Is There a Relationship between EBITDA and Investment Intensity? An Empirical Study of European Companies

Svetlana Kotšina[1] and Aaro Hazak[1+]

[1] Department of Economics, Tallinn University of Technology

Abstract. This study focuses on the relationship between company's EBITDA and investment intensity. The study is based on a sample of 8,074 companies in six European Union (EU) member states over a nine year period from 2001 to 2009. We use regression analysis as the methodology. We have identified a strong positive impact of EBITDA on investment intensity in the following year(s). The relationship is however significantly weaker in Ireland and Greece – countries where the economic crisis and its aftermath have had a especially strong adverse impact. It is interesting to note that the effect of EBITDA on profitability appears to have decreased already in 2007, i.e. before the economic crisis became clearly perceived, demonstrating that the relationship between past profitability and investment intensity may be among the variables to study more closely when exploring cyclicality in companies' financial behaviour. Further more detailed research on the above relationship would be needed in order to identify what are the drivers of under- and overinvestment, and its ties with economic fluctuations.

Keywords: EBITDA, investment intensity, European Union

1. Introduction

The economic crisis of recent years has brought to light the variances in companies' resistance to external shocks. One of the possible determinants of the exposure of companies to economic fluctuations might be their investment intensity, i.e. the increase in their long-term (tangible) assets. Due to the fact that investments once made tend to be difficult to be disposed off at favourable terms, any unjustified investments may have a strong adverse effect on companies' sustainability, especially during the time of economic decline. On the other hand, the lack of productive investments might generate extra dividends in the short term but harm company viability in the longer perspective.

Investment intensity has been found to work as a signal about future profitability and share prices (Lev and Thiagrajan, 1993). Sometimes the motivation to invest may thus lie in the signalling of expansion and perceived future returns, while the actual profit impact of the investment may receive unduly little attention. Li (2004) has brought out that overinvestment remains often unnoticed by investors, and that companies where management has large free cash flows for investments at their disposal or where leverage is low tend to make more unjustified investments.

Several previous studies have identified a rather strong relationship between profitability and investment intensity, for example Blanchard et al. (1994), Lamont (1997), Berger and Hann (2003), Harford (1999), Opler et al. (1999, 2001), among others. Interestingly, all the mentioned studies reveal the related problem of over investment – the availability of funds leads to inefficient investment under the lack of projects with sufficient returns and reasonable risk.

Richardson (2006) brings out large positive free cash flows as an important driver of overinvestment, meaning that past profits and cash flows appear to explain part of unproductive investments. Jostarndt (2002) has found support to the agency theory (Jensen and Meckling, 1976), identifying that some of the investments may be rather in the short term interest of management (e.g. leading to increased bonuses) but not increase the wealth of company owners.

[+]Tel.: +372 6204 057; fax: +372 6203 946;
E-Mail Address: aaro.hazak@tseba.ttu.ee.

The effects of economic fluctuations on the nexus between companies' investments and profitability has received very little attention. In this short pilot paper, we look into the relationship between companies' EBITDA and investment intensity in six EU countries under different phases of the economic cycle, with the purpose of gaining some insight into this matter in order to better plan more detailed studies.

2. Data and Methodology

We use data from the Amadeus database. The dataset derived from Amadeus includes data of 8,074 companies over a nine year period from 2001 to 2009. We have used annual data on each company's tangible fixed assets and total assets (balance sheet value as at the beginning and end of each year), depreciation cost, EBITDA, country (country where the company has been registered) and industry (8 main industries based on the NACE Rev.1.1 classification) for our study. Our dataset covers 6 countries for which the necessary data was available, namely the United Kingdom, Germany, France, Greece, Ireland and Sweden. When forming our sample, we have excluded those companies where tangible fixed assets form less than 20% of total assets, in order to focus on companies where investments into physical assets have a considerable role in the business model. Also, outliers have been excluded (observations falling into top 1% minimum or maximum in terms of fixed assets balance and return on assets margins).

As regards the methodology of our pilot study, we have used regression analysis (pooled OLS), correlation analysis and descriptive statistics to study the relationships between EBITDA and investment intensity. For the regression models, we have constructed the following variables based on the Amadeus source data:

- *INV* (Investment intensity; in Euros): tangible fixed assets as at the end of the year minus tangible fixed assets as at the beginning of the plus annual depreciation cost;
- *EBITDA*: Profit before financial items, tax, depreciation and amortisation (in Euros);
- *TAN* (Tangibility; in percentages): tangible fixed assets divided by total assets.

We have employed the following regression model:

$$INV_i = \beta_0 + \beta_1 EBITDA_i + u_i, \tag{1}$$

where i denotes the i-th company in the sample. We have performed the White test to control for potential heteroscedasticity.

The results obtained based on this exploratory pilot study should provide a better basis for further research employing more sophisticated econometric models on a broader dataset incorporating more control variables.

3. Empirical Findings

We can observe from Figure 1 (left panel) a decreasing trend in the tangibility of our sample companies from 2003 to 2009. This is explained by lower investment levels into fixed assets (Figure 1, right panel) as well as by the fact that current assets (e.g. trade receivables and inventories) had started to accumulate in comparison to the net increase in the carrying value of tangible fixed assets, a sign of overheating of the economy. The decrease in tangibility is especially sharp in 2008 and 2009, the effect of the global economic crisis, leading to decreased investments, decreased asset values as well as longer receivable collection periods and slower inventory turnovers.
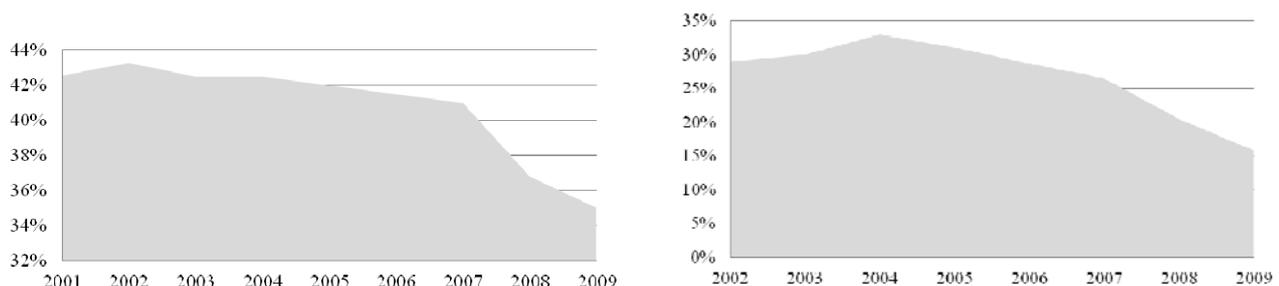

Fig. 1: Average tangibility (left panel) and average annual increase in tangible fixed assets (right panel), Amadeus data.

Sample statistics and a correlation matrix of *EBITDA* and *INV* variables have been presented in Table 1. In order to test for the robustness of results, we have presented the correlation matrixes for the combinations of five *INV* indicators and three *EBITDA* indicators. The differences in those *EBITDA* and *INV* variables lie in time lags. For example, $EBITDA_0$ denotes no time lag, INV_1 a 1-period time lag and $EBITDA_{Avg\ 1-3}$ an average of the *EBITDA* variables in periods from +1 to +3 (i.e. average of *EBITDA* with a 1, 2 and 3-year lag).

TABLE I.　　SAMPLE STATISTICS AND CORRELATION MATRIX

Sample statistics	N	Min	Max	Average	Std Error
EBITDA	8,074	-549,700	9,765,500	19,949	200.7
INV	8,074	0	5,944,000	12,561	210.3
Correlation matrix	INV_1	INV_2	INV_3	$INV_{Avg\ 3-4}$	$INV_{Avg\ 3-5}$
$EBITDA_0$	0.448	0.451	0.493	0.533	0.493
$EBITDA_{Avg\ 1-2}$			0.571	0.637	0.587
$EBITDA_{Avg\ 1-3}$			0.632		0.665

It can be noted from Table 1 that the correlation between *EBITDA* and *INV* remains relatively high (0.45-0.67) in all cases, irrespective of the time lags used. Replacing *EBITDA* and *INV* with a relative terms variable (e.g. percentage increase) might give different results, and this would be done in future versions of the paper. We also note that as investment levels decreased during the economic crisis, and there was an even larger decrease in profits, the relationship between investment intensity and *EBITDA* may have a nonlinear nature, necessitating the use of more sophisticated panel regression models for future research.

We have presented below the results of the pooled OLS regression model for the impact of *EBITDA* with one year time lag on *INV*.

TABLE II.　　REGRESSION MODEL

	Coefficient	Std. Error	t	P
$EBITDA_{t-1}$	0.504	0.002	316.4	0.0031
Constant	1,107	754	8,060	0.009
Industry dummies	yes			
Year dummies	yes			
Country dummies	yes			
R^2	0.32			

We can see that in a model specified as above, EBITDA level can explain 32% of investment intensity in the following period. Based on the model results, EBITDA of EUR 1 million would result on average in EUR 0.5 million of investments in the following year.

To control for robustness of results, we have performed a similar modelling exercise on the relationship between *EBITDA* with a two year time lag and *INV*. We found the results to be similar in terms of coefficients and statistical significance, with the coefficient for $EBITDA_{t-1}$ being 0.52.

Similarly to previous studies, as outlined in the Introduction, the relationship between EBITDA and future investments appears to be positive based on this preliminary modelling exercise, and the economic significance of this relationship appears to be strong.

We find that the impact of EBITDA on future investments is particularly strong in the boom years of 2004-2006, and started to decrease thereafter. It is interesting to note that the impact of EBITDA on profitability weakened already in 2007, i.e. before the economic crisis became clearly evident, demonstrating that the relationship between past profitability and investment intensity may be one of the characteristic features when studying cyclical behaviour in companies' investment activities.

Country wise analysis shows that the relationship between EBITDA and investment intensity was weaker than average in Ireland and Greece. This is an interesting finding given the particularly devastating impact that the economic crisis and its aftermath have had in these countries. Although it requires more detailed analysis, it

may be argued that the relatively low level of profits reinvested into productive assets (and, in parallel, relatively many unproductive placements of funds generated from earnings or excessive payment of dividends) might be among the reasons for lower resistance to economic fluctuations in Greece and Ireland.

As expected, the above relationship appears to be stronger in investment intensive industries, like energy, transportation, manufacturing as well as real estate.

Further investigation of these issues remains an interesting task for future research. Areas of expanding the model include incorporating additional variables (e.g. indicators of company age, size and financial behaviour), controlling for company level fixed effects and replacing the absolute terms *EBITDA* and *INV* variables with relative ones.

4. Conclusions

Based on the preliminary results reached by the current phase of our study, we find that in our sample, EBITDA level of a company can explain 32% of investment intensity in the following period. Similarly to previous studies, the relationship between EBITDA and future investments appears to be positive based on our modelling exercise, and the economic significance of this relationship appears to be strong. Based on the model results, EBITDA of EUR 1 million would result on average in EUR 0.5 million of investments in the following year.

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The results obtained based on this exploratory pilot study provide a better basis for further research employing more sophisticated panel data econometric models on the same or expanded datasets. This study is part of a broader project aiming to identify the drivers and elements of pro- and counter-cyclicality in the financial behaviour of real sector companies (see e.g. Avarmaa et al., 2011 and 2012; Ruubel and Hazak, 2011a, b, Kotšina and Hazak, 2012).

5. Acknowledgment

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