was a regression model with several financial ratios used as proxies of the relevant variables. The analysis provided strong evidence of profit manipulation and highlighted the significance of improving transactions' control.

3. Hypotheses

Regarding the independent variables used in the published models, we found that there is significant variation, and that variable are defined according to data availability and individual research objectives. However, it should be noted that the variables used in the various studies are not actually irrelevant, as they usually include indicators that reflect mainly the financial status of companies and the size of the object of analysis.

Limiting ourselves to relatively recent work in the existing literature, we observed that McDonald (2008) used the age of the subsidiary and the sales of the parental company, both in absolute terms and as a denominator to create profitability ratios. He also used the tax rate of the country where the affiliated company is located. Lo, Wong, and Firth (2010) in a similar approach used profitability ratios, but also added some control variables such as D/A (liabilities to assets), ROE (return on equity), as well as a number of pseudo-variables related to the tax environment of the business, the size of the assets in absolute terms and the market conditions. Sun, Li, and Zheng (2017) used a transfer profit calculation formula according to which the independent variables were the differences of the multinationals with the reference values on gross profit, the amount of sales tax, as well as the amount of income tax.

Kramarova (2021) created a regression model using the discretionary accruals as an independent variable and various profit indicators, such as Net income to Assets and ROA, as regressors. Gramlich *et al.* (2004) used a number of independent variables, which included the pre-tax income ratio to the value of the business, the tax rate, the size of the assets and the leverage of the business. They also used the gross profit margin as an alternative dependent variable. Finally, Wong, Kim, and Lo (2015), in addition to conventional variables such as tax size, business size and leverage, introduced additional variables to their model, such as return on assets (ROA) and

book value of the business. According to the review of the relevant literature, we can formulate the following research hypothesis:

H1: It is expected that the Berry ratio of affiliated companies will be lower than that of independent companies, as the former through the management of intra-group transactions manipulate their earnings. Affiliated companies can impose various expense charges such as administrative support, royalties, management fees etc., to achieve the reduction of their net profits and tax liability, achieving thus a lower Berry ratio.

The larger the difference in tax rates between different countries or areas, the greater the potential tax savings from transferring profits to the area where the lower tax rate applies. The ability to manipulate corporate results is greater in companies that make large volumes of transactions between their affiliated companies. For these companies, a small change in the price of the intra-group transaction could have a significant impact on profitability and a corresponding benefit from tax savings. The manipulation of the prices of intra-group transactions for tax incentives, leads to large differences in the declared profitability between different countries where the affiliated companies are active. Therefore, the existence of large groups with numerous transactions between their affiliated companies and large differences in tax rates between countries, are incentives and opportunities for shifting profits from region to region (Conover and Nichols, 2000; Lo, Wong, and Firth, 2010; Beebeejaun, 2018). Consequently, the following hypothesis is formed:

H2: It is expected that increased tax rates, are positively related to the manipulation of corporate profits.

Tax tightening is an effective mechanism to prevent companies from manipulating profits through intra-group transactions (Chen, Lin, and Chang, 2001; Lo, Wong and Firth, 2010). Therefore, the following hypothesis is formed:

H3: It is expected that the manipulation of corporate results through the prices of intra-group transactions between related companies will decrease after the adoption of the OECD guidelines and the introduction of a new framework for controlling intra-group transactions exclusively by the Greek Ministry of Finances in 2013.

4. Empirical Model

For the empirical analysis of the paper, a VECM panel regression analysis model was implemented. The regression model we use is based on the work presented in the literature review, adapted to the case of Greece, and based on the data obtained from the published financial statements of the companies that comprise the sample of this research, as presented in the Amadeus Tp-Catalyst database.

Following the above, the regression equations were formulated according to the following models:

$$Y = \beta_0 + \beta_{i,1} \cdot X_{i-1} + \beta_{i,2} \cdot X_{i-2} + \beta_{j,1} \cdot \mathrm{Re}l * X_{i-1} + \beta_{j,2} \cdot \mathrm{Re}l * X_{i-2} + \varepsilon$$

Where Xi are the available variables:

• ROCE = Return on Capital Employed (%)
• ROTA = Return on Total Assets (%)
• NCPM = Net Cost-Plus Margin, Net Profit Margin (%)
• EBITDA = Profit margin before taxes, interest, and depreciation (%)
• Sales = Total sales in thousand euros
• Op. P / L = Operating Profit / Loss in thousand euros
• Tax = Taxation in thousand euros
• P / L_{tax} = Profit / loss after taxes in thousand euros
• WC = Working Capital in thousand euros
• Rel. = Related, Dummy variable that takes the value 1 if the company is grouped and 0 if the company is independent
• Rel * Xi = It is the interaction of the pseudo-variable Rel with the independent variables Xi.

In order to create different models with the objective to formulate the optimum comprehensive approach towards resolving the issue under investigation, i.e., the manipulation of corporate results through intra-group transactions in Greece, we have considered the following two variables as dependent variables:

• EBIT = Profit margin before taxes and interest (%)
• BR = Berry ratio, Index defined as: (Gross profit) / (Operating expenses) (%)

It should be noted that the presence of the interactions of the dummy variable Rel with the other independent variables, will contribute to an improved analysis regarding the way in which this variable affects our model.

The present work is considered significant in the field of tax compliance in Greece, as it is one of the few efforts to approach the process of transferring profits through intra-group transactions between affiliated companies. The data used are from 2010 to 2017 and retrieved from the Amadeus Tp-Catalyst database. The sample consists of 2,131 companies from most sectors of the Greek economy, of which 971 are independent companies and 1,160 are affiliated companies. The number of available control variables is sufficient to extract the results with confidence. The total sample consists of 17,048 comments, of which 7,768 refer to independent companies and 9,280 to related companies.

5. Data Analysis

The descriptive statistics of the variables included in our model are depicted in Table 1.

Table 1. *Descriptive statistics*

	Minimum	Maximum	Mean	Std. Deviation
Gross Margin	-88,91	100,00	22,1926	19,69159
EBIT	-99,88	93,94	1,6960	13,70046
EBITDA	-97,25	99,97	6,1148	14,54570
ROCE	-845,78	981,19	7,2190	57,76921
ROTA	-96,42	91,49	,7613	11,35381
NCPM	-100,00	981,51	4,3337	41,49948
BR	,00	206,29	1,4520	4,01225
Sales	,00	9900533,00	37820,9723	297158,10432
Operating P/L	-9727721,00	958000,00	106,0102	91587,56851
Taxation	-560448,00	79782,19	-52,9339	8554,33825
Working capital	-2601000,00	10172000,00	10105,3859	193746,81135
Number of observations 17.048				

Source: *Own study.*

To create regression models, certain assumptions need to be made in order for the result of the research to be statistically significant. From the relevant tests we performed, it turned out that our data do not have a problem of multicollinearity (Table 4, Annex), but at level the variables are not stationary. On the contrary, the first differences are stationary (Tables 5 and 6, Annex) and for this reason we will use the first differences of the variables when calculating the model. Also, according to the results of the Granger causality test, there are significant causation relationships between the variables, both for the BR index (Table 7, Annex) and for EBIT (Table 8, Annex). Therefore, the appropriate model for the analysis is the VAR model using two lags, as indicated by the assumption tests. The cointegration check for the variables (Tables 9 and 10, Annex) indicates that there is cointegration among the variables and the model to be used is the error correction model (VECM).

VAR models create two different equations, one for the long-run and one for the short-run relationships of the variables. The long-term equations are shown in the following table (Table 2).

Table 2. *Long-term VECM coefficients*

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
	BR	**EBIT**
ROCE(-1)		0.201459
		[20.2075]
ROTA(-1)	1.652243	-0.537175
	[7.06428]	[-9.28681]
NCPM(-1)	-2.620070	-0.075142
	[-20.0266]	[-4.23789]

EBITDA(-1)	4.414217 [29.0709]	-0.151528 [-3.53529]
GROSSMARGIN(-1)	-0.394232 [-4.86708]	
REL_BR(-1)	9.106059 [11.5900]	
REL_ROTA(-1)	-1.346479 [-4.03569]	
REL_NCPM(-1)	2.540186 [17.7778]	
REL_EBIT(-1)		-0.651393 [-5.01754]
REL_EBITDA(-1)	-4.400886 [-12.7476]	
REL_GROSSMARGIN(-1)	0.870078 [5.73710]	
C	-12.83225	-2.387443

Source: *Own study.*

From the above table it is concluded that for the BR index, the values of the t-statistic are statistically significant for the variables ROTA, EBITDA, REL_BR, REL_NCPM and REL_GROSSMARGIN with a positive sign, while for the variables NCPM, GROSSMARGIN, REL_ROTA and REL_EBITDA there is a significant but negative sign. This means that the BR index is inversely affected in the long run by changes in these variables. Thus, when the ROTA and EBITDA prices increase, the BR index decreases, while when the NCPM and Grossmargin prices increase, the BR index increases. Finally, it turns out that Rel_BR has a positive rate, the highest in value, which means that affiliated companies will have a long-term lower BR index than unrelated ones. On the contrary, for EBIT index there are less significant relationships since only the coefficient of the variable ROCE, denoted a significantly positive sign, while ROTA, NCPM, EBITDA and REL_EBIT, denoted a negative sign.

The results of the short-run model for both variables include more variables, because the cointegration test showed that the optimal number of lags is equal to two. The results are depicted in detail in the Annex (Tables 11-13), but the statistically significant relationships are shown in the following table (Table 3). The signs in the short-term equations are correct and we do not have to change them as we did with the long-term equation.

Table 3. *Short-term VECM coefficients*

Coefficient sign	BR	EBIT
Positive	ROTA(-1) EBITDA(-2) REL_ NCPM(-1) GROSSMARGIN(-2) REL_BR(-1) REL_BR(-2) BR(-1)	ROCE(-1) ROCE(-2) GROSSMARGIN(-1) REL_EBITDA(-2)
Negative	BR(-2) NCPM(-1) NCPM(-2) GROSSMARGIN(-2) REL_ROTA(-1) REL_EBITDA(-1) REL_EBITDA(-2)	EBIT(-2) ROTA(-1) NCPM(-1) NCPM(-2)) REL_GROSSMARGIN(-2)
R-Square	0,3268	0,204

Source: *Own study.*

6. Conclusions

Based on the existing international literature, we chose the BR index and the EBIT index as dependent variables and the other financial variables as independent. Since causality relationships are often detected in economic data rather than simple correlations, we performed a Granger causality test. As existing economic theory reinforces this belief and the research hypotheses move in the same direction, we believe that affiliated companies within corporate groups perform intragroup transactions based on profit ratios over specific periods of time, to manipulate their taxable material and reduce the amounts they pay in taxes.

The size of the sample in terms of number of companies, number of available ratios and time depth, allowed the analysis through a VAR model that could provide proof for the possible time-delayed earnings management of the firms. The change in tax ratios and the implementation of the new legal framework have been identified in the international literature as factors that affect earnings management. However, a lagged model has never been used to assess the effects of these changes over time. The present research implemented a VECM model to examine the possible use of transfer pricing by affiliated companies to decrease their tax burden which can be considered an innovation in this field of research.

According to our results, the BR index features a negative correlation with the variables ROTA, EBITDA, REL_BR, REL_NCPM and REL_GROSSMARGIN, while it displays a positive relationship with NCPM, GROSSMARGIN, REL_ROTA and REL_EBITDA. Consequently, the hypotheses of the present analysis are confirmed, since the correlation with REL_BR is negative, which means that the affiliated companies, which scored a value of 1 in the Related dummy variable, will

have long-term lower Berry index values than the independent ones. The results obtained in the other two interaction variables (REL_ROTA and REL_EBITDA) are contradictory but reinforce the research hypothesis that the results are manipulated by affiliated companies. From our analysis the significant outcomes that emerged, support the theory of manipulation of profits by affiliated companies and reinforce the conclusions of previous research.

In the long-term equilibrium equation for the BR index, the coefficients for the variables ROTA and NCPM have opposite signs to the interaction variables REL_ROTA and REL_EBITDA. This suggests that affiliates, whose behavior is reflected in their interactions, act in a different way from the independent firms. That behavior explains the differentiation in signs. A similar conclusion is drawn from the second equation of long-run equilibrium that we created for the dependent variable EBIT. The signs of the variable EBIT and REL_EBIT, which is the only statistically significant one, are opposite in the equation. This is the main reason we added, the dummy variables and their interactions as independent variables to the model, to determine whether there is a difference in the behavior of affiliated and independent companies.

The results of the short-term analysis of the two variables also presented an interesting outcome. The BR index is significantly affected only by its lags and no other variable, while EBIT is affected by its own lags and in addition by the lags of the variables ROCE, ROTA, NCPM and GROSSMARGIN. On the other hand, the results of the interactions with the Related dummy variable are completely different. The BR index is significantly affected by the interactions with the NCPM, EBITDA, GROSSMARGIN and the BR index itself, while the EBIT index is significantly affected only by the EBITDA and GROSSMARGIN ratios.

To the best of the authors' knowledge, a similar model of autoregressive vectors has not been identified in the current literature, so the present work is innovative as it is the first to be conducted in Greece with VAR models for intra-group transactions and manipulation of profits. The above results are indicative of the differentiation that has been observed at all levels of the analysis, since profitability indicators, such as the Berry ratio, include operating expenses which are an important source of manipulation of the results of affiliated companies. The opposite is presented by the results of the dependent variables in relation to the independent variables and their interactions with the dummy variables, which is an indication that the operating expenses are being manipulated by the affiliated companies. Earnings before interest and taxes (EBIT) do not demonstrate significant differences between independent and affiliated companies, while the index is affected by all other profitability variables. In contrast, the BR index does not interact at all with the other variables in the short run, however significant effects are indicated by the Related dummy variable (Rel).

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ANNEX

Table 4 - Multicollinearity tests

Variance Inflation Factors
Included observations: 17048

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
ROCE	3.06E-07	1.163361	1.145472
ROTA	9.17E-06	1.332762	1.326797
NCPM	5.98E-07	1.167769	1.155171
OP_PL	5.69E-12	53.56043	53.56036
SALES	1.17E-14	1.180761	1.161937
PLTAX	5.55E-12	44.98775	44.98574
TAX	6.70E-11	5.498314	5.498103
WC	3.79E-14	1.602177	1.597830
EBITDA	5.91E-06	1.651878	1.403784
GROSSMARGIN	2.71E-06	2.674908	1.178258

Table 5 - Stationarity tests for ROCE at level

Method	Statistic	Prob.**
Levin, Lin & Chu t*	3.481	0.9998

** Probabilities are computed assuming asympotic normality

Table 6 - Stationarity tests for ROCE at first differences

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-3261.9	0.0000

** Probabilities are computed assuming 61symptotic normality

Table 7 - Granger causality test for BR

Pairwise Granger Causality Tests
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ROCE does not Granger Cause BR	12786	0.52538	0.7171
BR does not Granger Cause ROCE		0.57865	0.6781
ROTA does not Granger Cause BR	12786	5.21304	0.0003
BR does not Granger Cause ROTA		2.44666	0.0443
NCPM does not Granger Cause BR	12786	7.01946	1.E-05
BR does not Granger Cause NCPM		12.6664	3.E-10
OP_PL does not Granger Cause BR	12786	0.18023	0.9487
BR does not Granger Cause OP_PL		2.85725	0.0222
SALES does not Granger Cause BR	12786	0.02891	0.9984
BR does not Granger Cause SALES		7.75672	3.E-06
TAX does not Granger Cause BR	12786	0.42464	0.7910
BR does not Granger Cause TAX		0.37460	0.8269
WC does not Granger Cause BR	12786	0.02882	0.9984
BR does not Granger Cause WC		1.00562	0.4030
EBITDA does not Granger Cause BR	12786	3.01234	0.0170
BR does not Granger Cause EBITDA		1.06740	0.3708
GROSSMARGIN does not Granger Cause BR	12786	3.89169	0.0037
BR does not Granger Cause GROSSMARGIN		3.38644	0.0089
REL_EBITDA does not Granger Cause BR	12786	1.63459	0.1625
BR does not Granger Cause REL_EBITDA		4.07761	0.0026
REL_GROSSMARGIN does not Granger Cause BR	12786	3.14880	0.0135
BR does not Granger Cause REL_GROSSMARGIN		0.39037	0.8157

Table 8 - Granger causality test for EBIT

Pairwise Granger Causality Tests
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ROCE does not Granger Cause EBIT	12786	6.46735	0.0016
EBIT does not Granger Cause ROCE		2.85895	0.0574
ROTA does not Granger Cause EBIT	12786	75.0168	4.E-33

EBIT does not Granger Cause ROTA		60.0146	1.E-26
NCPM does not Granger Cause EBIT	12786	8.48170	0.0002
EBIT does not Granger Cause NCPM		560.171	6E-234
OP_PL does not Granger Cause EBIT	12786	1.24515	0.2879
EBIT does not Granger Cause OP_PL		2.41656	0.0893
SALES does not Granger Cause EBIT	12786	0.65702	0.5184
EBIT does not Granger Cause SALES		0.08286	0.9205
TAX does not Granger Cause EBIT	12786	1.70657	0.1815
EBIT does not Granger Cause TAX		0.55170	0.5760
WC does not Granger Cause EBIT	12786	0.46947	0.6253
EBIT does not Granger Cause WC		0.09438	0.9099
EBITDA does not Granger Cause EBIT	12786	32.5216	8.E-15
EBIT does not Granger Cause EBITDA		70.8337	3.E-31
GROSSMARGIN does not Granger Cause EBIT	12786	5.21157	0.0055
EBIT does not Granger Cause GROSSMARGIN		56.0990	6.E-25
REL_EBIT does not Granger Cause EBIT	12786	9.84521	5.E-05
EBIT does not Granger Cause REL_EBIT		0.04844	0.9527
REL_EBITDA does not Granger Cause EBIT	12786	6.01594	0.0024
EBIT does not Granger Cause REL_EBITDA		3.57755	0.0280
REL_GROSSMARGIN does not Granger Cause EBIT	12786	4.26293	0.0141
EBIT does not Granger Cause REL_GROSSMARGIN		23.9374	4.E-11

Table 9 - Cointegration test for BR

Kao Residual Cointegration Test				
Null Hypothesis: No cointegration				
Trend assumption: No deterministic trend				
Automatic lag length selection based on SIC with a max lag of 2				
Newey-West automatic bandwidth selection and Bartlett kernel				
			t-Statistic	Prob.
ADF			-20.57953	0.0000
Residual variance			12.52675	
HAC variance			8.228693	
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(RESID)				
Method: Least Squares				
Included observations: 12786 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-1.002591	0.011527	-86.97886	0.0000
D(RESID(-1))	0.203918	0.009422	21.64219	0.0000
R-squared	0.411257	Mean dependent var		0.021049
Adjusted R-squared	0.411211	S.D. dependent var		3.688526
S.E. of regression	2.830302	Akaike info criterion		4.918800
Sum squared resid	102407.6	Schwarz criterion		4.919966

Log likelihood	-31443.89	Hannan-Quinn criter.		4.919190
Durbin-Watson stat	2.056080			

Table 10 - Cointegration test for EBIT

Kao Residual Cointegration Test				
Null Hypothesis: No cointegration				
Trend assumption: No deterministic trend				
Automatic lag length selection based on SIC with a max lag of 2				
Newey-West automatic bandwidth selection and Bartlett kernel				
			t-Statistic	Prob.
ADF			-43.94251	0.0000
Residual variance			38.47104	
HAC variance			29.32551	
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(RESID)				
Method: Least Squares				
Included observations: 10655 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-1.046897	0.013651	-76.69276	0.0000
D(RESID(-1))	0.328773	0.010736	30.62260	0.0000
D(RESID(-2))	0.220729	0.008714	25.33019	0.0000
R-squared	0.410865	Mean dependent var		0.247476
Adjusted R-squared	0.410754	S.D. dependent var		6.125812
S.E. of regression	4.702316	Akaike info criterion		5.934269
Sum squared resid	235534.7	Schwarz criterion		5.936317
Log likelihood	-31611.82	Hannan-Quinn criter.		5.934960
Durbin-Watson stat	2.063864			

Table 11 - Short-term VECM coefficients for BR (1)

Error Correction:	D(BR)
CointEq1	-0.001410
	(0.00111)
	[-1.26546]
D(BR(-1))	-0.493844
	(0.01295)
	[-38.1255]
D(BR(-2))	-0.530716
	(0.01332)
	[-39.8579]
D(ROTA(-1))	0.015963
	(0.00849)
	[1.87976]
D(ROTA(-2))	0.000191
	(0.00863)
	[0.02218]
D(NCPM(-1))	-0.004107
	(0.00415)
	[-0.99020]
D(NCPM(-2))	-0.002840
	(0.00404)
	[-0.70245]
D(EBITDA(-1))	0.007554
	(0.00733)
	[1.03015]
D(EBITDA(-2))	0.010919
	(0.00739)
	[1.47783]
D(GROSSMARGIN(-1))	-0.009125
	(0.00944)
	[-0.96712]
D(GROSSMARGIN(-2))	-0.038841
	(0.00929)
	[-4.17890]
D(REL_ROTA(-1))	-0.048444
	(0.01878)
	[-2.57930]
D(REL_ROTA(-2))	-0.002197
	(0.01742)
	[-0.12608]
D(REL_NCPM(-1))	0.049872
	(0.00721)
	[6.91768]
D(REL_NCPM(-2))	0.036265
	(0.00832)
	[4.36005]
D(REL_EBITDA(-1))	-0.062569
	(0.02405)
	[-2.60178]
D(REL_EBITDA(-2))	-0.056530
	(0.02304)
	[-2.45360]

Table 12 - Short-term VECM coefficients for BR (2)

D(REL_GROSSMARGIN(-1))	0.018577
	(0.01780)
	[1.04364]
D(REL_GROSSMARGIN(-2))	0.055458
	(0.01904)
	[2.91216]
D(REL_BR(-1))	0.754870
	(0.08047)

	[9.38048]
D(REL_BR(-2))	0.730148
	(0.06177)
	[11.8207]
C	-0.053134
	(0.06536)
	[-0.81301]
R-squared	0.326759
Adj. R-squared	0.322413
Sum sq. resids	77091.46
S.E. equation	3.484032
F-statistic	75.18217
Log likelihood	-17029.88
Akaike AIC	5.340805
Schwarz SC	5.385236
Mean dependent	0.002782
S.D. dependent	4.232524

Table 13 - Short-term VECM coefficients for EBIT

Error Correction:	D(EBIT)
CointEq1	-0.211909
	(0.01287)
	[-16.4629]
D(EBIT(-1))	-0.226033
	(0.02649)
	[-8.53155]
D(EBIT(-2))	-0.175390
	(0.02616)
	[-6.70499]
D(ROCE(-1))	0.015030
	(0.00411)
	[3.65967]
D(ROCE(-2))	0.017752
	(0.00395)
	[4.49473]
D(ROTA(-1))	-0.055906
	(0.01849)
	[-3.02285]
D(ROTA(-2))	-0.020360
	(0.01938)
	[-1.05053]
D(NCPM(-1))	-0.009957
	(0.00467)
	[-2.13081]
D(NCPM(-2))	-0.014694
	(0.00469)
	[-3.13228]
D(EBITDA(-1))	0.033762
	(0.02748)
	[1.22850]
D(EBITDA(-2))	0.025255
	(0.02662)
	[0.94882]
D(GROSSMARGIN(-1))	0.031861
	(0.01479)
	[2.15391]
D(GROSSMARGIN(-2))	0.006811
	(0.01736)
	[0.39226]
D(REL_EBIT(-1))	-0.090563
	(0.05091)
	[-1.77873]
D(REL_EBIT(-2))	-0.044618
	(0.05337)
	[-0.83605]
D(REL_EBITDA(-1))	0.068997
	(0.05394)
	[1.27921]
D(REL_EBITDA(-2))	0.152237
	(0.05646)
	[2.69635]
D(REL_GROSSMARGIN(-1))	0.054284
	(0.03863)
	[1.40515]
D(REL_GROSSMARGIN(-2))	-0.109066
	(0.03150)
	[-3.46207]
C	0.495617
	(0.13981)
	[3.54502]
R-squared	0.204093
Adj. R-squared	0.195407
Sum sq. resids	325539.9
S.E. equation	8.788268
F-statistic	23.49667
Log likelihood	-15286.99
Akaike AIC	7.195679
Schwarz SC	7.265787
Mean dependent	0.336520
S.D. dependent	9.797500