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Financial Leverage and its Determinants in Companies Producing Electricity from Wind Resources in Latvia

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***Abstract* – The paper aims to analyse the development of the financial leverage and its determinants in companies producing electricity from wind resources in Latvia during 2005–2012. The financial ratio technique is used to compute the financial leverage in the companies and the regression analysis method is employed to determine the relationships between variables. The results of the analysis revealed that wind electricity generating companies use substantial share of debt and the financial leverage is increasing. Statistically significant relationships were found between the financial leverage and profitability of companies, their growth opportunities, collateral value of assets, size of the company and an effective tax rate. Results will be used to construct weighted average cost of capital (WACC) for the economic assessment of investment into wind electricity sector in Latvia.**

***Keywords* – Wind, electricity, financial leverage, static trade-off theory, pecking order theory.**

I. Introduction

With the aim to increase the level of security of supply and to improve the sustainability of energy sector the Latvian Cabinet of Ministers adopted Regulations No. 571 on the Guidelines for Energy Sector Development 2007–2016 (Cabinet of Ministers, 2006). The Regulations set the target for the country's energy sector to increase the share of electricity from renewable energy sources (RES-E) in the final consumption of electricity up to 49.3% in 2010. Seeking to achieve this target the country self-committed to promote the construction of cogeneration units and production of RES-E.

After the National Renewable Energy Action Plan (2009) was published in 2009, the RES-E target for the Latvian energy sector was updated and increased up to 59.8% in 2020. Although hydro resources will play a crucial role in fulfilling the RES-E target, it is expected that the contribution of wind electricity will be meaningful too (National Renewable Energy Action Plan of Latvia, 2009). It is planned that the share of electricity produced from wind resources will contribute by structural share of 10.5% to the RES-E target implementation in 2020. There will be installed totally 416 MW of wind power plants in 2020, which will produce up to 910 GWh of electricity (National Renewable Energy Action Plan of Latvia, 2009).

In order to achieve the RES-E targets in wind sector additional investments are required. Considering the peculiarities of wind electricity sector (namely, requirements for high initial investment, sufficient growth of the installed wind capacities and electricity generation volume) diversified financial sources are needed for the acquisition of assets and formation of an optimal capital structure in the companies by ensuring profitability, wealth to the shareholders and increasing value of the company. This means that exclusively internal financing sources are not sufficient; huge and increasing external financing in the form of debt, showing an increasing financial leverage, is needed.

Thus far, little is known about the financial leverage and its determinants in the companies engaged in wind electricity sector in Latvia. For the author of this paper this information was necessary when making the economic assessment of wind electricity sector in Latvia. Namely, the information was needed when computing the cost of the investment in wind electricity sector in Latvia and calculating the wind electricity production cost.

Thus, this paper covers the following question: what are the values of the financial leverage ratios in the companies producing electricity from wind resources in Latvia and what are the determinants of the financial leverage?

The paper aims to analyse the financial leverage, its tendencies and the determinants in the companies producing electricity from wind resources in Latvia during 2005–2012.

To implement the aim the following tasks were set:

- to prepare a set of indicators used to describe the development of the financial leverage in Latvia after reviewing the scientific literature on the issue of the financial leverage and its determinants;
- to present methodology applied for determining the relationship between the financial leverage and selected variables;
- to discuss the developments of the financial leverage in the companies producing electricity from wind resources;
- to assess the relationships between the financial leverage and its determinants.

The literature review, financial statement and the method of regression analysis are used to implement the aim and tasks of the paper.

II. Literature Review

A. Concept of Leverage

The concept of leverage is well disclosed in the literature of corporate finance (Kapil, 2011), where the term "leverage" is applied to describe the use of certain fixed costs (they act as a

"lever") that influence on the company's performance, i.e. on its significantly increased profitability. For a company the "lever" is a fixed operating cost and fixed financing cost. From this, three types of leverage are segregated – total, operating and financial leverage.

The total leverage encompasses operating and financial leverages. It links sales and earnings per share of the company.

The operating leverage is associated with the asset acquisition activities and represents the capability of the company to use the fixed operating cost to augment the impact of sales changes on the company's operating profit (EBIT). The degree of the operating leverage (DOL) is estimated by (1) (Kapil, 2011):

$$DOL = \frac{\%\ Change\ in\ EBIT}{\%\ Change\ in\ sales}. \quad (1)$$

The value of the DOL indicator shows how strongly the given percentage change in sales influences the change of the EBIT (Kapil, 2011).

The financial leverage is associated with the financing activities. If the fixed cost funds (debt or preferred capital), which require fixed interest rate or fixed preferred dividend payments, are included into the capital structure of the company, it is said that the company uses the financial leverage (Kapil, 2011). Since the use of debt is more common in practice than the use of preferred capital, the financial leverage usually refers to the use of debt in capital structure. A company having debt on its balance sheet is called leveraged and a company that finances its activity only through equity is said to be unleveraged (Graham & Smart, 2011). The financial leverage is used to augment the results of a company by using fixed cost financing (Kapil, 2011; Graham & Smart, 2011). Namely, J. Graham & S. Smart (2011) showed that the common practice of a company to deduct interest payments from the taxable income gives a good incentive for that company to substitute the debt for equity. The degree of the financial leverage (DFL) is computed by (2) (Kapil, 2011):

$$DFL = \frac{\%\ Change\ in\ EPS}{\%\ Change\ in\ EBIT}, \quad (2)$$

where EPS is the earnings per share. Value of the DFL indicator shows how strongly a certain percentage change in EBIT will influence the change of profit after taxes or earnings per share.

B. Static Trade-off and Pecking Order Theories

The financial leverage has been well documented in the scientific literature. The interest in the topic arose after the paper by F. Modigliani & M. H. Miller (1958) was published. In their paper the authors presented the leverage "irrelevance" theory. It states that "in the absence of the transaction cost, no tax subsidies on the payment of interest, and the same rate of interest of borrowing by individuals and corporations, firm value is independent of its leverage" (Kumar, 2008). In later years new theories, such as models based on agency cost (Jensen & Meckling, 1976), asymmetric information signalling framework (Ross, 1977), static trade-off and pecking order theories (Myers & Majluf, 1984) were developed, which analysed the determinants of the financial leverage in the company.

Considering the number and content of recently published papers, which mainly refer to the static trade-off (STO) and pecking order (PO) theories, it is worth to present the main propositions of these frameworks, which are the bases of further investigations.

The STO theory is substantiated by the proposition that the capital structure of a company is formed by making a trade-off between the benefits received from the use of debt and the costs related to the usage of debt (Gungoraydinoglua & Öztekinb, 2011). Namely, bankruptcy costs and tax benefits are considered when deciding about the capital structure and the usage of the leverage in the company (Gungoraydinoglua & Öztekinb, 2011). As R. Kumar (2008) observed "the higher the cost of bankruptcy, the lower the debt and vice versa" and "the higher the maximum marginal rate of tax, the higher the debt and vice versa". A summary of the main STO theory statements that have been defended by various proponents of the STO theory including, R. Kumar (2008), J. S. Franklin & K. Muthusamy (2010), T. Ashraf & S. Rasool (2013) is given below:

- Seeking to profit from the tax shield on interest expenses the highly taxed companies use more debt compared to the low taxed companies. Thus, the highly taxed companies are more leveraged.
- The non-debt tax (for example, depreciation) shield is a substitute for the tax shield on interest expenses. Subject to a large non-debt tax shield (i.e. when there is a possibility to deduct large amounts of depreciation from the taxable income) the companies use less debt and are less leveraged.
- Profitable companies are more leveraged in order to offset/avoid corporate taxes.
- The companies supplying their customers an exclusive product are less leveraged because the special use of capital eliminates opportunities to use this capital in alternative ways when the companies become bankrupt.
- Large-scale companies usually are engaged in several tasks, thus, their performed activities are diversified. Diversified activities provide the company with diversified income streams. This means lower volatility of earnings and protection of the company from the financial distress. Such a company looks "safer" to the banker, thus, a debt financing is easier received. As a result, the positive relationship links the size of the company and the leverage. However, if a company receives risky income streams, there exists a negative correlation between the earnings and the leverage.
- The companies having collateral assets have more possibilities to use bank funds in comparison to the companies using intellectual assets. Thus, the former are more leveraged.

- The companies from manufacturing industries have higher financial leverage ratios compared to the companies providing services.

PO theory states that the company's capital structure is a function of the dividend and investment policies (Kumar, 2008). The theory is based on the statement that "the companies prefer to use internal equity to pay dividends and finance new investment". (Kumar, 2008). Actually, they have a hierarchy of the financing sources. To avoid flotation costs resulting from the external financing, the companies initially prefer internal financing sources to pay dividends and realize growth expectations (Kumar, 2008). If the internal financing sources (retained earnings, surplus or reserves) are used intensively and there are only several perspective investment opportunities then the debt level in that companies is low and the companies are low leveraged (Franklin & Muthusamy, 2010; Gungoraydinoglua & Öztekinb, 2011; Ashraf & Rasool, 2013). In the case of the financial deficiency, the companies use the external financing sources to realize investment opportunities (Kumar, 2008; Ashraf & Rasool, 2013). Since the flotation costs of debt are lower compared to the external equity, their debt stands the first in the rank when choosing the external financing source (Kumar, 2008). Again, the companies prefer bank loan and the public debt is used only later if external financing is required. Equities are issued when market overvalues them (Kumar, 2008). Hybrid securities are used as a last resort (Franklin & Muthusamy, 2010).

The results of the empirical research prove that the financial leverage decreases with the age of the company (Kumar, 2008). This means that matured and experienced companies are able to accumulate necessary funds themselves. Since they need less both short- and long-term borrowed funds, they are less leveraged.

The proponents of the PO theory state that the "companies with high growth rates should have a higher debt ratio since the need for external funds would be higher" (Franklin & Muthusamy, 2010). Gill *et al*. (2012) empirically proved the statement.

Opposed to the STO theory, the PO theory states that there exists a negative relationship between the profitability of the company and the financial leverage (Ashraf & Rasool, 2013). The main argument is that profits are used to cover the debt and related interest payments. When the company earns profit, debts are paid and the financial leverage decreases (Kumar, 2008).

The leverage is different in domestic and multinational companies. Multinational companies use various sources of earnings. As a result they have better opportunities to earn profits and use them to finance investments. Thus, multinational companies have less debt and are less leveraged (Kumar, 2008).

C. Determinants of the Financial Leverage

Thus far, a lot of papers investigating the determinants of the financial leverage in companies have been published. The increasing interest in the topic arose because of the impact of the financial leverage on profitability, wealth to shareholders and value of the company (Ashraf & Rasool, 2013). Besides, when an inappropriate capital structure is chosen the risk of bankruptcy increases (Gill & Mathur, 2011). As it was observed by F. J. Sanchez-Vidal (2014) the investigation of the determinants of the financial leverage is crucial for economic policy making.

One could notice that papers dealing with the determinants of the financial leverage are unified by several generic features. Firstly, the authors of the studies mainly empirically test the selected financial leverage theories. Secondly, the papers focus on the establishment of links between the financial leverage and its determinants by estimating the determinant elasticity of the financial leverage. Thirdly, the method of the regression analysis is one of the most often employed methods for the assessment of positive/negative impact of determinants on the financial leverage.

However, as it will be disclosed below, the findings of the researchers are different and they depend on the industry, country, time, phase of the business cycle and the financial leverage ratios analysed.

A relevant review of the determinants that influence the company's financial leverage was done by R. Kumar (2008). After the review of more than one hundred papers published in the academic journals during a decade till 2005, the author segregated and discussed eight frameworks/theories helping to understand the level of the financial leverage in a company and summarized the determinants of the financial leverage found in the scientific literature. The results of the analysis revealed that among various determinants the size of the company, profitability and tangibility (collateral value) of assets are the most important determinants of the financial leverage.

H. S. Song (2005) analysed the determinants of the financial leverage in about 6000 Swedish companies utilizing the panel data regression analysis method. The impact of eight financial leverage determinants on three financial leverage ratios (total debt, short-term debt and long-term debt ratio) was analysed. The results of the research showed that the uniqueness and expected growth of total assets were not correlated to and, thus, were not statistically significant determinants of the selected financial leverage ratios. The author assumed that the reasons for this could be: 1) incorrectly selected indicators describing the determinants of the financial leverage. They could not give relevant information about the companies' growth possibilities in future, 2) because "the effects of the two different theories neutralize each other". The research results disclosed that there existed some differences in:

- *the determinants of the selected financial leverage ratios*. All three selected financial leverage ratios were statistically significantly correlated to the asset structure (tangibility of assets), profitability, the size and income variability of the companies, but only short- and long-term debt ratios were correlated to non-debt tax shield.
- *the expected and estimated impact of the determinants on the financial leverage ratios*. It was estimated that

all the financial leverage ratios were negatively correlated to profitability. This proved that: 1) the pecking order theory is suitable when explaining the level of the financial leverage in the companies; 2) companies are tended to use internal resources (profit) to finance the acquisition of current and non-current assets. While the estimated impact of the selected determinants on the long-term debt ratio matched the expected one, the impact of the determinants on the short-term debt ratio was found inverse and required additional theoretical explanation and investigation.

S. J. Franklin & K. Muthusamy (2010) researched the determinants that affected high debt-equity ratio found in Indian pharmaceutical industry, which during the analysed period grew at a fast rate and from this point of view was similar to the renewable energy producing industries worldwide. After having applied the multiple regression method, the authors found that the increase in the share of non-current assets, showing an increasing demand for investment that required long-term finances (including debt financing), was positively related to the financial leverage. A positive correlation was found between the interest expenses and the financial leverage too. The authors argued that the positive link was established due to the occurrence of the feature of increasing interest expenses (they emerged from using more debt finances) to reduce the company's taxable profit. Other positive relationships were set between the financial leverage and the size of the company, retained earnings, earnings before interest and tax, intrinsic value of shares and profitability. It was found that the development of sales and cash flows negatively affected the financial leverage.

T. Ashraf & S. Rasool (2013) explored the determinants of the financial leverage in automobile industry in Pakistan during 2005–2010. Seven determinants were analysed by applying the multiple regression method. The results of the research showed that the financial leverage depended only on the size of a company (log of total assets was taken as a proxy), tangibility of non-current assets (gross non-current assets to total assets ratio was employed) and growth of total assets. It was found that both the growing and larger in size companies were less leveraged. The authors assumed that this could be related to the preferences of the owners of companies to use the internal financing source for acquisition of assets instead of debt financing. However, the companies, which had more tangible assets, were more leveraged because tangible assets could have a collateral value, which was considered when receiving the long-term loan. Since correlations between the financial leverage and profitability, taxes, risk and non-debt tax shield were found statistically insignificant, thus, it could be stated that these determinants were of low importance when deciding about the capital structure in the companies.

A. Gill & N. Mathur (2011) investigated the determinants of the financial leverage in a small sample of the Canadian manufacturing and service companies during 2008–2010. The ordinary least square regression method was used. Three regression models were prepared: 1) using entire sample; 2) using the data of the manufacturing industry; 3) using the data of service industry. The research results showed that the financial leverage in the entire sample of the companies could increase when the size of a company and the number of subsidiaries increased, but it could decrease when profitability, value of collateralized assets and the effective tax rate of the company increased as well as in the case when the company had good growth opportunities. The determinants of the financial leverage in manufacturing and service industries were found different; the determinant elasticity of the financial leverage was found industry-specific as well. Profitability, effective tax rate and growth opportunities were the most important determinants of the financial leverage in manufacturing industries and the companies could become less leveraged when the aforementioned indicators improved. The regression model for the service industry demonstrated slightly different correlations. Although profitability was found as the most important determinant of the financial leverage in service industry, its impact was found positive. An increasing effective tax rate and collateralized assets were other relevant determinants of the decreasing financial leverage in the service industry.

A year later, A. Gill *et al*. (2012) made a survey research and examined the determinants of the financial leverage in small business companies in India. As in their aforementioned study, the authors found that the financial leverage was different in service and manufacturing industries. The authors estimated that the financial leverage in manufacturing industry was tended to increase most significantly when total assets increased and small business performance (profitability) improved along with increasing sales and perceived overall growth of the small business. Non-current and current assets, taxes and family support were not statistically significant determinants of the financial leverage in manufacturing industry. Only three statistically significant determinants of the financial leverage were found in service industry of India. Namely, service-providing companies could become more leveraged when they were growing, their sales were increasing and families strongly supported the small business.

W. Ningsih and N. Djuaeriah (2013) analysed the determinants of the financial leverage in the companies comprising cement industry. The basic features of cement industry were as follows: it developed at a rapid rate and it was a capital-intensive industry. These two features made cement industry slightly similar to wind electricity production sector, which grew fast in terms of the installed wind capacities, wind electricity production volume, and required various internal and external funds to satisfy an increasing demand for investments. Resulting from the STO and PO frameworks, the authors constructed a linear regression model with seven determinants. The results showed that only the return on assets, return on equity and shareholders of equity ratio were statistically significantly correlated to the financial leverage. The authors argued that the increase in return on equity and assets signalled that the company received more profits. This was understood as a positive sign and as a possibility to apply for additional external financing sources.

Thus, the financial leverage increased. The authors went further and explained consequences that could appear due to the increased financial leverage in the company. When the financial leverage increased significantly, the company's control devolved to bondholders, who would be willing to liquidate the company if they decided to regain their investment. If such a hazard appeared, the administrative costs of the bankruptcy incurred. These fixed costs would likely make only a small share of total costs in a large company, but a great share in a small company (thus small companies should more carefully take the decision about the level of debt!). The company, which sought to avoid the bankruptcy and the related costs, would reduce expenditure (training, advertising etc.). The buyers would quickly observe changes and start worrying about the maintenance of an appropriate quality of purchased products. This could lead to a reduction in orders and sales, which later could result in a chain reaction. Thus, the reasoning provided by the authors disclosed how the benefits provided by the increased financial leverage could be offset by the expected costs of bankruptcy.

F. J. Sanchez-Vidal (2014) analysed the determinants in Spain by applying the quantile regression method. This research differed from the previously discussed studies in the way the existence of non-linear relationships were investigated, the determinants related to three theories (STO, PO and information asymmetry problem) were analysed and phases of the business cycle were considered. The results of the analysis showed that "for highly-leveraged companies many determinants are no longer significant and cash flow variable is crucial if companies would like to decrease their debt levels".

It is worth to present the results of Kelemli-Ozcan *et al*. (2012) who analysed the developments of the financial leverage ratios during the phases of the business cycle in a number non-financial companies, financial institutions and regions having unique institutional organization and regulatory environment. This paper differed from the above-discussed studies in the way its authors made efforts to understand the exogenous processes of the leverage. The tendency analysis showed that the financial leverage was quite stable in the USA and European non-financial companies during various phases of business cycle, but accounting differences impacted on a bit higher financial leverage ratio in the European non-financial companies. The financial leverage was found countercyclical in non-financial companies. Due to the meaningfully increasing total assets over equity the financial leverage ratio was significantly increasing in the USA investment and commercial banks during economic growth, but was decreasing during the economic recession period. This demonstrated the procyclical nature of the financial leverage in the financial institutions of the USA. The authors concluded that the "leverage at the bank and firm level did not signal an impending recession". Later, the authors estimated the relationship between the financial leverage and tightness of the bank regulation. It was set that tight bank regulation was a relevant factor of the low level of deleveraging of banks in the emerging economies during the economic recession.

Thus, the results of literature review disclosed that thus far the static STO and PO frameworks are the most applied theories when empirically investigating the determinants of the financial leverage. There could be several reasons for this. Firstly, theories are well developed; they are consistent and comprehensive. Secondly, the data for the quantitative assessment of the relationship between the financial leverage and various determinants are publicly available and the econometric methods are developed. Thus, this paper will also refer to the STO and PO theories for the determination of the relationship between the financial leverage and determinants, but this time in the wind electricity sector.

III. Methodology

A. Data

The data necessary for the research were received from Latvian Statistics Database. 15 wind electricity producing companies in Latvia were analysed in 2005. The number of companies has increased up to 21 in 2012. These companies had 50.315 MW out of 59.665 MW of totally installed wind capacity in Latvia in 2012. Since totally 84.3% of the installed wind capacity was covered by the research, it could be argued that the sampling of observations was sufficient to generalize the results and speak about the financial leverage in wind electricity sector in Latvia.

Various indicators could be used to describe the financial leverage in a company. Long-term debt to total assets ratio was used to disclose the financial leverage in the paper by T. Ashraf & S. Rasool (2013); whereas total liabilities to total assets ratio was employed in the work by A. Gill & N. Mathur (2011). Debt to equity ratio was applied by W. Ningsih & N. Djuaeriah (2013). H. S. Song (2005) analysed three ratios, i.e. total debt to capital, short-term debt to capital and long-term debt to capital ratios. S. Kalemli-Ozcan *et al*. (2012) measured the financial leverage by using ratios of assets to equity, total liabilities to total assets, total debt to total assets and total debt to equity. The computations revealed that the patterns in the constructed data series were mainly consistent, therefore further analysis was done by using assets to equity ratio. Three indicators (namely, debt to equity ratio, total obligations to total assets ratio, as well as long-term-obligations to total assets ratio) will be used to disclose the financial leverage in this paper. These indicators will be computed by applying the financial ratio technique described in NASDAQ OMX (2010).

Based on the results of the reviewed literature possible determinants of the financial leverage in wind electricity producing companies in Latvia are provided in Table I.

TABLE I

POSSIBLE DETERMINANTS OF FINANCIAL LEVERAGE BASED ON STO AND PO THEORIES AND ANALYSED IN THE STUDY

Variable	Abbre-viation	Indicator	Expected relationship
Profitability	ROE	Return on equity	+/–
	ROA	Return on assets	+/–
Size of the companies	TAC	Total assets per company	+
	TUC	Turnover per company	+
Collateral value of assets	FA	Fixed assets	+
Growth opportunities	GROWTH	Change in total assets between two consecutive years (2011-2012) scaled by previous year total assets (2011)	–
Effective tax rate	TAX	Income tax divided by earnings before tax	+

B. Method

The multiple regression method was chosen to disclose the relationships between the dependent and independent variables and to identify the determinants of the financial leverage. The mathematical expression of the regression model is provided in (3):

$$Y_i = \beta_0 + \beta_1 X_{1i} + ... + \beta_k X_{ki} + \varepsilon_i, \quad (3)$$

where Y_i is the dependent variable (the financial leverage) at time i; β_0, β_1, β_{ki} are the coefficients of the regression model that are to be estimated; X_{1i}; X_{ki} are the independent variables from 1 to k at time i; ε_i is the error.

The average elasticity of the financial leverage in respect to its determinant l is computed by (4):

$$\bar{E}_l = \beta_l \cdot \frac{\bar{X}_l}{\bar{Y}}. \quad (4)$$

This shows that when the value of the determinant l increases by 1% from its average value $\bar{X}_l$, the financial leverage increases/decreases by E_l % of its average value $\bar{Y}_l$ (Boguslauskas, 2004).

Several tests were employed to determine the correct structure of the regression model. Firstly, agreeable to Z. Hajiha & H. A. Akhlaghi (2013) normality of errors was tested. χ^2 (Chi-square) was applied. If the critical (theoretical) value of χ^2 was higher than the calculated value (or the chosen significance level was lower than p-value), the H_0 hypothesis that residuals were normally distributed was accepted. Secondly, autocorrelation between the variables was examined. For this purpose Durbin-Watson test was used (Ningsih & Djuaeriah, 2013; Durbin-Watson Significance Tables). If the observed value of the statistics was less than the tabulated lower bound d_L, the hypothesis H_0 of non-autocorrelated errors was rejected. If the test statistic value was greater than the upper bound d_U, the hypothesis H_0 of non-autocorrelated errors was accepted. If the observed test statistic value was greater than 2, 4-d was computed and compared to the tabulated values of d_L and d_U. If the test value was between d_L and d_U, the test was inconclusive (Durbin-Watson Significance Tables). Thirdly, heteroscedasticity was checked. For this purpose White's test was used (Tastan, 2012). If the test statistics (LM) was greater than the critical value (or p-value of the test statistics was smaller than the chosen level of significance (5%)), the H_0 hypothesis of constant variance (homoscedasticity) was rejected. Fourthly, collinearity was tested by applying Variance Inflation Factor (VIF). If VIF(b_k) > 4, then X_k variable was correlated with other variable (Boguslauskas, 2004). Fifthly, t-ratio and p-values were considered when testing the significance of b_k coefficients included into the regression model. If p-value was lower than the chosen significance level (10% significance level was chosen since the number of observations is small), the b_k coefficient included into the model was considered as statistically significant. Otherwise, it was excluded from the regression model and a new model was prepared (Boguslauskas, 2004). The goodness of fit was decided considering the value of the adjusted-R^2 (Ningsih & Djuaeriah, 2013). Finally, the value of F-test was used to state if variables included into the regression model significantly affected the financial leverage (Ningsih & Djuaeriah, 2013).

IV. RESULTS

A. The Financial Leverage Ratios in Latvian Wind Electricity Producing Companies

Wind electricity producing companies use substantial share of debt as is evident from the debt to equity ratio, total obligations to total assets ratio, as well as from the long-term obligations to total assets ratio (see Fig. 1).

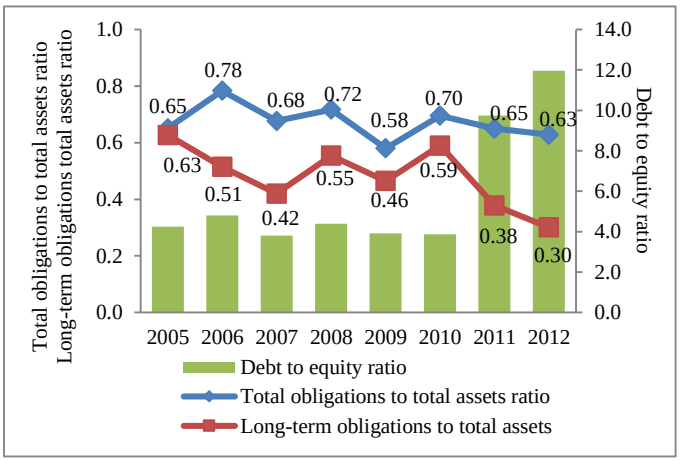

Fig. 1. Changes of the financial leverage ratios of companies producing electricity in wind power plants in Latvia during 2005–2012 (own calculations).

As it is seen in Fig. 1, wind electricity producing companies were leveraged. The financial leverage (total obligations to total assets ratio was taken as a proxy) was high and varying in time. During 2005–2012 the financial leverage was 0.6–0.8 in wind electricity producing companies. This shows that the companies acquired 60–80% of total assets through the long-

and short-term obligations. During the economic growth period (2005–2007) wind electricity producing companies were highly leveraged (0.65–0.78), but they were slightly deleveraged during the economic recession (2008–2009). The reason could be the changed lending policy of the financial institutions. When the economic recession started, the financial institutions limited the supply of loans to many economic sectors, including the wind electricity production sector. Besides, for the implementation of new wind projects they asked the owners of the companies to increase their shares by taking more responsibilities and risks. As a result, total obligations to total assets ratio in Latvia reduced from 72% (in 2008) to 58% (in 2009). During the economic recovery period the financial leverage returned to the pre-crisis level (0.63–0.70). However, the data of the last three years demonstrate a reducing trend of the financial leverage. In 2012, the value of the financial leverage ratio was 0.63.

The development of the long-term obligations to total assets ratio demonstrate some different tendencies. During the economic growth and economic recovery periods the share of long-term obligations used to finance total assets was significantly reducing. In 2012, the long-term obligations to total assets ratio was half as high as in 2005. However, during the economic recession period the long-term obligations used to finance total assets exceeded the level achieved in 2007 by 20%.

When comparing the developments of total obligations to assets and long-term obligation to assets ratios achieved during the different phases of the Latvian business cycle, it is evident that the share of short-term obligations increased during the economic growth and economic recovery periods, but it reduced during the economic recession. The question arises, if the significant increase in short-term obligations was suitable for the company and would not make harm to the company in future?

Seeking to answer this question the author of this paper referred to the scientific literature which told that "short-term obligations should match current assets" (Fosberg, 2014). The actual situation in Latvian companies showed a different picture. During the economic growth and recovery periods there was a fixed mismatch between the short-term obligations and the current assets. The data of the year 2012 demonstrated that the current assets made 17.6% of total assets, but the short-term obligations – 32.8% of total liabilities and own capital. This means that some share of the non-current assets (buildings and equipments) was acquired through the short-term obligations. Was it good?

In order to answer the question one has to take into account that: 1) the financing of non-current assets through short-term instruments requires to breakdown the huge amounts payable (for example, the loan received for the purchase of wind turbine and related interest payments) during a short time period; 2) the non-current assets are illiquid assets during the short-term, thus, they cannot be sold quickly.

If the volume of current assets (cash or other liquid current assets) is low or part of available current assets are illiquid (for example, some inventories or amounts receivable from debtors that cannot be recovered on time), the company can suffer solvency problems, i.e. problems when settling with the creditors who had financed the acquisition of long-term assets. Thus, such a company requires to take new loans to redeem old debts, increase own capital or apply to the renewable energy policy regulator for subsidies (investment grants or higher feed-in tariffs), which finally are paid by the final electricity consumers.

During the economic growth period when better borrowing possibilities exist, the solvency issues could be tackled easier and quicker, but during the economic recession, when the lending policy of financial institutions is tight and supply of the funds is strongly limited, this can lead to serious problems, including bankruptcy of the company if own capital cannot be used or other relevant actions are not taken.

As it is evident from the Latvian experience several actions were taken: 1) wind electricity sector regulating policy was revised (currently, RES-E support policy is under the revision too); 2) own capital was increased during the economic recession period. For example, until 2008 the share of own capital was about 30%, but during the economic recession period it increased by 5 percentage points. As a result, the share of short-term obligations reduced to 11.5% and perfectly matched the share of current assets (11.0%).

This reasoning disclosed some possible consequences when inappropriate capital structure was chosen. There could be several other reasons why short-term obligations increased in the wind electricity production sector. For example, some wind power plants were under the construction and, namely, during the construction phase the short-term financing was used. Besides, accounts receivable were significantly increasing in Latvia during 2009–2012 (approximately by 15% a year) and short-term debts could be used to cover them.

The development of debt to equity ratio revealed that the amount of debt over equity was high but rather stable during 2005–2010. However, it increased during 2011–2012. The reasons for this in more detail are analysed in the next Section.

B. Regression Analysis

The results of the regression models showing the relationship between the financial leverage and its determinants are provided in Table II.

TABLE II

RESULTS OF REGRESSION MODELS (NUMBER OF OBSERVATIONS N = 8)

No of the model	Variable	Coefficient	Std. error	*t*-ratio	*p*-value	VIF
1	Const	12.5665	1.99498	6.299	0.0007	
	ROE	–0.24799	0.06909	–3.589	0.0015	

No of the model	Variable	Coefficient	Std. error	*t*-ratio	*p*-value	VIF
	Durbin-Watson			1.95924		
	Test for normality of residual			χ^2 = 0.41761, *p*-value = 0.81155		
	White test for heteroskedasticity			LM = 0.28357, *p*-value = 0.86781		
	Adjusted-R^2			0.62930		
	F(1;6)			12.8832, *p*-value (F) = 0.01151		
2	Const	11.6100	2.27669	5.099	0.0022	
	ROA	–0.66766	0.24606	–2.713	0.0349	
	Durbin-Watson			1.23680		
	Test for normality of residual			χ^2 = 1.18237, *p*-value = 0.55367		
	White test for heteroskedasticity			LM = 3.40071, *p*-value = 0.18262		
	Adjusted-R^2			0.476155		
	F(1;6)			7.36273, *p*-value (F) = 0.03495		
3	Const	3.99742	0.83098	4.811	0.0030	
	GROWTH	0.09507	0.02565	3.706	0.0100	
	Durbin-Watson			1.65218		
	Test for normality of residual			χ^2 = 4.77634, *p*-value = 0.09180		
	White test for heteroskedasticity			LM = 5.43762, *p*-value = 0.06595		
	Adjusted-R^2			0.64534		
	F(1;6)			13.7369, *p*-value (F) = 0.01001		
4	Const	–0.68261	0.98332	–0.6942	0.5135	
	FA	$2.412 \cdot 10^{-7}$	$3.343 \cdot 10^{-8}$	7.217	0.0004	
	Durbin-Watson			2.08373		
	Test for normality of residual			χ^2 = 0.31851, *p*-value = 0.85278		
	White test for heteroskedasticity			LM = 6.16655, *p*-value = 0.04581*		
	Adjusted-R^2			0.879489		
	F(1;6)			52.08598, *p*-value (F) = 0.00036		
5	Const	–1.79942	0.70613	–2.548	0.0436	
	TAC	$4.130 \cdot 10^{-6}$	$3.571 \cdot 10^{-7}$	11.57	$2.51 \cdot 10^{-5}$	
	Durbin-Watson			1.20202		
	Test for normality of residual			χ^2 = 0.610681, *p*-value = 0.73687		
	White test for heteroskedasticity			LM = 1.48774, *p*-value = 0.47527		
	Adjusted-R^2			0.94992		
	F(1;6)			133.770, *p*-value (F) = 0.00003		
6	Const	10.1968	1.22741	8.308	0.0002	
	TAX	–0.45784	0.11132	–4.113	0.0063	
	Durbin-Watson			1.650052		
	Test for normality of residual			χ^2 = 0.01587, *p*-value = 0.99210		
	White test for heteroskedasticity			LM = 1.17158, *p*-value = 0.55667		
	Adjusted-R^2			0.69454		
	F(1;6)			16.9161, *p*-value (F) = 0.00627		
7	Const	7.54121	1.86331	4.047	0.0099	
	TUC	$7.708 \cdot 10^{-6}$	$2.333 \cdot 10^{-6}$	3.303	0.0214	1.001
	ROA	–0.65255	0.15117	–4.317	0.0076	1.001
	Durbin-Watson			2.442105		

No of the model	Variable	Coefficient	Std. error	*t*-ratio	*p*-value	VIF
	Test for normality of residual			$\chi^2 = 4.74511$, *p*-value = 0.093242		
	White test for heteroskedasticity			LM = 6.96942, *p*-value = 0.22293		
	Adjusted-R^2			0.80246		
	F(2;5)			15.2177, *p*-value (F) = 0.00748		
8	Const	12.7916	1.13063	11.31	$9.43 \cdot 10^{-5}$	
	TAX	–0.35376	0.07778	–4.548	0.0061	1.219
	ROA	–0.41470	0.13129	–3.159	0.0251	1.219
	Durbin-Watson			2.85497		
	Test for normality of residual			$\chi^2 = 0.53512$, *p*-value = 0.76524		
	White test for heteroskedasticity			LM = 7.53178, *p*-value = 0.18400		
	Adjusted-R^2			0.93793		
	F(2;5)			53.8637, *p*-value (F) = 0.00041		

*–1% level of significance is considered

As it is seen in Table II, 6 univariate and 2 multivariate regression models satisfy the conditions described in the methodological section of the paper. Namely:

- errors of the regression models are normally distributed, since the computed *p*-values of tests for normality are higher than 0.05;
- constant variance (homoscedasticity) assumption is approved, since the computed *p*-values of White's test are higher than 0.05;
- errors are not autocorrelated, since the computed Durbin-Watson statistics are higher than d_U (8;1) = 1.003 and d_U (8;2) = 1.489;
- b_k coefficients of regression models are statistically significant, since the computed *p*-values of *t*-statistics are lower than 0.05;
- the prepared regression models are statistically significant, since *p*-values (F) are lower than 0.05.

Univariate regression models showed that the profitability, effective tax rate, collateral value of assets, size of the company and growth were statistically significant determinants of the financial leverage in the companies producing electricity from wind resources in Latvia.

Negative relationships were found between the financial leverage and profitability (Models 1 and 2) and the effective tax rate (Model 6). This showed that the financial leverage increased when profitability (β_{ROE} = –0.248, β_{ROA} = –0.668) and the effective tax rate (β_{TAX} = –0.458) reduced. The relationship found between the financial leverage and profitability was in line with the PO theory. However, the PO theory and the following research speaks about the situation when the financial leverage reduces due to the increasing profits, which are used to cover debts. The Latvian case is slightly different, i.e. profitability (ROA and ROE) was reducing and the financial leverage was increasing. The found relationship could be explained in the following way: although generally profitability reduced, it was higher in wind electricity producing companies than in other sectors in Latvia. For example, ROA in wind electricity producing companies was 4.3%, whereas it was 1.8% in electricity, gas, steam and air conditioning supply sector and about 2% in all other economic sectors in 2012. Therefore, when making the investment decision, investors could consider the existence of differences between the profitability in various sectors of national economy. Thus, even the relationship between the financial leverage and profitability was found negative, however, higher profitability in wind electricity producing companies compared to profitability in other companies signalled about the investment possibilities and motivated investors to select the wind electricity sector. Seeking to offset corporate taxes companies could increase the amount of debt, which later resulted in increased financial leverage. Thus, actually the STO theory is correct when substantiating the negative relationship between the variables.

Initially, the negative relationship found between the financial leverage and the effective tax rate in Latvian companies could suggest that the research findings are not in line with the theory and previously performed research results, which demonstrated that the effective tax rate should be positively related to the financial leverage. The findings of this research supplemented the scientific literature in the way they showed that even a reducing effective tax rate could be the reason to choose the leverage. Namely, the Latvian case approved that the effective tax rate could be important when taking the decision about the capital structure, i.e. even a reducing effective tax rate could motivate using leverage to reduce corporate income taxes.

The average elasticity of the financial leverage in respect to profitability, when ROE and ROA indicators were considered, and the effective tax rate was –1.2%, –1.0%, and –0.8%, respectively. This meant that when profitability (ROE) reduced by 1% from its average value of $\bar{X}_{ROE}$ = 27.14%, the financial leverage increased by 1.2% from its average value of $\bar{Y}$ = 5.84. The computed udjusted-R^2 revealed that the proportion of the variance in the financial leverage explained by ROE, ROA and the effective tax rate was 62.9%, 47.6% and 69.5%, respectively. This showed that the explanatory power of other determinants remained high (about 30–50%),

and suggested that multivariate regression models should be prepared.

Thus far, the wind electricity producing companies in Latvia demonstrate growth both in terms of total assets and turnover. On average, every year total assets increase by 22.2% and during the last two years the growth rates were especially high, i.e. 77.2% (in 2011) and 43.9% (in 2012) a year. The turnover of companies increases by 26.5% a year. The EU energy policy regarding the development of renewable sector in EU Member States, Latvia's commitment to increase the volume of RES-E, feed-in tariff scheme guaranteeing for wind electricity producers higher than market price electricity purchase price for 20 years could attract some investors. Besides, the wind electricity sector is capital-intensive and requires higher investment than usual. Although the investment requirements per 1 kW of installed capacity reduced in the world, they still remain high. Thus, in addition to own financial resources other financing sources are required to finance the wind projects. Altogether, this shows that the wind sector has growth opportunities and it is likely that the financial leverage will increase in future. The results of the computations approved the reasoning about the positive relationship between the companies' growth and the financial leverage ($\beta_{GROWTH} = 0.095$, Model 3). It was computed that the elasticity of the financial leverage in respect to the growth of the company was 0.3%. The growth rate of the company alone could explain 64.5% of variance of financial leverage in wind electricity producing company in Latvia.

Positive relationships between the financial leverage and fixed assets ($\beta_{FA} = 2.41 \cdot 10^{-7}$) and the size of the company ($\beta_{TAC} = 2.13 \cdot 10^{-6}$) were found too. These findings are in line with the theories and previously performed research results, which show the following:

- Due to the possibility of fixed assets to serve as collateral for receiving loans the financial leverage increases. It was found that when fixed assets increased by 1% from their average value of $\bar{X}_{FA} = 27.02$ million EUR the financial leverage increased by 1.1% in Latvia;
- Bigger in size companies are more leveraged, since these companies have better access to capital markets. The research results revealed that when total assets falling to one company increased by 1% the financial leverage increased by 1.3%. The size of the company could explain 95% of variance of the financial leverage.

Two statistically significant multivariate regression models were prepared. They showed that the explanatory power of models increased when instead of one determinant several were included. Model 7 disclosed that the size of the company and profitability were statistically significant determinants of the financial leverage. These determinants could explain 80.2% of variance of the financial leverage. It was computed that the financial leverage was positively related to the size of the company ($\beta_{TUC} = 7.71 \cdot 10^{-6}$), whereas negatively – to profitability ($\beta_{ROA} = -0.653$). It was computed that average elasticity of the financial leverage in respect to profitability and the size of the company was –1.0% and 0.7%, respectively. This reflected that the financial leverage was more elastic to profitability. Model 8 showed that an effective tax rate and profitability could explain 93.8% of variance of the financial leverage. The elasticity of the financial leverage in respect to these determinants was similar to the elasticity found in univariate models, i.e. $\beta_{TAX} = -0.354$ and $\beta_{ROA} = -0.415$.

V. Conclusion

The research investigated the development of the financial leverage and its determinants in companies producing electricity from wind sources in Latvia during 2005–2012.

By applying the financial ratio technique, three financial leverage ratios were computed. It was found that the wind electricity producing companies used substantial share of debt. The development of total obligations to total assets ratio revealed that the financial leverage was high and varying in time. 60–80% of total assets were financed through the obligations. The development of the long-term obligations to total assets ratio demonstrated a reducing trend, which reflected that the share of short-term obligations used to acquire fixed assets was increasing. Evidences were found that the financial leverage depended on the phase of the Latvian business cycle, i.e. during the economic recession wind electricity producing companies were slightly deleveraged.

By applying the method of regression analysis the evidence was found that the financial leverage (debt to equity ratio) was statistically significantly related to the profitability of companies, their growth, collateral value of assets, size of the company and effective tax rate.

It was found that there were negative relationships between the financial leverage, profitability and the effective tax rate, whereas positive links were set between the financial leverage and growth, collateral value of assets, size of the company. The determined relationships are in line with the theory of the financial leverage and previously performed research results.

The calculated average elasticity of the financial leverage in respect to its determinants showed that changes in the size of the company and profitability had the greatest impact on changes of the financial leverage.

The results of this research will be used to construct the weighted average cost of capital (WACC), which is known as an appropriate tool to measure the total cost of capital and is used as a discount rate, for the economic assessment of the investment into the wind electricity sector in Latvia.

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