

# Company Profitability and Labour Intensity under Different Phases of the Economic Cycle: A Pan-European Empirical Study

Raul Ruubel<sup>1</sup> and Aaro Hazak<sup>1+</sup>

<sup>1</sup> Department of Economics, Tallinn University of Technology

**Abstract.** Our paper seeks to investigate the relationship between company profitability and labour intensity in 17 European Union (EU) member states in the comparative perspective of Central and Eastern Europe (CEE) and Western Europe (WE). Our study is based on the 2001 to 2009 data of 93,500 companies from the Amadeus database. We find that companies with higher labour intensity tend to operate with higher EBITDA margins, potentially the effect of their larger flexibility to changes in demand and overall economic conditions. However, we find that companies with higher labour intensity have lost relatively more in their profitability during the 2008-2009 economic crisis. This may relate to potentially large redundancy costs of labour intensive companies under a need to decrease workforce as a result of lower activity levels. Another explanation might be that salaries as well as staff numbers did not react to the economic crisis as quickly as other costs and companies' profits did.

**Keywords:** profitability, labour intensity, European Union

## 1. Introduction

The recent economic crisis has highlighted the differences in companies' resistance to cyclical shocks. One of the potential drivers of the vulnerability of companies to cyclical fluctuations might be their labour intensity, i.e. the reliance on labour in total inputs. On the one hand, labour costs would be relatively easy to cut under economic downturn, whereas inflationary pressure during years of growth may result in nominal salary increases that are not sufficiently corresponding with improvements in productivity or increases in output prices. Labour intensity is to a large extent determined by industry specifics. Berman and Pflieger (1997) have found that different industries tend to demonstrate variances in their immunity to cyclical shocks. Labour intensity may explain part of these differences.

In addition to the number of employees per unit of output, labour intensity in financial terms is also impacted by the salary level. Inter-industry wage differences have been observed already by Slichter (1950) while numerous later studies have investigated the causes of salary variances on samples from different countries (incl. in Europe), industries and time periods, including papers on the interrelations between company profitability and salary level, for example Magda et al. (2011), Du Caju et al. (2010 and 2011) and Ruubel and Hazak (2011), to mention some recent studies.

In this short pilot paper, we look into the relationship between company profitability and labour intensity in 17 European Union (EU) member states in the comparative perspective of Central and Eastern European (CEE) and Western European (WE) countries under different phases of the economic cycle.

## 2. Data and Methodology

We use data from the Amadeus and Eurostat databases. The dataset derived from the Amadeus database includes data of 93,500 companies over a nine year period from 2001 to 2009. We have used annual data on each company's profitability (EBITDA margin), labour intensity (total annual personnel cost divided by total annual costs; i.e. the share of labour costs in total costs), country (country where the company has been

---

<sup>+</sup> Corresponding author. Tel.: +372 6204 057; fax: +372 6203 946;  
e-mail address: aaro.hazak@tseba.ttu.ee.

registered) and industry (8 main industries based on the NACE Rev.1.1 classification) for our study. Our dataset covers 17 countries for which the necessary data was available. We have divided those into two groups based on the overall characteristics of their economic conditions: CEE (including Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Poland and Slovenia) and WE (including Belgium, Germany, Finland, France, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom).

In parallel, we have used industry and country level data on average labour intensity and average profitability from the Eurostat database, which covers the entire population of companies operating in 24 EU countries (all EU member states, except for Cyprus, Malta and Ireland for which the necessary data was not available). Data from the Eurostat database was available for a slightly different time period, namely 1996-2007.

As regards the methodology of our pilot study, we have used analysis of variance (ANOVA) and descriptive statistics to study the relationships between labour intensity and profitability in different regions, industries and different phases of the economic cycle. In order to apply ANOVA, we have divided our dataset into groups based on the labour intensity level (three rough groups of identical size – high, medium and low labour intensity), phase of the economic cycle (years 2001-2003, 2004-2007 and 2008-2009) and economic region (CEE or WE). In order to identify whether the relationships between labour intensity level and profitability in these groups are different, we have applied the Fisher Least Significant Difference (LSD) test. The results obtained based on this exploratory pilot study should provide a better basis for further research employing more sophisticated econometric models on the same dataset.

### 3. Empirical Findings

There appear to be notable differences in the labour intensity levels between CEE and WE companies (see Figure 1). It can be noted that there is a vast difference in the labour intensity level of the Mining industry (C) companies between CEE and WE countries. The significantly higher labour intensity in CEE mining companies might be explained by less use of technology and relatively more operations being performed by human resources. In all other industries, labour intensity in WE companies appears to be, on average, higher than in CEE companies of the same industry. This may be primarily explained by the significantly higher salary level in WE, as highlighted by Ruubel and Hazak (2011), whereas the cost of other inputs is expectedly less different between CEE and WE countries, given the relatively open markets and free trading of goods within the EU.

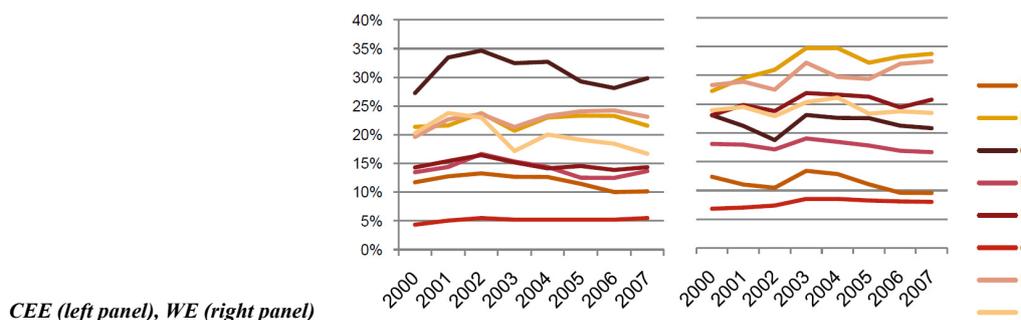


Fig. 1: Average annual labour intensity in CEE and WE companies by industries (Eurostat data)<sup>1</sup>.

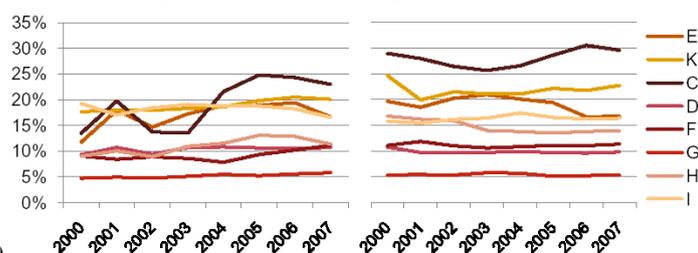
In CEE, labour intensity levels appear to have been rather stable over the period from 2000 to 2007. Although there has been a considerable increase in nominal salaries in all industries in CEE during this period (Ruubel and Hazak, 2011), this appears to have been offset either by reduced staff numbers or increase in the role of other inputs in total costs. An exception to the overall stability in industry average labour intensity levels over time is the Transport, storage and communications sector (I), where the overall 18% decrease in labour intensity over 2000 to 2007 might be partially explained by increased fuel prices,

<sup>1</sup> Industries: C – Mining and quarrying; D – Manufacturing; E – Electricity, gas and water supply; F – Construction; G – Wholesale and retail trade: repair of motor vehicles, motorcycles and personal and household goods; H – Hotels and restaurants; I – Transport, storage and communications; K – Real estate, renting and business activities.

which have decreased the share of labour costs in companies' total cost bases, as well as by technological advances which might have reduced the need for staff.

As regards the WE countries, the dynamics in nominal salaries appear to be somewhat more versatile than in the case of the CEE countries. However, no significant changes have taken place in average labour intensity levels in any of the industries when comparing 2007 and 2000 levels.

As regards EBITDA margins in the CEE and WE regions by industries over 2000 to 2007 (please refer to Figure 2), we can see that the East-West differences are much smaller than in the case of labour intensity. As discussed in Ruubel and Hazak (2011), average EBITDA margins in different industries appear to be quite similar in CEE and WE with mining sector (C) being the only considerable exception. The mining sector tends to be characterised by non-relocatability, which may be a reason for limited convergence in the profitability rates in this sector between CEE and WE. Furthermore, we can note that the mining sector along with the utilities sector (E) – another non-relocatable investment intensive industry – are the ones with highest fluctuations in average EBITDA margins over 2000-2007, both in CEE and WE. Although Berman and Pfleeger (1997), among other authors, have drawn attention on the low cyclicality in these industries, companies operating in both of these industries are expectedly characterised by relatively high fixed costs as well as by an exposure to dynamics in fuel prices, which may be among the reasons for fluctuating EBITDA margins. Another reason for the changes in average EBITDA margins over the years may be that both utilities and mining (more broadly energy) tend to be strongly regulated industries.



CEE (left panel), WE (right panel)

Fig. 2: Average annual EBITDA margins in CEE and WE companies by industries (Eurostat data).

Overall, it is an expected finding that EBITDA margins in CEE and WE are not substantially different, at least in the case of relocatable businesses, given the (relatively) free movement of capital. Further discussion on the dynamics in the sample companies' profitability and salary level can be found in Ruubel and Hazak (2011).

Moving on to the analysis of company level data based on the Amadeus database, we observe considerable dispersion of average labour intensity and EBITDA margins, and we therefore test the statistical significance of the differences in these variables between the CEE and WE regions by employing the analysis of variance (ANOVA). Overall, we find the CEE versus WE differences to be statistically significant on a 99% level (see Table 1) with the exception of EBITDA margins in the utilities sector (E) as well as a lower confidence level (95%) in the hotels and restaurants sector (H). Based on the above analysis (see Figure 2) the result regarding the utilities sector may be explained by the fluctuations in annual EBITDA margins both in CEE and WE, potentially explained by fuel price dynamics as well as regulatory matters.

TABLE I. DIFFERENCES IN AVERAGE LABOUR INTENSITY AND EBITDA MARGIN IN CEE AND WE COMPANIES (AMADEUS DATA)

Industry:	All	C	D	E	F	G	H	I	K
CEE average labour intensity	18.7%	29.9%	21.3%	26.1%	18.6%	8.2%	29.1%	23.4%	34.1%
WE average labour intensity	24.8%	22.3%	24.4%	22.1%	29.5%	13.6%	38.2%	34.3%	39.9%
Statistical significance of CEE/WE difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CEE average EBITDA margin	10.9%	22.7%	11.1%	17.5%	10.3%	7.5%	13.2%	14.7%	14.6%
WE average EBITDA margin	9.4%	17.1%	9.6%	17.9%	9.1%	6.2%	14.0%	11.1%	13.6%
Statistical significance of CEE/WE difference	0.000	0.000	0.000	0.287	0.000	0.000	0.040	0.000	0.000

Similarly to what is depicted on Figures 1 and 2, we can note that there are notable differences in companies' labour intensity between CEE and WE in all industries. However, the differences in EBITDA margins remain statistically significant but have little economic significance. An exception is the mining sector (C), where the 5.6 pp difference between the average EBITDA margin in CEE and WE companies

may be explained by the non-relocatability of mining businesses, which might hinder the cross-EU convergence of industry profitability margins and return rates.

As a next step, we tested the statistical significance of differences in the EBITDA margins of companies with different labour intensity levels (Table 2). In the case of WE, we find there to be statistically significant differences in the EBITDA margins of companies of all industries (except for the Mining sector, C) depending on their labour intensity. As can be seen from Table 2, the economic significance of these differences remains notable, and higher labour intensity appears to be related to higher profitability. There are two exceptions to this finding – the Hotels and restaurants sector (H) and the Real estate, renting and business activities sector (K), where high labour intensity does not appear to lead to increased EBITDA margins. In the latter two industries, correlation coefficients between WE sample companies' EBITDA margin and labour intensity of 0.01 (H) and 0.03 (K) also show that the relationship between the two indicators is absent. The full WE sample correlation coefficient between EBITDA margin and labour intensity of 0.23 demonstrates that a correlation between the two variables exists, but is not very strong. This warrants a need for further study with more sophisticated panel data econometric methods to include control variables and account for dynamic effects.

TABLE II. RELATIONSHIP BETWEEN AVERAGE LABOUR INTENSITY AND EBITDA MARGIN IN CEE AND WE COMPANIES (AMADEUS DATA)

Industry:		All	C	D	E	F	G	H	I	K
CEE	Average EBITDA margin at companies with low labour intensity	7.6%	21.4%	9.9%	14.9%	9.4%	5.9%	13.0%	10.4%	12.7%
	Average EBITDA margin at companies with medium labour intensity	11.1%	23.5%	11.5%	16.2%	9.7%	7.3%	11.8%	14.8%	17.1%
	Average EBITDA margin at companies with high labour intensity	14.1%	23.1%	11.8%	21.4%	11.6%	9.4%	14.7%	18.8%	14.0%
	Statistical significance of difference	0.000	0.423	0.000	0.000	0.000	0.000	0.054	0.000	0.000
	WE	Average EBITDA margin at companies with low labour intensity	6.6%	16.8%	8.0%	14.3%	8.7%	4.4%	14.1%	8.5%
	Average EBITDA margin at companies with medium labour intensity	9.6%	17.0%	9.9%	19.3%	9.0%	5.9%	14.3%	11.6%	15.3%
	Average EBITDA margin at companies with high labour intensity	11.9%	17.5%	10.8%	20.1%	9.7%	8.1%	13.7%	13.2%	12.2%
	Statistical significance of difference	0.000	0.401	0.000	0.000	0.000	0.000	0.004	0.000	0.000

As regards CEE, in the case of all industries, except for Mining (C), there appears to be a statistically significant difference between EBITDA margins in companies with different labour intensity levels. Similarly to WE companies, higher labour intensity tends to be associated with higher profitability with the Hotels and restaurants sector (H) and the Real estate, renting and business activities sector (K) being the two exceptions. The full CEE sample correlation coefficient between EBITDA margin and labour intensity of 0.25 shows, similarly to WE, that a correlation between the two variables exists, but is not very strong, requiring a more detailed study to establish the drivers of profitability and the role of labour intensity in this.

TABLE III. AVERAGE LABOUR INTENSITY AND EBITDA MARGIN UNDER DIFFERENT PHASES OF THE ECONOMIC CYCLE (AMADEUS DATA)

Years:		2001-2004	2004-2007	2008-2009	Statistical significance of difference	Change 2004-2007 vs 2001-2004	Change 2008-2009 vs 2004-2007
CEE	Average EBITDA margin at companies with low labour intensity	7.00%	8.00%	7.90%	0.0000	1.00%	-0.10%
	Average EBITDA margin at companies with medium labour intensity	10.70%	11.50%	11.10%	0.0010	0.80%	-0.40%
	Average EBITDA margin at companies with high labour intensity	13.70%	14.70%	13.90%	0.0000	1.00%	-0.80%
	Statistical significance of difference	0.0000	0.0000	0.0000			
WE	Average EBITDA margin at companies with low labour intensity	6.70%	6.70%	6.40%	0.0000	0.00%	-0.30%
	Average EBITDA margin at companies with medium labour intensity	9.80%	9.70%	9.10%	0.0000	-0.10%	-0.60%
	Average EBITDA margin at companies with high labour intensity	12.00%	12.10%	11.40%	0.0000	0.10%	-0.70%
	Statistical significance of difference	0.0000	0.0000	0.0000			

Finally, we tested whether there are any considerable differences in the EBITDA margins of companies with different labour intensity levels under different phases of the economic cycle (please refer to Table 3). The differences in these variables appear to be statistically significant in different time periods (2001-2003, 2004-2007 and 2008-2009). Our ANOVA results reveal that the years of economic crisis, namely 2008 and 2009, have overall brought along a larger decrease in the EBITDA margins of companies with higher labour intensity. This finding appears to be valid for both CEE and WE companies (see last column of Table 3). At the same time, the years of economic boom (2004-2007) do not seem to have had a significantly different overall impact on the changes in the profitability of companies with different labour intensity levels. A potential explanation for the different reactions of companies' profitability to the economic crisis depending on their labour intensity is the potentially large redundancy costs under a need to decrease workforce as a result of lower activity levels. Another explanation might be that salaries as well as staff numbers did not react to the economic crisis as quickly as other costs and companies' profits did. Further investigation of these issues remains an interesting task for future research.

#### **4. Conclusions**

There appear to be notable differences in the labour intensity levels between CEE and WE companies. In all industries, except for the mining industry, labour intensity in WE companies appears to be, on average, higher than in CEE companies of the same industry. This may be primarily explained by the significantly higher salary level in WE, whereas the cost of other inputs is expectedly less different between CEE and WE countries, given the relatively open markets and free trading of goods within the EU. The significantly higher labour intensity in CEE mining companies compared to their WE counterparts might be explained by less use of technology and relatively more operations being performed by human resources.

We find that companies with higher labour intensity tend to operate with higher EBITDA margins, potentially the effect of their larger flexibility to changes in demand and overall economic conditions. However, we find that companies with higher labour intensity have lost relatively more in their profitability during the 2008-2009 economic crisis. This may relate to potentially large redundancy costs of labour intensive companies under a need to decrease workforce as a result of lower activity levels. Another explanation might be that salaries as well as staff numbers did not react to the economic crisis as quickly as other costs and companies' profits did.

The results obtained based on this exploratory pilot study should provide a better basis for further research employing more sophisticated panel data econometric models on the same dataset.

#### **5. Acknowledgment**

We are grateful to the Estonian Science Foundation (grant no ETF8796) for financial support.

#### **6. References**

- [1] Berman, J., and J. Pflieger (1997). Which industries are sensitive to business cycles? *Monthly Labor Review*, February, pp. 19–25.
- [2] Du Caju, P., G. Kátay, A. Lamo, D. Nicolitsas and S. Poelhekke (2010). Inter-Industry Wage Differentials In EU Countries: What Do Cross-Country Time Varying Data Add to the Picture? *Journal of the European Economic Association*, April/May 2010, Vol. 8, No. 2-3, pp. 478-486.
- [3] Du Caju, P., F. Rycx and I. Tojerow (2011). Inter-Industry Wage Differentials: How Much Does Rent Sharing Matter? *The Manchester School*, Vol. 79, pp. 691-717.
- [4] Magda, I., F. Rycx, I. Tojerow and D. Valsamis, (2011). Wage Differentials across Sectors in Europe: An East-West Comparison. *Economics of Transition*, Vol. 19, Online, doi: 10.1111/j.1468-0351.2011.00417.x.
- [5] Slichter, S.H. (1950). Notes on the Structure of Wages. *Review of Economics and Statistics*, Vol. 32, pp. 80-91.
- [6] Ruubel, R., A. Hazak, (2011). Is There a Relationship between Company Profitability and Salary Level? A Pan-European Empirical Study. Lijuan, D. (Ed.): *Innovation, Management and Service*. International Proceedings of Economics Development and Research, IACSIT Press, Vol. 14, pp. 332-337.