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The impact of electricity prices on jobs and investment in the Belgian manufacturing industry

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Summary

Belgium is losing manufacturing jobs and it is losing these jobs at a faster pace compared to most other European countries. Whilst the impact of labour costs on the competitiveness of our industry is much debated and documented, the impact of the price of electricity remains unquantified. Using data of 10 European, highly industrialised countries, we estimate the impact of electricity prices on jobs and investment in Belgian manufacturing. We estimate that the *elasticity of employment with respect to the electricity price* is on average -0.30 and the *elasticity of investment* equals on average -0.55. This means that a drop in the price of electricity of 1% would lead, holding all other things equal, to 0.30% extra manufacturing jobs and 0.55% extra manufacturing investment. Our findings are robust to different calculation methods.

Others have estimated that electricity prices in Belgium are 10%-35% higher than in the neighbouring countries. Combining this information with the estimated elasticities, we calculate a price drop of 10% of the Belgian electricity price would lead within the manufacturing industry to an increase of 12,000 full-time jobs and an increase of €550 Million in yearly investment.

These numbers are likely to be an underestimation of the impact. We take a conservative stance on the price handicap and Belgium has historically specialised in the most electricity intensive sectors. Furthermore, our approach does not quantify spillovers to other manufacturing nor services industries.

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I. INTRODUCTION

Belgium is shedding jobs in the manufacturing industry. Over the past 2 decades approx. 150,000 jobs have been lost at Belgian manufacturing companies (Figure 1). Of course, Belgium is not the only country experiencing a structural shift away from manufacturing, but it has suffered more compared to most highly industrialised EU countries (Figure 2). From Belgium's neighbouring countries, France experienced a similar decline, but the Netherlands and especially Germany performed significantly better.

Belgian manufacturing employment

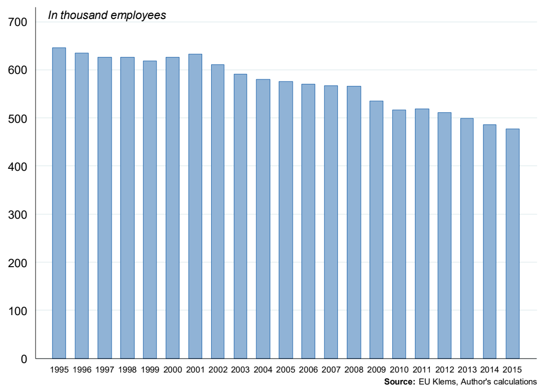

Figure 1: Evolution of employment in the Belgian manufacturing industry (NACE 10-33)

Relative evolution

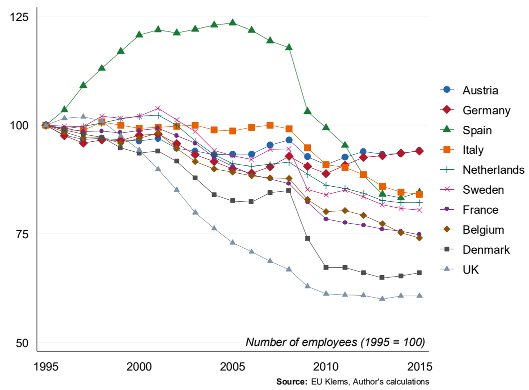

Figure 2: Relative evolution of employment in the manufacturing industry in 10 countries (1995=100)

Do we need to worry about this trend? As such, the 2017 Belgian unemployment rate (7.2%) is lower than 1995's (9.2%). Even during the financial and sovereign debt crisis of the past decade, unemployment remained well below the levels seen in the nineties. The jobs lost in the manufacturing industry are indeed compensated by newly created jobs in services industries. We are sometimes led to believe these newly created services jobs only involve e.g., computer programmers, pharmaceutical researches and health workers. This is not completely true. In absolute numbers, the so called *less knowledge intensive services* showed an increase in employment of 3-to-1 compared to the increase in employment of the *knowledge intensive services* during 1997-2013.[1] Higher paying manufacturing jobs are predominantly replaced by lower paying services jobs. If we worry about job market polarisation[2], where we end up with only the so called *lousy and lovely jobs* and nothing in between, we hence do need to worry about the health of our manufacturing industry.

The main driving forces of this structural change of our economy are widely covered and studied in academic papers as well in the mainstream media. Technology replaces workers by machines. Outsourcing of non-core activities moves workers from the payroll of a manufacturing company to the payroll of a services company[3]. Globalisation and increased international trade offshores jobs to emerging countries. The reason why Belgium lost comparably more manufacturing jobs than our neighbouring countries is often blamed on higher labour costs.

[1] See Bijnens & Konings (2017) "An Enterprise Map of Belgium".
[2] The term polarisation was first introduced by Goos & Manning (2007) "Lousy and lovely jobs: The rising polarisation of work in Britain".
[3] Berlingieri (2013). "Outsourcing and the Rise in Services" estimates that professional and business services outsourcing (e.g., catering services or payroll administration) accounts for approx. 25% of the fall in manufacturing employment.

Employment share of sectors with high electricity intensity

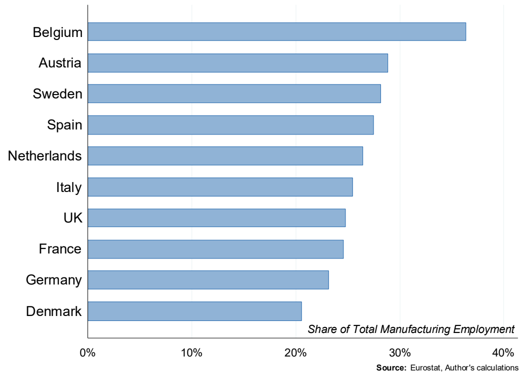

Figure 3: Share of employment of the 8 most electricity intensive manufacturing industries[4] vs. total manufacturing employment

Electricity prices Belgium vs. neighbouring countries

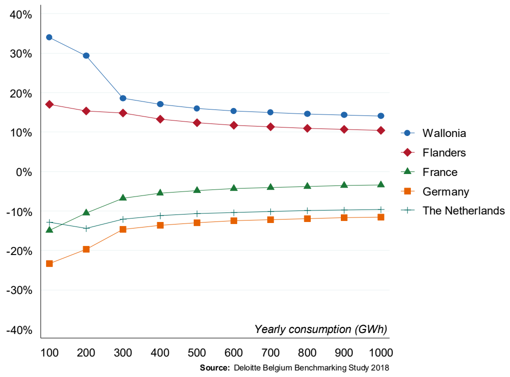

Figure 4: Relative deviation of electricity prices vs average prices in Belgium and its neighbouring countries (2018, baseload consumer profiles, taken from Deloitte Benchmarking Study '18)

Next to labour costs, energy costs are also an important part of total production costs in manufacturing. Consequently, electricity prices can have important effects on employment as well. On the one hand, higher electricity prices lead to higher costs and lower competitiveness which can translate in lower output and investment and thus lower employment. On the other hand, higher electricity prices make capital goods such as machinery more expensive relative to labour, which could increase employment. Which of the two effects dominates is an empirical question and depends highly on the substitutability between energy and labour in the production process. Previous studies however, have found energy and labour to be weak substitutes. This means that to produce a particular level of output, firms can replace energy by labour only to a limited extent. Consequently, the loss in competitiveness dominates and higher energy prices are likely to result in lower employment. This is particularly relevant for Belgium as electricity intensive industries[5] such as the chemical sector take a higher share in total manufacturing. Figure 3 shows that the high electricity intensive sectors in Belgium account for almost 40% of total manufacturing employment. In e.g., Germany, this is less than 25%.

Evolution of Belgian manufacturing employment in function of electricity intensity

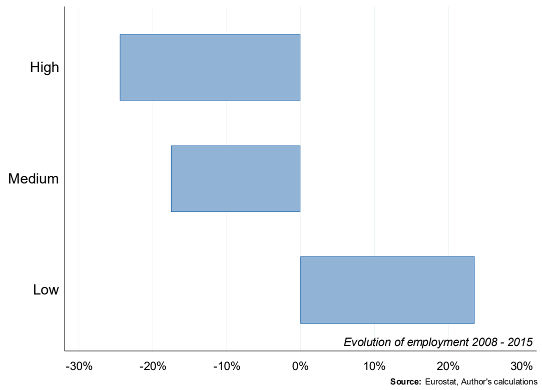

Figure 5: Evolution of Belgian employment in the manufacturing industry. The 24 NACE 2-digit industries (10-33) are divided in 3 groups of 8 industries based on their electricity intensity.

[4] The most electricity intensive manufacturing sectors are basic metals, chemicals and chemical products, coke and refined petroleum products, other non-metallic mineral products, paper products, rubber and plastic products, textiles and wood products.

[5] Throughout this report *electricity intensity* is an average over NACE 2-digit sectors and is defined as total electricity consumption of the sector divided by total added value of the sector. This does not necessarily correspond with the electricity intensity of individual firms whose electricity intensity can be (substantially) higher or lower than the sector average.

At the same time, Belgium also has higher electricity prices for industrial consumers compared to its neighbouring countries (Figure 4).[6]

Currently the Belgian government is debating how and when the switch away from nuclear energy will be implemented and what the price impact on households and businesses will be. Yet, little is known about what the impact on employment will be if electricity prices rise vis-à-vis Belgium's neighbouring countries. Figure 5 shows that at least there is a link between job losses and electricity that deserves further scrutiny.

II. ECONOMIC MODEL

We want to estimate the impact of a change in electricity price on employment and investment in the manufacturing industry. This is also called the elasticity of employment and investment with respect to the price of electricity.

We use an economic model that defines the level of employment in a certain industry in a certain country at a certain time in function of the price of electricity, the electricity intensity of a sector and a number of unobserved and/or unknown characteristics that impact the level of employment:

$$Emp_{cst} = f(Price_{cst}, EI_{cs}, X_{cst}) \qquad (1)$$

Where Emp_{cst}, $Price_{cst}$ and EI_{cs} stand for the level of employment (*Emp*), electricity price (*Price*) and electricity intensity (*EI*) in country *c*, in sector *s*, in year *t*. All other factors that affect employment are pooled in the vector X_{cst}. In our estimation strategy, we need to control for these as they could affect both electricity prices and employment, thereby potentially introducing a bias in our coefficient estimates. We will do so by including various so called *fixed effects* which are explained below. We write equation (1) in first differences, namely we relate the growth in employment to the change in electricity prices and approximate this relationship by a logarithmic, linear function.

The specification of our model becomes:

$$\Delta emp_{cst} = \alpha_1 \Delta price_{cst} + \alpha_2 \Delta price_{cst} * EI_{cs} + \alpha_3 EI_{cs} + \sum_i \beta_{emp,i} FE_i + \epsilon_{emp,cst} \qquad (2)$$

Where Δemp_{cst} represents the percentage change in employment[7] and $\Delta price_{cst}$ denotes the percentage change in the electricity price.[8] We also include an interaction between the electricity price and the electricity intensity of the sector $\Delta price_{cst} * EI_{cs}$. The hypothesis is that the effect of the electricity price is larger in more electricity intensive sectors. FE stands for the fixed effects. $\epsilon_{emp,cst}$ stands for the remaining unobserved or unknown parameters that impact the level of employment.

Taking first differences controls for all factors that affect the sectoral employment level in a country that are fixed over time. For example, proximity to a harbour, historically high or low productivity

[6] Germany is often regarded as having higher electricity prices compared to Belgium. Industrial users with high electricity intensity (measured as electricity costs compared to gross value added), however, enjoy a reduced *EEG umlage* leading to lower prices for these users. As a robustness check we also analysed the data leaving Germany out; this did not change the main conclusion.

[7] Computed as $\ln(Emp_{cs,t}) - \ln(Emp_{cs,t-1})$ where ln(x) stands for the natural logarithm of x.

[8] Computed as $\ln(Price_{cst}) - \ln(Price_{cst-1})$.

levels, … drop from the equation. On top of this, we also include various fixed effects, denoted by FE, controlling for various other factors that could affect employment growth. We first include year fixed effects, which stands for time specific characteristics that influence employment growth in all sectors and countries in a similar way. An example is the business cycle. On top of this, we also include country fixed effects, which pick up factors that vary at the country level such as labour cost (changes). A sector fixed effect allows to account for sector specific influences such as the fact that a certain industry is hit harder by automation or offshoring to emerging countries than others. These fixed effects can also be combined. A country-year fixed effect, e.g., allows to account for the fact that the business cycle has hit Spain harder than Belgium. Including more and more fixed effects, makes our results more robust against potential confounding factors but also takes away – potentially useful – variation in our variables of interest. Therefore we opt to report a large range of results, adding each time more and more fixed effects. In our most demanding specification where we check, for example, whether a larger than average change in the electricity price for the Chemical Industry in Belgium is related to a deviation in employment growth from the average employment growth in the Chemical Industry in Belgium over the sample period.

The parameters of interests are α_1 and α_2 as these give the elasticity of the change in employment in function of the change in the price of electricity. The elasticity is different depending on the electricity intensity of the sector if $\alpha_2 \neq 0$.

We use a similar first difference, log-linear model to estimate the elasticity of investment. We regard investment as the change in the capital stock. The model hence becomes:

$$invest_{cst} = \alpha_4 \Delta price_{cst} + \alpha_5 \Delta price_{cst} * EI_{cs} + \alpha_6 EI_{cs} + \sum_i \beta_{inv,i} FE_i + \epsilon_{inv,cst} \quad (3)$$

Where $invest_{cst}$ is calculated as the logarithm of the 2-year moving average of the amount invested by an industry in a certain country in a certain year to filter out the volatility in investment. It hence is calculated as $invest_{cst} = \ln(Invest_{cst} - Invest_{cst-1})$. Since actual investment lags the investment decision, $\Delta price_{cst}$ now denotes $\ln(Price_{cst-1}) - \ln(Price_{cst-2})$. Similar to the model for employment, the parameters of interests are now α_4 and α_5.

In section VI. we will test different specifications of the economic model to check the robustness of our findings.

III. DATA

We estimate the coefficients (α_i and β_i) of the economic model described in the previous section on a dataset with the below characteristics:

- 10 countries with a similar level of industrialisation as Belgium, consisting of Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Spain, Sweden and the UK.
- 24 manufacturing sectors, NACE Rev. 2 codes 10 – 33.
- Time period 2008 – 2015.
- Employment per country, per sector, per year (in full time equivalents).
- Gross investment per country, per sector, per year
- Price of electricity per country, per sector, per year (excluding VAT and other recoverable taxes and levies).
- Electricity intensity per country, per sector (electricity consumption in kWh per € added value).

The dataset is assembled via multiple sources. We start from the Eurostat Structural Business Statistics.[9] This reports, amongst others, employment, added value and gross investment for EU countries on the NACE Rev. 2 2-digit level. We merge this data with electricity price information per sector per country per year. This electricity price information is assembled as follows:

- Eurostat electricity prices per EU country for non-household consumers.[10] Prices are reported on a bi-annual basis for 7 consumption bands up to 150,000 MWh. Yearly prices are calculated as the average over the 2 semesters.
- Prices for higher consumption bands are taken from Deloitte's "Benchmarking Study of Electricity Prices between Belgium and neighbouring countries."[11] The study gives baseload and peakload prices[12] for Flanders, Wallonia,[13] the Netherlands, France and Germany for the period 2013-2018 for 10 consumption bands 100 MWh – 1,000,000 MWh. Prices for other countries and/or other years are extrapolated based on the 2013-2017 evolution in Belgium, the Netherlands and France.[14] We have now obtained electricity prices for 15 consumption bands per country for 2008-2015.[15]
- We estimate for each NACE 2-digit manufacturing sector (10-33) how much of the sector's electricity consumption is taken by each of the 15 consumption bands. This is done based on firm level electricity consumption of surveyed Belgian firms. We subsequently merge this consumption profile per sector with the pricing information per country, year and consumption profile to obtain prices per country, year and sector. This hence assumes the consumption profiles per sector are similar across countries used in our study. This is a realistic assumption since technology levels in manufacturing in the most industrialised countries in Europe are comparable.

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9 http://ec.europa.eu/eurostat/web/structural-business-statistics
10 http://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_price_statistics
11 http://www.febeliec.be/data/1520415400Report%20Benchmarking%20study%20electricity%202018%20FINAL.pdf
12 We calculate the average as 35% peakload and 65% baseload. This corresponds with baseload hours on weekdays between 8h00 and 20h00.
13 We calculate the price for Belgium as 70% Flanders and 30% Wallonia.
14 Germany is not used for extrapolation as prices for high consumption profiles in Germany differ significantly from the one for lower consumption profiles due to the reduced EEG umlage.
15 We have used other methods to couple Eurostat prices for low consumption with Deloitte prices for high consumption to obtain the full price data. This did not change the main results.

We calculate the electricity intensity of sector in a country based on the electricity consumption per sector and country taken from Eurostat.[16] The sector aggregation level is in between NACE 1-digit and NACE 2-digit. This consumption is spread over the underlying NACE 2-digit codes based on the detailed energy statistics from the German Statistical Office.[17] We again assume similar technology levels across industries in 10 countries of our dataset. Finally, the electricity intensity per country and sector is calculated as the average electricity consumption divided by the average added value per country and sector over the period 2008-2015.

[16] http://ec.europa.eu/eurostat/cache/metadata/en/nrg_10_esms.htm
[17] https://www.destatis.de/EN/FactsFigures/EconomicSectors/Energy/Use/Tables/EnergyConsumptionBranches.html

IV. ECONOMETRIC ANALYSIS

We estimate the model of Equation 2 (Employment) and Equation 3 (Investment) on the dataset described in the previous section using the ordinary least square (OLS) method and by introducing different parameters into the model (with and without interaction with electricity intensity, with and without several fixed effects).

Impact of electricity prices on Employment

Figure 6 and Appendix 1 give the estimates for the elasticity of employment in function of the price of electricity (coefficient α_1 of Equation 2). We find a statistically significant negative elasticity that is equal to around -0.30. The estimates using the model with the widest possible set of fixed effects (year, country, country x year, sector, sector x year, country x sector) confirm the results and make our findings very robust.

The negative value of the elasticity means that changes of the electricity price and employment go in opposite directions. In other words, an elasticity of -0.30 implies that an electricity price increase (decrease) of 1% leads to an employment decrease (increase) of 0.30%. Our findings are in line with recent scientific findings for Germany.[18]

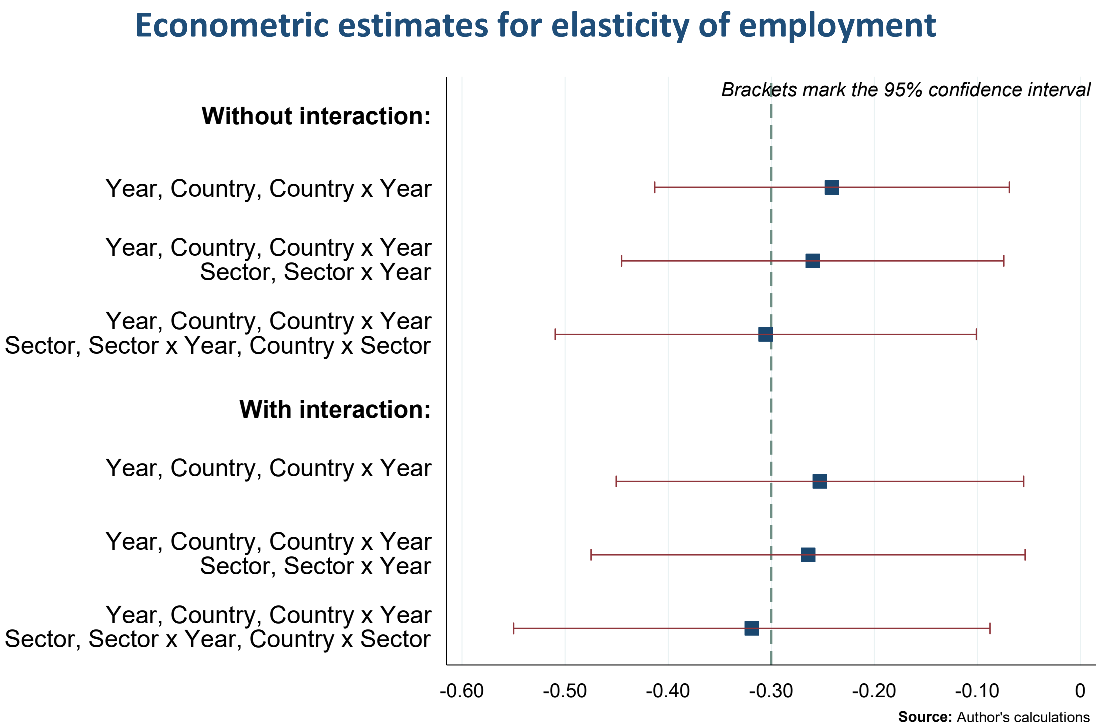

Figure 6: Econometric estimates for the elasticity of employment in function of electricity prices (coefficient α_1 of Equation 2). Estimates given for the model excluding and including the interaction term with electricity intensity as well as with different combinations of year, country and sector fixed effects. Detailed regression results in Appendix 1.

The estimates for the interaction term (coefficient α_2 of Equation 2) are statistically not different from 0. This means that, estimating this model on our dataset, we do not see a higher impact of the electricity price on employment in sectors with high electricity intensity than in sectors with a lower

[18] Cox et al. (2014) "Labour demand effects of rising electricity prices: Evidence for Germany" find unconditional demand elasticities for labour in function of electricity prices in between -0.06 and -0.69 depending on the skill levels of the involved labour.

intensity. This seems counterintuitive. The reason is that the electricity prices per sector in our dataset are correlated with the electricity intensity of the sector.[19] Highly intensive sectors have high consumption and hence lower prices. In the next section we therefore keep prices constant over sectors within a year within a country and find results in line with an overall elasticity of -0.30.

Impact of electricity prices on Investment

Figure 7 and Appendix 2 give the estimates for the elasticity of investment in function of the price of electricity (coefficient α_4 of Equation 3). We find a statistically significant negative elasticity when the broadest set of possible fixed effects is introduced. This again makes the results very robust around -0.55. Due to the specification of the model in Equation 3 and the fact the absolute level of investment is volatile and highly country and sector specific, the estimates using less fixed effects are less explanatory. The estimates for the interaction (coefficient α_4 of Equation 3) are again statistically not different from 0. In the next section we also perform robustness checks on these results and this does not change the overall conclusion.

The negative value of the elasticity again means that changes of the electricity price and investment go in opposite directions. In other words, an elasticity of -0.55 implies that an electricity price increase (decrease) of 1% leads to an investment decrease (increase) of 0.55%.

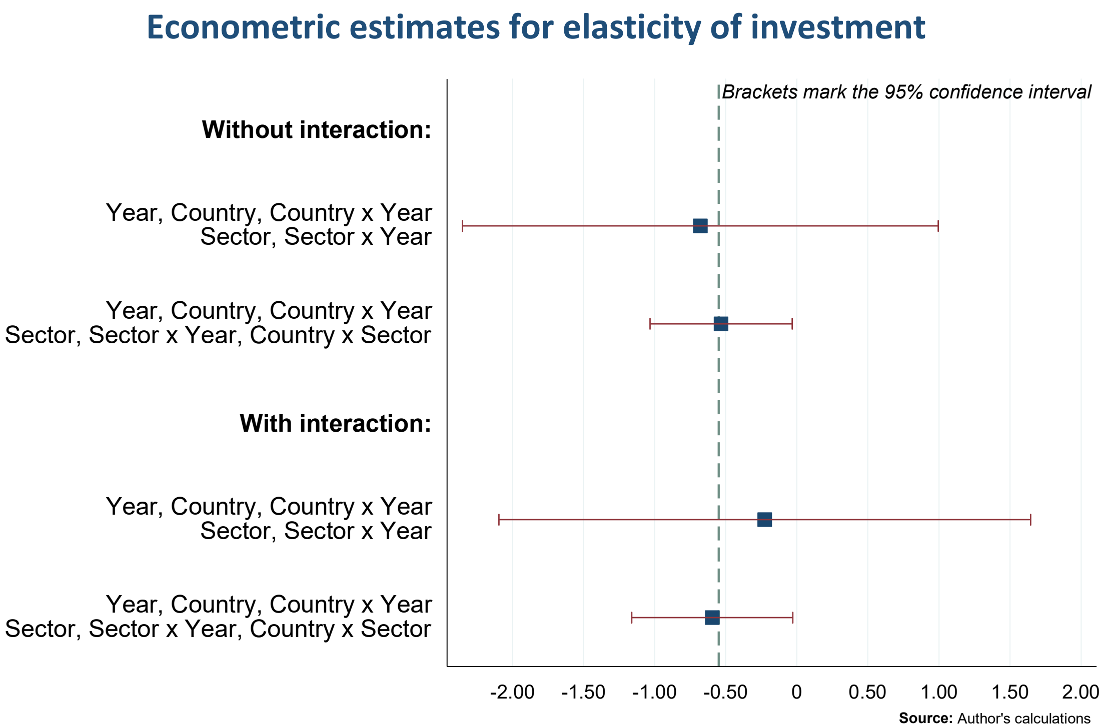

Figure 7: Econometric estimates for the elasticity of investment in function of electricity prices (coefficient α_4 of Equation 3). Estimates given for the model excluding and including the interaction term with electricity intensity as well as with different combinations of year, country and sector fixed effects. Detailed regression results in Appendix 2.

[19] We find a correlation of -0.4. The price per sector is based on a consumption weighted average over the prices for different consumptions bands. Sectors with high electricity intensity have relatively more heavy electricity users and since the price decreases with increased consumption, the weighted average price for these sectors is relatively lower.

V. ECONOMIC INTERPRETATION OF THE RESULTS

According to Deloitte's benchmarking study on electricity prices, the electricity price in Belgium for industrial users is 10.5% to 34% higher than in its neighbouring countries.[20] We take a conservative stance and calculate what a price drop of 10% of Belgian electricity prices would mean, holding all other variables equal.

Impact of a 10% electricity price drop

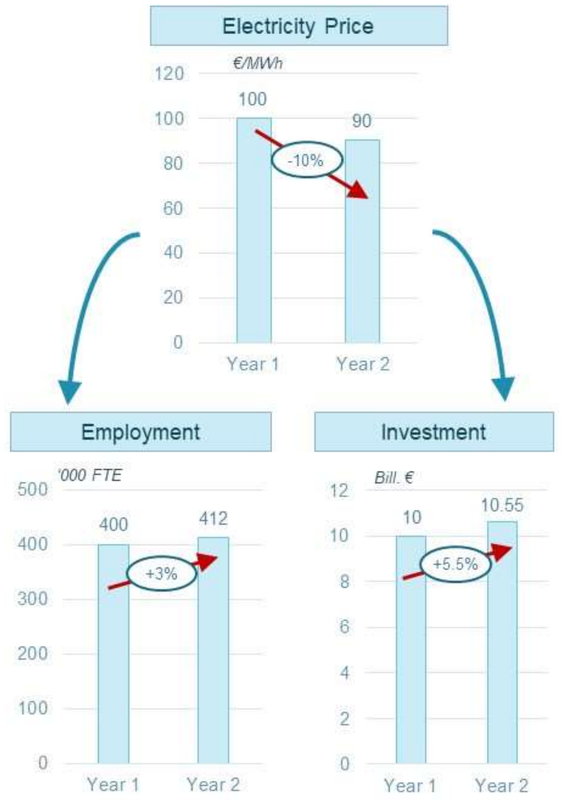

Figure 8: Impact of a 10% electricity price drop (holding all other things equal) on Belgian employment and investment in the manufacturing industry (NACE 10-33).

According to Eurostat current employment and investment in the Belgian manufacturing industry is respectively around 400,000 FTE and €10 Billion p.a.

Using the elasticities we have calculated (-0.30 for employment and -0.55 for investment), we estimate a price drop of 10% of the electricity price would lead to an increase of 12,000 full-time jobs (3% of 400,000) and an increase of €550 Million in yearly investment (5.5% of €10B).

This is likely to be an underestimation of the impact. The increase in employment and investment are purely within 2-digit NACE industry and exclude possible direct spillovers to other manufacturing industries (e.g., an increase in automotive activity will lead to an increase steel and battery production activity) and direct spillovers to services industries (e.g., an increase in manufacturing activity leads to a higher demand for business services). Furthermore, well paid manufacturing jobs indirectly also create a higher demand for local non-tradable services in the immediate vicinity.[21] As more people are employed in manufacturing this leads to an increase in demand for services like restaurants and haircuts leading to more people employed in these sectors.

Furthermore, the estimated elasticities are averages across all manufacturing sectors across Europe. As sectors with a high electricity intensity are overrepresented in Belgium, the Belgian elasticity is expected to be higher (more negative).[22]

[20] http://www.febeliec.be/data/1520414276Persbericht%20Elektriciteitsprijzen_ENG_20180307.pdf

[21] Moretti (2010) "Local multipliers" estimates that 1 manufacturing job in a given city, creates 1.6 jobs in non-tradable sectors in the same city. Goos, Konings & Vandeweyer (2015) "Employment growth in Europe: The roles of innovation, local job multipliers and institutions" even estimate this effect to be as large as 5 for high tech jobs.

[22] In the next section we will show elasticities are higher (more negative) for sectors with a high electricity intensity.

VI. ROBUSTNESS CHECKS AND SECTOR SPECIFIC ELASTICITIES

Impact on employment

To test the accurateness of our estimates we now also test the model using the base loglinear specification without first differences:

$$emp_{cst} = \alpha_7 price_{ct} + \alpha_8 price_{ct} * EI_{cs} + \alpha_9 EI_{cs} + \sum_i \beta_{emp,i} FE_i + \epsilon_{emp,cst} \quad (4)$$

We want to avoid correlation between the electricity price and the electricity intensity and hence keep the electricity price constant across sectors within a country. We replace the yearly electricity price with the average of the Eurostat prices for the different consumption bands in a given year.

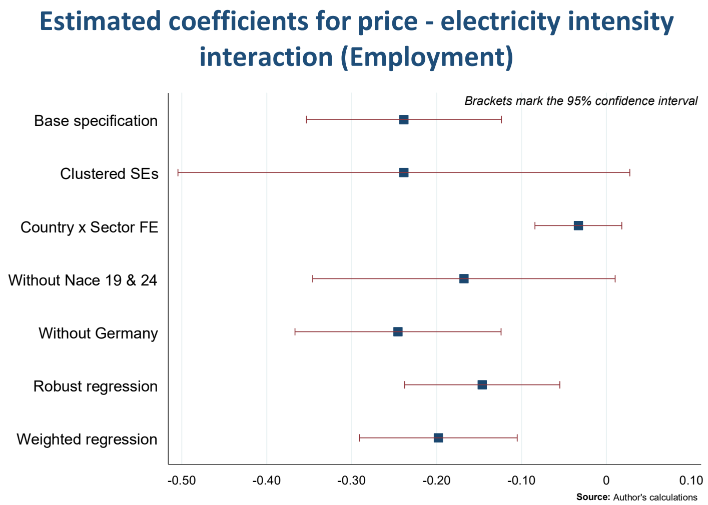

Figure 9: Estimated coefficients for the interaction term with electricity intensity (coefficient α_8 of Equation 4) based on different specifications of the model for employment. Detailed regression results in Appendix 3.

We first introduce country, year, sector, country x year and sector x year fixed effects (base specification) and cluster the standard errors on the country, sector level (clustered SEs). Next we also introduce country x sector fixed effects. To test the impact of outliers on the model, we leave out the 2 most electricity intensity sectors (without Nace 19 & 24) as well as Germany (without Germany) as it has a high price difference between low and high consumption profiles. We also perform a robust regression that puts less weight on outlier observations. Finally we also perform a regression where the sectors are weighted by the square root of the number of FTEs (weighted regression). Detailed regression results can be found in Appendix 3.

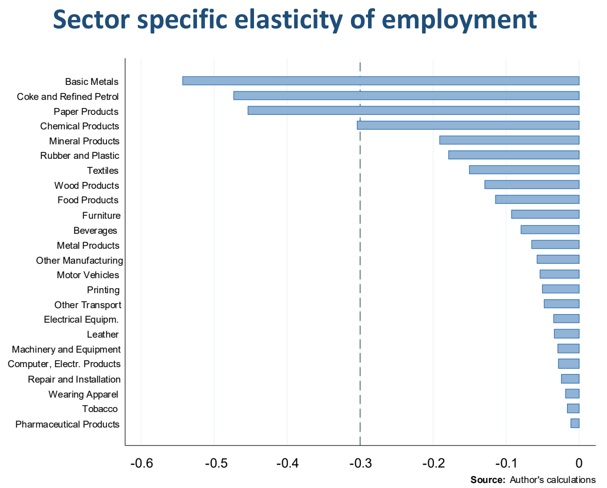

Figure 10: Electricity intensity specific elasticities of employment based on a coefficient of -0.2 for the interaction term (coefficient α_8 of Equation 4). Electricity intensity per sector calculated as average across studied countries. The line at -0.3 marks the estimate from the base specification.

Only the estimate with country x sector fixed effects is not significantly different from 0 as there is too little variation left when electricity prices are averaged out. The estimates using the clustered regression and the regression leaving out the most electricity intensive sectors are negative and different from 0 with a 90%

confidence margin. The other estimates are negative and different from zero with a 99% confidence margin. This implies a higher electricity price has indeed a negative effect on employment.

The estimates for the coefficient of the interaction term with electricity intensity (coefficient α_8 of Equation 4) are given in Figure 9 and Appendix 3.[23] The estimates lie around -0.2. This result, however, cannot be interpreted yet as an elasticity as it still needs to be multiplied with the electricity intensity of the sector. Figure 10 shows the elasticities for each manufacturing sector based on an estimated coefficient for the interaction term with electricity intensity (coefficient α_8 of Equation 4) of -0.2. We clearly see that these results are in line with the average elasticity across sectors we estimated at -0.3 in the previous section. For the most electricity intensive sectors to elasticity can go to -0.5 implying a price drop of -10% in the electricity price would lead to increase of jobs with +5%.

[23] Note that the coefficient for *price* (α_7) is not estimated as it is absorbed by the country x year fixed effect.

Impact on investment

We also test the robustness of our findings with respect to investment using a similar model as for the previous employment robustness check. We again keep the electricity price constant per country per year:

$$invest_{cst} = \alpha_{10} price_{ct} + \alpha_{11} price_{ct} * EI_{cs} + \alpha_{12} EI_{cs} + \sum_i \beta_{inv,i} FE_i + \epsilon_{inv,cst} \qquad (5)$$

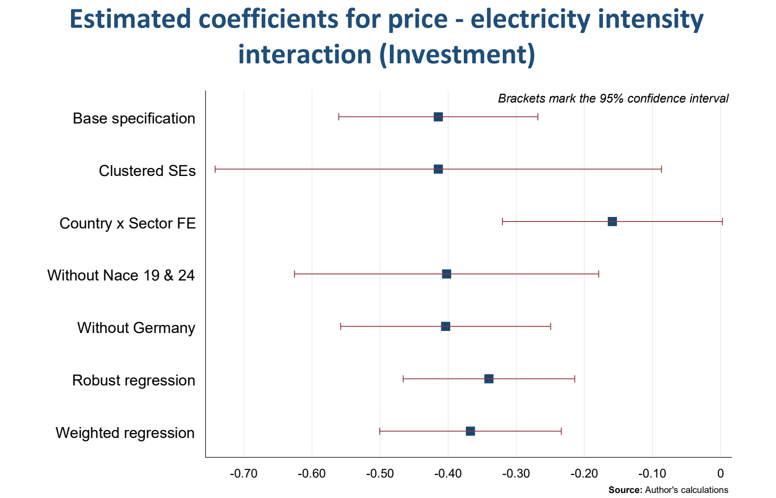

Figure 11: Estimated coefficients for the interaction term with electricity intensity (coefficient α_{11} of Equation 5) based on different specifications of the model for investment. Detailed regression results in Appendix 4.

The results are shown in Figure 11 and details given in Appendix 4. with the exception of the model with country x sector fixed effects, all estimates are negative and different from 0 with at confidence margin of 95%-99%. The estimate of the model with the country x sector fixed effects remains negative with a 90% confidence margin. We can hence safely conclude that the coefficient is negative. A higher electricity price has a negative effect on investment.

Similar to employment, the estimated result cannot be interpreted yet as an elasticity. As the results given in Figure 11 lie around -0.40 we estimate the sector specific elasticity based on this value. Figure 12 shows the result. For the highest electricity intensive sectors, the elasticity of investment with respect to the price of electricity lies around -1. This means a price drop of -10% of the electricity price will trigger, all other things equal, an increase in investment of 10% in these sectors.

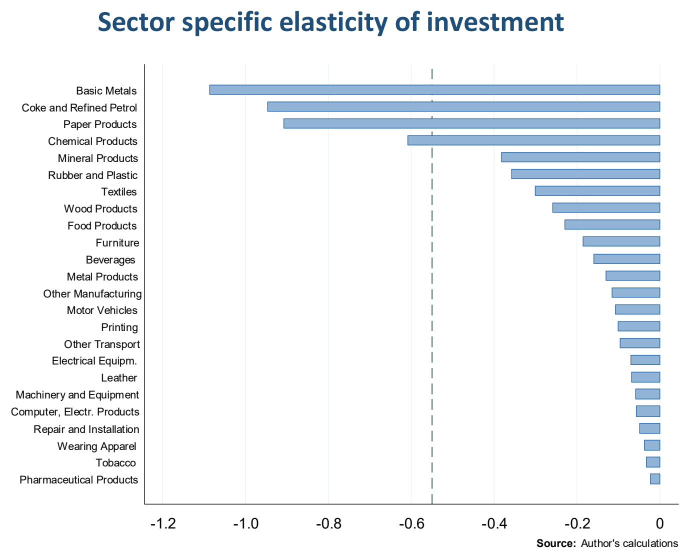

Figure 12: Electricity intensity specific elasticities of employment based on a coefficient of -0.4 for the interaction term (coefficient α_{11} of Equation 5). Electricity intensity per sector calculated as average across studied countries. The line at -0.55 marks the estimate from the base specification.

VII. CONCLUSION

We have combined information from multiple sources and created a dataset for 10 countries for the period of 2008-2015 with manufacturing sector level electricity prices, employment and investment. Using state-of-the-art econometric tools, we calculate the so called elasticity of employment and investment with respect to the price electricity. This is the % change in employment and investment in function of a % if the electricity price.

We find an overall elasticity of employment of approx. -0.30. Taking the electricity intensity of the sector into account, we estimate values from close to zero (for the lowest electricity intensity sectors) to -0.55 (for the highest electricity intensity sectors).

For investment we find an overall elasticity of employment of approx. -0.55. Again taking the electricity intensity of sector into account, we estimate values from close to zero (for the lowest electricity intensity sectors) to over -1 (for the highest electricity intensity sectors).

Elasticities of -0.30 (employment) and -0.55 (investment) mean that an electricity price drop of -1% leads, holding all other things equal, to an increase in employment of 0.30% and an increase in investment of 0.55%.

We bring these estimated elasticities to the Belgian reality. Deloitte Belgium shows that Belgian electricity prices are at least 10% higher than prices in our neighbouring countries. When prices in Belgium are brought in line with the neighbouring countries, this could hence lead to an increase of 12,000 full-time jobs and an increase of €550 Million in yearly investment. A price drop higher than 10% would lead to a similar increase in employment and investment gains.

These figures are likely to be an underestimation. The 10% price difference is at the lower side of the price difference calculated by Deloitte. In addition, our estimation method does not take into account direct spillovers to other narrowly defined sectors either within manufacturing or services. Nor does it include indirect spillovers coming from an increased demand for non-tradeable services in the immediate vicinity driven by extra manufacturing workers. Furthermore, Belgium has historically specialised in the most electricity intensive industrial sectors meaning that the Belgian elasticities are higher than the pan-European ones.

APPENDIX: DETAILED REGRESSION RESULTS

Appendix 1 – Regression results: Impact of Electricity Prices on Employment (Eq. 2)

	(1) Δemp	(2) Δemp	(3) Δemp	(4) Δemp	(5) Δemp	(6) Δemp	(7) Δemp	(8) Δemp
$\Delta price$	0.00313	-0.241**	-0.260**	-0.305**	0.0113	-0.253*	-0.264*	-0.319**
	(0.0319)	(0.0877)	(0.0945)	(0.104)	(0.0410)	(0.101)	(0.107)	(0.118)
$\Delta price$ * Elec. Intensity					-0.00905	0.00220	0.00283	0.00770
					(0.0290)	(0.0284)	(0.0284)	(0.0313)
Electricity Intensity					0.000134	-0.00113	-0.00432	N/A
					(0.00264)	(0.00250)	(0.00479)	
Year FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country X Year FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Sector FE	No	No	Yes	Yes	No	No	Yes	Yes
Sector X Year FE	No	No	Yes	Yes	No	No	Yes	Yes
Country X Sector FE	No	No	No	Yes	No	No	No	Yes
Observations	1554	1554	1554	1554	1554	1554	1554	1554
R^2	0.000	0.197	0.369	0.458	0.000	0.197	0.370	0.458

[1] Standard errors in parentheses
[2] Statistical significance levels: + p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001
[3] Observations based on 24 Manufacturing NACE Rev. 2 (2008) 2-digit sectors (10-33) for 10 countries (Austria, Belgium, Denmark, Germany, France, Italy, Netherlands, Spain, Sweden, UK) for the period 2008-2015
[4] $\Delta emp = \ln(Emp_t) - \ln(Emp_{t-1})$
[5] $\Delta price = \ln(Price_t) - \ln(Price_{t-1})$
[6] Electricity Intensity based on average electricity consumption divided by average added value 2008-2015

Appendix 2 – Regression results: Impact of Electricity Prices on Investment (Eq. 3)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$invest$	$invest$	$invest$	$invest$	$invest$	$invest$	$invest$	$invest$
$\Delta price$	2.806***	-8.769***	-0.678	-0.533*	3.883***	-7.253***	-0.226	-0.595*
	(0.583)	(1.402)	(0.853)	(0.255)	(0.730)	(1.586)	(0.953)	(0.289)
$\Delta price$ * Elec. Intensity					-0.790	0.796^{+}	-0.234	0.0344
					(0.525)	(0.453)	(0.254)	(0.0757)
Electricity Intensity					0.401***	0.306***	0.186***	N/A
					(0.0465)	(0.0395)	(0.0428)	
Year FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country X Year FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Sector FE	No	No	Yes	Yes	No	No	Yes	Yes
Sector X Year FE	No	No	Yes	Yes	No	No	Yes	Yes
Country X Sector FE	No	No	No	Yes	No	No	No	Yes
Observations	1339	1339	1339	1339	1339	1339	1339	1339
R^2	0.017	0.388	0.847	0.990	0.070	0.418	0.850	0.990

[1] Standard errors in parentheses

[2] Statistical significance levels: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[3] Observations based on 24 Manufacturing NACE Rev. 2 (2008) 2-digit sectors (10-33) for 10 countries (Austria, Belgium, Denmark, Germany, France, Italy, Netherlands, Spain, Sweden, UK) for the period 2008-2015

[4] $invest = \ln(Invest_t + Invest_{t-1})$

[5] $\Delta price = \ln(Price_{t-1}) - \ln(Price_{t-2})$

[6] Electricity Intensity based on average electricity consumption divided by average added value 2008-2015

Appendix 3 – Regression results: Robustness checks elasticity of employment (Eq. 4)

	(1) *Base Regression*	(2) *Clustered SE*	(3) *Country x Sector*	(4) *Without NACE 19/24*	(5) *Without Germany*	(6) *Weighted Regression*	(7) *Robust Regression*
$price$	N/A	N/A	N/A	N/A	N/A	N/A	N/A
$price$ * Elec. Intensity	-0.238**	-0.238+	-0.0330	-0.168+	-0.245**	-0.198**	-0.146**
	(0.0585)	(0.135)	(0.0261)	(0.0908)	(0.0619)	(0.0473)	(0.0466)
Electricity Intensity	-0.522**	-0.522	N/A	-0.251	-0.537**	-0.447**	-0.280*
	(0.157)	(0.360)		(0.258)	(0.165)	(0.127)	(0.125)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country X Sector FE	No	No	Yes	No	No	No	No
Observations	1806	1806	1806	1675	1614	1806	1806
R^2	0.894	0.894	0.998	0.894	0.876	0.907	0.931

[1] Standard errors in parentheses
[2] Statistical significance levels: + p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001
[3] Observations based on 24 Manufacturing NACE Rev. 2 (2008) 2-digit sectors (10-33) for 10 countries (Austria, Belgium, Denmark, Germany, France, Italy, Netherlands, Spain, Sweden, UK) for the period 2008-2015
[4] Dependent variable $emp = \ln(Emp_t)$
[5] $price = \ln(Price_t)$
[6] Electricity Intensity based on average electricity consumption divided by average added value 2008-2015

Appendix 4 – Regression results: Robustness checks elasticity of investment (Eq. 5)

	(1) *Base Regression*	(2) *Clustered SE*	(3) *Country x Sector*	(4) *Without NACE 19/24*	(5) *Without Germany*	(6) *Weighted Regression*	(7) *Robust Regression*
$price$	N/A	N/A	N/A	N/A	N/A	N/A	N/A
$price$ * Elec. Intensity	-0.414** (0.0745)	-0.414* (0.166)	-0.159+ (0.0823)	-0.402** (0.114)	-0.404** (0.0786)	-0.367** (0.0680)	-0.340** (0.0642)
Electricity Intensity	-0.891** (0.199)	-0.891* (0.435)	N/A	-0.744* (0.324)	-0.866** (0.210)	-0.804** (0.181)	-0.653** (0.171)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country X Sector FE	No	No	Yes	No	No	No	No
Observations	1775	1775	1775	1642	1583	1775	1775
R^2	0.848	0.848	0.980	0.853	0.830	0.855	0.880

[1] Standard errors in parentheses
[2] Statistical significance levels: $^+$ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001
[3] Observations based on 24 Manufacturing NACE Rev. 2 (2008) 2-digit sectors (10-33) for 10 countries (Austria, Belgium, Denmark, Germany, France, Italy, Netherlands, Spain, Sweden, UK) for the period 2008-2015
[4] Dependent variable $invest = \ln(Invest_t)$
[5] $price = \ln(Price_t)$
[6] Electricity Intensity based on average electricity consumption divided by average added value 2008-2015

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