ENERGY PRICES AND THEIR IMPACT ON THE COMPETITIVENESS OF THE EU STEEL INDUSTRY

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Abstract

An essential part of the EU's growth strategy is support to its own international competitiveness. The reason is that the domestic industry is losing its former positions and is being pushed out of both domestic and international markets. Developments on the international steel market over the last year confirm that the market is likely to see significant changes as a result of protective measures. Most of them will jeopardise the international competitiveness of the European steel industry with negative impacts on its overall economic growth. The aim of this paper is to analyse the influence of energy prices and, based on an international comparison of production conditions, identify the comparative advantages of the EU in this segment. For this purpose, use will be made of the RCA indicator and other research methods. The authors formulate some statements concerning the future development of this sector and the conditions which need to be satisfied to boost its competitiveness.

Keywords: competitiveness, energy security, european steel industry, international trade
JEL Classification: F01, F40, E62

1. Introduction

The growing turbulences in the development of the world economy have been inducing increasingly higher international tension, fear and uncertainty in recent years. This has had a major impact not only on decisions regarding new investments, their territorial dislocation and attenuation projects, but also on significant macroeconomic decisions about the strategic orientation of countries or their clusters. As regards the world commodity market, its development has become increasingly more subject to the consequences of adaptation measures of the largest producers of raw materials and materials, as well as the pressure from new exporters from less developed countries. This has been reflected in the high volatility of demand and realisation prices. Similar turbulences have also been seen on the international market for steel and steel products, where the developed economies, especially the US, Japan and the EU, had long been the most important players. In 2000, they covered half of the world demand in aggregate. Chinese high production did not even cover domestic demand and the country was, therefore, dependent on its imports. However,

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This paper presents the results of the project VEGA. No. 1/0897/17: The Importance of the European Energy Union Project for its Strategic Interests in the Context of the Enhancement of Competitiveness of SR.

the situation has been changing dramatically. By 2016, the world's steel production volume had almost doubled in comparison to 2000, and the Chinese share in it increased from 12% to almost 50% (Table 1). In the meantime, the US and EU production fell by 23% and 14%, respectively, due to the pressure of cheap imports.

Table 1 | World Steel Production (millions of tonnes)

	2000	2005	2008	2010	2012	2014	2015	2016	2016 vs. 2000 (%)
EU	193	196	199	173	169	169	166	162	–16
China	129	356	512	639	731	823	804	808	529
Japan	106	112	119	110	107	111	105	105	–1
USA	102	95	92	80	89	88	79	79	–22
Russia	59	66	69	67	70	71	71	70	18
Brazil	28	32	34	33	35	34	33	31	11
India	27	46	58	69	77	87	89	95	253
Other	205	246	262	263	283	286	273	277	35
Total	849	1,148	1,343	1,433	1,560	1,670	1,620	1,627	92

Source: Authors' calculation based on the World Steel Association (WSA), 2017.

Chinese steel exports have been growing steadily with the expansion of the production base. While the export volume in 2005 reached 27 million tonnes (13% of the world's exports) and was mainly focused on the neighbouring countries, in 2016 it was as much as 108 million tonnes (36% of the world's exports) and its main destinations were the US and the EU. The simultaneous decline in EU production was affected by gradual decrease in its consumption *per capita* due to an increase in the standard of living and changes in both production and own consumption, as well as due to changes in the overall structure of goods in unitary trade with third countries. These paid for a major part of their imports by exports of steel goods (Russia, Ukraine and India). As the GDP growth of this group, especially as regards its generation in the primary sector, was not accompanied by an adequate increase in labour productivity, it naturally brought about an increase in the total production costs, which, in turn, resulted in a decline in the international competitiveness of the whole sector.

Developments on the international market started to change dramatically after 2015. The slowdown in the growth of the Chinese economy and the decline in domestic demand for steel redirected its overproduction to exports. In 2016, its imports into the EU reached almost 40 million tonnes and they were expected to rise by another 13 million tonnes by 2017 (WSA). Even more dramatic changes were registered in imports of Chinese steel into the US. Its imports gradually escalated and broke through mainly owing to its substantially lower prices than those offered by domestic or Canadian and Mexican producers, as well as owing to a more diversified range of cheap semi-finished products made of it. The gradual loss of competitiveness of US and European steelmakers was part of the global process of rapidly deepening bilateral trade deficits between China and the US (annually about USD 350–400 bn) and the EU (USD 130–150 bn). Although the share of the steel segment in this negative balance was not high (around 6–9%), the US and the EU opted to increase the protection of their domestic markets as early as 2016. In several waves, they introduced coordinated anti-dumping measures against imports of selected kinds of steel. The reason was the unlawful application of state aid by the Chinese government and a number of other indirect forms of support to its production. With the advent of the new US administration, these protective measures assumed a new dimension. In 2017, customs duties were extended to other steel products (stainless steel, *etc*.), and in 2018, the US decided to increase the flat-rate duty by 25% for all imports of steel into the US, regardless of the country of origin of its producers. Canada and Mexico have been temporarily exempted. Paradoxically, 50% of the imported steel comes to the US from just these countries, Brazil and South Korea. The discussed relations raise the need to examine the extent to which steel production in the EU is and will be competitive, what main cost bases it relies on, and what potential risks the development in this sector may bring in the future. The comparative advantages of production included lower (subsidised) energy prices, as well as reliability and security of supplies, especially of electricity and natural gas, for a rather long time. Therefore, the main aim of this paper is to examine these relations in more detail, compare and quantify the extent to which the European steel industry is actually competitive on a global basis, and to formulate certain conclusions regarding the future of the sector.

2. Literature Review

The EU's success on the world export markets generally depends on effective use of its own comparative advantages and expansion of markets, which has brought about additional effects resulting from economies of scale. Its strategic scenario has always been based on growing competitiveness, although it should be said that the strategies were gradually carried by other sectors or increasing intensity of use of individual factors of production. Therefore, considerable attention was paid to the assessment of its impact and relations to specific national economic sectors or enterprises. Porter (1990), Krugman (1994), Klváčová (2008), Garelli (2005), Roubini (2012) and Astrov, Hanzl-Weiss, Leitner *et al*. (2015) confirm that competitiveness is, and will also remain in the 21st century, a key element of the prosperity of every entity operating on the world markets. Although the presented theoretical opinions vary in argumentation, there is a consensus that competitiveness, whether at the macro- or microeconomic level, means for a business entity the ability to operate in the international environment successfully and in the long term, thus fulfilling the purpose of its economic existence. Secondary effects, such as higher employment and related internal consumption, a balanced national budget, positive development of the balance of payments current account or political stability in countries that are more competitive than others, are significant.

Consequently, the declining level of competitiveness was identified as the main reason for the deteriorating international position of the EU vis-à-vis its Transatlantic and Asian competitors (Baláž, Hamara, Sopková, 2015). The energy sector has therefore been at the centre of its attention since the very beginning of its integration process. It began with the formation of the European Coal and Steel Community (ECSC), thanks to which a common market was successfully established for primary energy sources, neutralising the struggle between individual countries for natural resources. However, despite its stronger integration, the EU was not able to reach a consensus on its energy policy for a long time, which meant, in fact, the loss of one of its potential comparative advantages. On the other hand, this group is one of the few which, when assessing their competitiveness in terms of energy consumption, address not only the prices and conditions of energy supplies, but also environmental aspects, intensive use of renewable energy sources or the so-called grid systems. All components of the energy algorithm bring about an increase in the final costs of its production and, ultimately, given the fact that other countries have so far taken a limited approach to such projects, a decline in the competitiveness of EU production. This also applies to steel, research into which is the main subject of this paper. Its demands on consumption of energy inputs are enormous and its production has many other consequences that affect the overall results of each producer.

One of the first economists to think about the link between energy and economic growth was Georgescu, who said: “Economy confirms that the great strides in technological progress have generally been touched off by a discovery of how to use a new kind of accessible energy” (Roegen, 1976). According to him, the availability of energy carriers at affordable prices has become an important condition for long-term economic growth and a determinant of the success of individual industries on international markets. In the EU, energy prices are significantly affected by the environmental policy, which is, to a large extent, also associated with higher energy prices caused by ever more extensive use of renewable source of energy. Its impact on economic competitiveness and the resulting structural shifts in industry have been analysed in a number of significant studies. For instance, the “Pollution Haven Hypothesis” confirms that producers respond to high energy prices by reducing the production of energy-intensive industries, which may result in reduced exports or the relocation of production to countries with lower energy prices. Hanna (2010) and Aldy (2011) analysed the impact of the carbon tax on production and imports, finding that, for example, the US carbon tax at the amount of USD 15 per tonne had resulted in a 3 to 4% reduction in the production of energy-intensive industries and a 1% increase in imports, respectively.

Khattab (2007) calculated that a 100% increase in energy prices due to the cancellation of subsidies had led to a 13 to 39% decline in the profit margin of energy-intensive industries. Kozluk (2014) proved the short-term negative impact of environmental regulation on productivity, but no such impact was confirmed in the long term. Cole (2014), based on data from 12,335 enterprises, concluded that in countries with stringent environmental legislation, the likelihood of outsourcing production to countries with less stringent legislation is 28% higher. This adversely affects not only the international competitiveness of producers but also the economy of the affected country.[1] Dechezleprêtre (2017) pointed out that increased costs related to environmental regulation, including carbon tax, did not have a negative impact on the competitiveness of industries or whole countries. A short-term negative impact was experienced by energy-intensive industries, including the steel industry. On the basis of data from five segments of the manufacturing industry in 1996–2007, Constantini (2012) proved that energy taxes and subsidies had a neutral or positive impact especially on the exports of high added-value products. In their assessments of the development of employment, production volume, exports and economic performance, Arlinghaus (2015), Flues (2015), Zhang (2004), Gerster (2017) and Wagner (2014) tried to prove that energy prices do not significantly affect competitiveness of enterprises. Other factors determining competitiveness were highlighted by Central European experts in economy, such as Taušer (2015), Fojtíková (2016), Melecký (2013) and others.

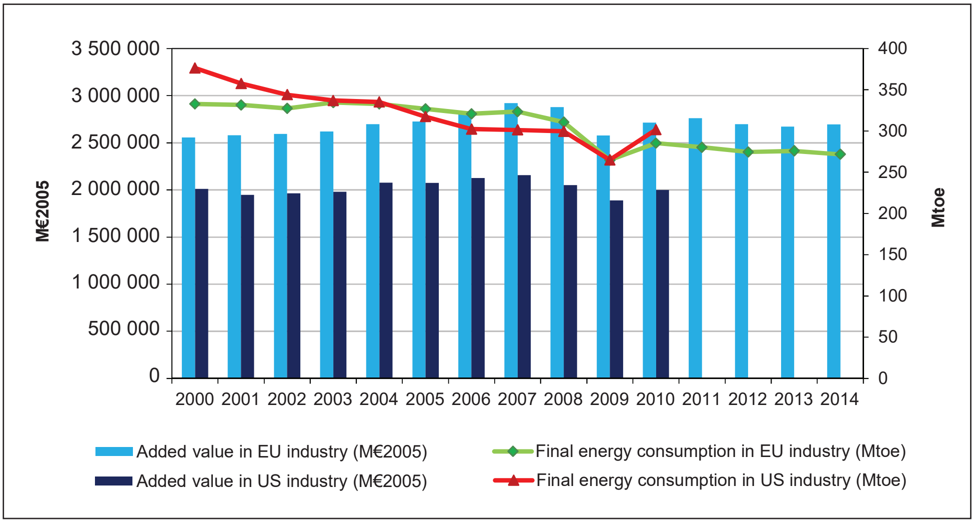
3. Problem Formulation and Data

In order for the EU economy to be competitive in the future, it is crucial that it is able to successfully absorb the constantly rising prices of all production inputs and eliminate them by using its own comparative advantages or providing direct support and full-scale deployment of high technologies and progressive services. Such fundamental changes call for a consistent strategic alternative that will enable making substantial structural changes within the EU, supported by extensive interventions across all respective areas of the European macro- and micro-economy. However, the possible implementation of such a historical project would require not only a political consensus on adoption of strategic decisions, but also convergence of hitherto autonomous national systems in the sectors of energy, transport, tax systems, *etc*. To retain its competitiveness, the steel industry must actively respond to many challenges emerging from the world markets. These relate not only to monopolisation of commodity markets and the resulting impact on the prices of raw materials, decreasing prices of individual products, the long-term increase in energy prices or ensuring secure access to its resources, but also the implementation of large-scale innovation programmes.

The EU's steel industry, which has so far been represented mainly by production of semi-finished products of a lower and middle innovation class, could thrive mainly thanks to the existing production experience resulting in high-quality production, a whole range of different forms of state support, and secured sales within that community. For two decades, a number of Europe-wide projects to reduce energy intensity have supported decreasing unit costs in steel production by shifting to less energy-intensive methods of production, higher specialisation or by attenuating those methods of production where such measures were not sufficiently effective. The use of more significant innovations was sporadic.

1 Aichele (2012) clarified that countries which had signed the Kyoto Protocol experienced an export decline of up to 13–14%.

Figure 1 | Energy Consumption and Added Value of EU and US Industries



Source: Authors' calculations based on the Odyssee database.

Table 2 | Energy Intensity in EU and US Industries

	2000	2010	2015	2010 vs. 2000 (%)	2015 vs. 2000 (%)
Energy intensity of EU industry (koe/€2005)	0.130	0.105	0.096	80	76
Energy intensity of US industry (koe/€2005)	0.187	0.151	–	81	–
Energy intensity of EU industry vs. US industry (koe/€2005) (%)	70	69	–	–	–
Energy intensity of EU manufacturing industry (koe/€2005)	0.2	0.156	0.135	78	68
Energy intensity of US manufacturing industry (koe/€2005)	0.306	0.205	–	67	–
Energy intensity of EU manufacturing industry vs. US manufacturing industry (koe/€2005) (%)	65	76	–	–	–

Note: US data available only until 2010.

Source: Authors' calculations based on the Odyssee database.

The above argumentation is supported by the results of a comparison of energy intensity in EU and US industries (Figure 1) based on data from the Odyssee database. They confirm that the EU has long been less energy-intensive than the US economy. Between

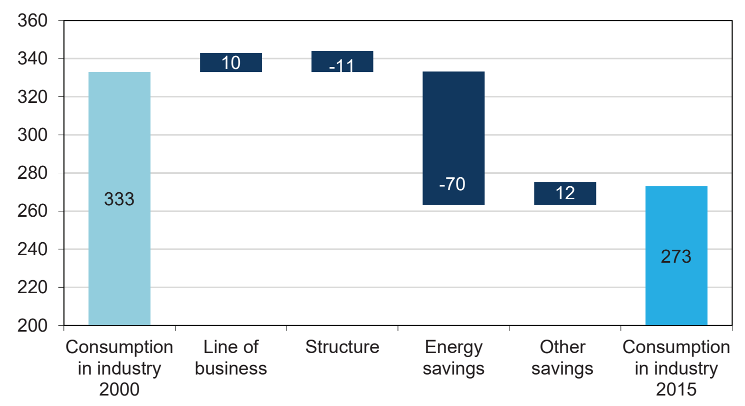
Prague Economic Papers, 2019, 28(5), 547–566, https://doi.org/10.18267/j.pep.715

2000 and 2010, EU industry averaged around 74% of the energy intensity of US industry.[2] The EU, compared to the US, for example, achieved higher output (measured by value added in constant prices) with comparable final energy consumption. European industry was able to increase its added value from 2,553,726 M€2005[3] in 2000 by roughly 6% to 2,711,625 M€2005 in 2010 (by 10.2% in 2015), with the final energy consumption being reduced in aggregate from 332.6 Mtoe in 2000 by 15% to 283.8 Mtoe in 2010, and by another 19% in 2014. In contrast, the US achieved added value in 2010 roughly at the level of 2000 (1,999,498 M€2005 in 2010, compared to 2,011,117 M€2005 in 2000), with the final consumption being reduced in aggregate from 376.3 Mtoe in 2000 by 20% to 301.6 Mtoe (2010). In both the EU and the US, the industry was able to significantly reduce energy intensity between 2010 and 2000, the EU by 20% and the US by 19% (Table 2).

Change in final energy consumption can be induced by various effects[4]:

- production changes (change in value added reflecting the impact of economic growth),
- structural changes (individual industries with different energy intensity are growing at different rates),
- energy savings (changes in energy consumption p.u. of production in the given sector),
- other effects (mostly negative due to declining production efficiency).

Figure 2 | Development of energy consumption in EU industry (2000–2015, Mtoe)



Source: Authors' calculations based on the Odyssee database.

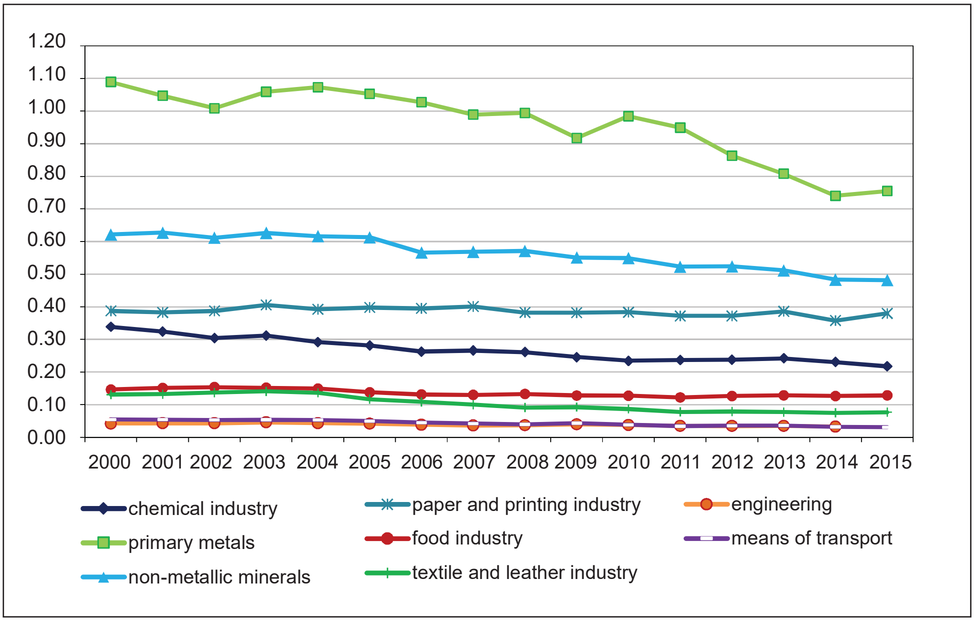
2 The ratio of final energy consumption (Mtoe) to value added (M€2005).

3 Millions of EUR in 2005 constant prices.

4 According to the Energdata 2017 methodology.

The reduction of energy consumption in EU industry from 2000 to 2015 (−60 Mtoe) was only down to energy savings per unit of production (Figure 2). The EU manufacturing industry, the steel industry (primary metals), the glassmaking industry (non-metallic minerals) and the chemical industry ranked among the largest energy consumers per unit of value added.[5] High energy prices motivated all energy-intensive industries to reduce their energy intensity. The textile and leather industry and the production of means of transport reduced their energy intensity by over 40% (2000–2015). Other industries also managed to reduce their energy intensity, on average, by 23% during said period (Figure 3).

Figure 3 | Energy Intensity in the EU Manufacturing Industry (2000–2015)



Source: Authors' calculations based on the Odyssee database.

The energy intensity of individual industries depends to a large extent on the development of prices of energy carriers. The higher the input costs and the energy intensity of the industry, the greater the incentive for the industry to reduce costs by increasing energy efficiency. They are reduced mainly through investments (in technologies, *etc.*) for which their return is important, and therefore companies, when making decisions, consider expected development on the markets rather than current commodity prices. Compared to the US, for example, the EU's energy intensity in 2010 was lower in all the crucial energy-intensive industries. In the chemical, wood processing and paper industries the difference was almost 50%.

5 Although the chemical industry has the largest energy consumption, given its relatively high added value, its energy intensity per unit of value added ranks fourth.

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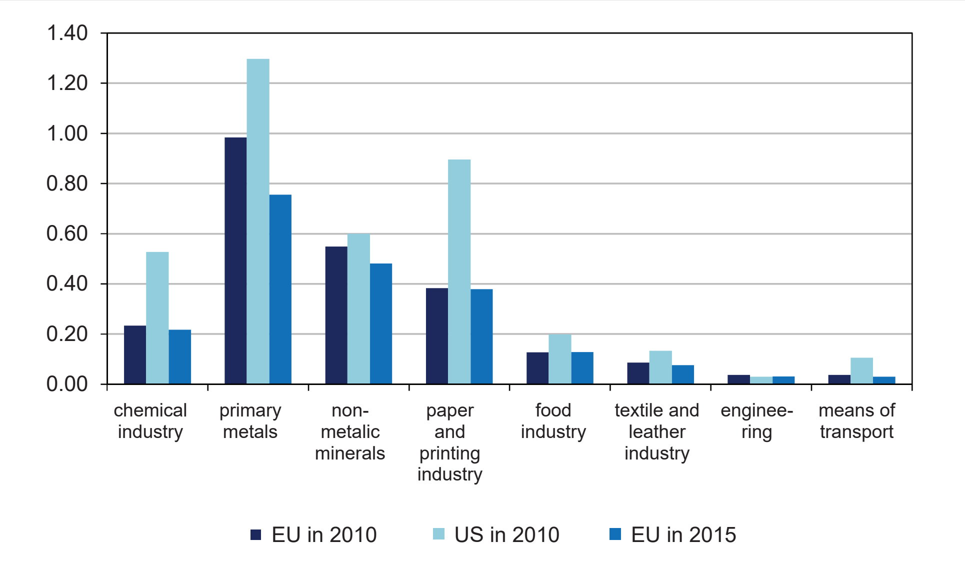
Figure 4 | Comparison of Energy Intensity in the EU and US Manufacturing Industries



Source: Authors' calculations based on the Odyssee database.

Industrial production has long been a crucial part of EU exports. Its share in the EU total export volume in 2016 was 68% (it decreased by 4% compared to 2005), with the largest share in this volume being, according to Eurostat (2017a), attributable to exports of machinery and means of transport (42%), other industrial products (23%) and chemical and steel industries (19% and 18%, respectively). The international competitiveness of an economy, among other factors, depends to a large extent on the costs of individual inputs; it needs to be noted that not only their absolute amount but also the amount achieved compared to other competitors is important. The available data (WSA) indicate the costs of EU industry, with Germany, France and Italy more than 20% higher than in the US, Mexico or China, and these costs have been on an upward trend over time. For example, between 2004 and 2014, they increased by 4% in Germany and by 10% in France and Italy compared to the US. The largest negative impact was imputable mainly to higher labour costs, but the costs of electricity and gas were several times higher than in the compared countries. As far as EU industry's energy costs are concerned, they represent a major competitive disadvantage, especially compared to the US. Both gas and electricity prices are well above the US price levels, with the assumption that this gap will continue increasing until 2040. They are expected to be even higher than in Japan and China. Energy costs accounted for about 4% of the gross output of the EU economy (US 4.6%, China 7.7%, Japan 5.1%). In the manufacturing industry the share is up to 7.5%, while it is 2.9% in the US, 5.9% in China and 5.4% in Japan (Astrov, Hanzl-Weiss, Leitner *et al.*, 2015). This shows that in most industries costs of labour, transport and services, are higher and, hence, more important than energy costs. These are important for the manufacturing industry, but only for certain segments. Among those with the highest energy consumption are the chemical industry and the steel industry (Table 3).

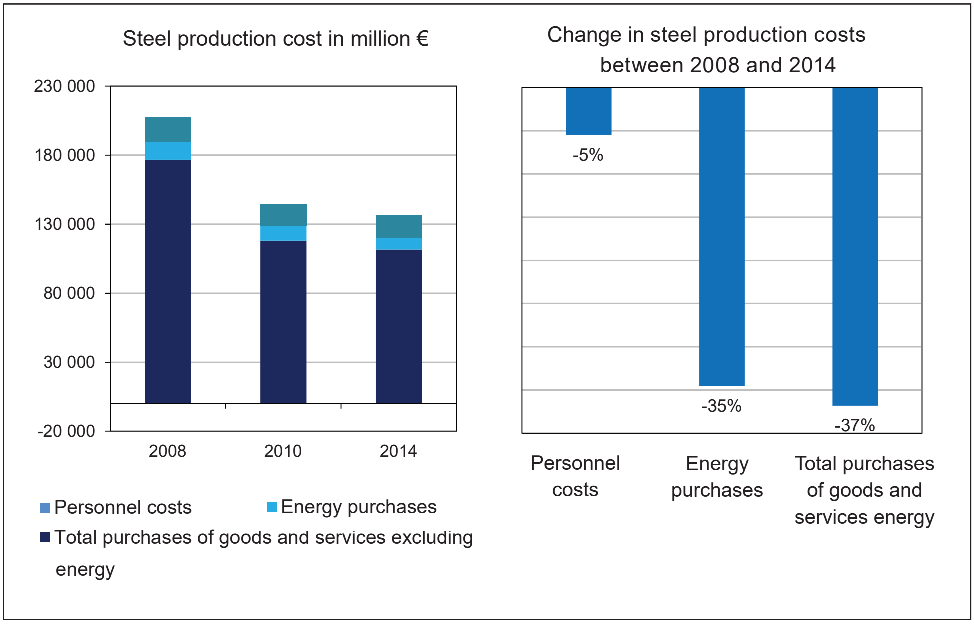
Table 3 | Share of EU's Manufacturing Industries in the Total Energy Consumption

Manufacturing industry		In 2015	
		Mtoe	Share in total energy consumption of EU industry (%)
Chemical industry	Mtoe	51.39	19
Steel industry	Mtoe	48.81	18
Non-metallic minerals	Mtoe	31.53	12
Wood processing industry	Mtoe	7.89	3
Paper, pulp and printing industry	Mtoe	33.27	12
Food industry	Mtoe	29.18	11
Textile and leather industry	Mtoe	4.47	2
Engineering	Mtoe	18.45	7
Transport means and equipment	Mtoe	8.07	3
Other industries	Mtoe	18.23	7

Note: Mtoe = Million tonnes of oil equivalent.
Source: Authors' calculations based on the Odyssee database.

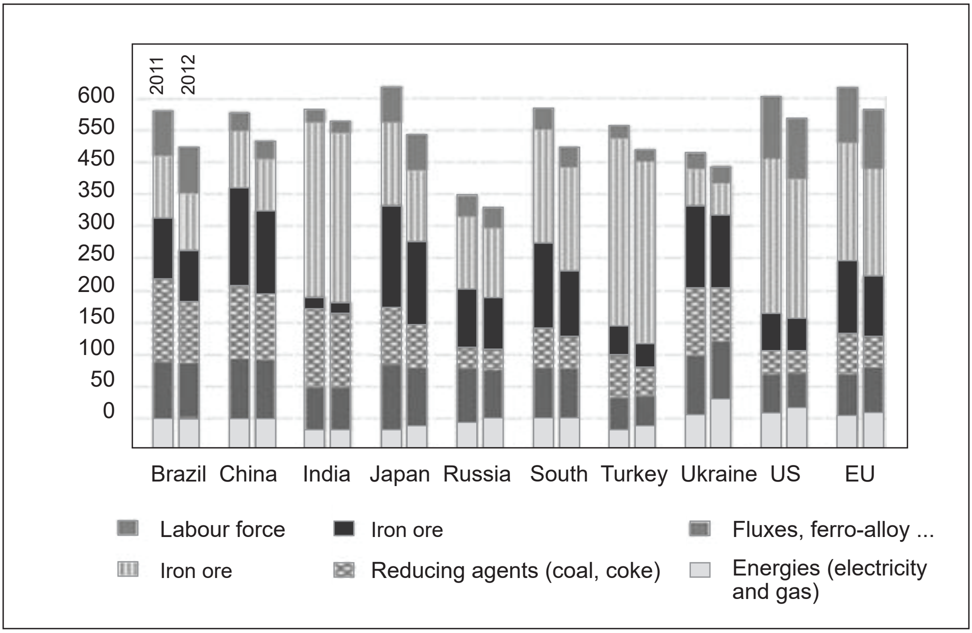
The share of the manufacturing industry in the total energy consumption is over 96%, *i.e.*, the manufacturing industry is the absolutely dominant energy consumer in the industrial sector. In the case of electricity, the difference between the EU and the US (represented by the State of Texas) or Canada (represented by the Quebec) or China is significantly greater. The US takes advantage of lower costs of acquisition of electricity, as well as significantly lower taxes or additional payments to support production from renewable energy sources (RES). Prices for German producers, despite the significant exemption of steel production from fees in support of RES to increase competitiveness, are significantly higher than in the US. With respect to rising electricity and gas prices, steel producers in the EU have had to take extensive measures to reduce energy intensity. Compared to 2008, it decreased by 26% in the primary metals sector. The total costs of energy purchases were reduced by 35% (Figure 5) despite an increase in the commodity prices, which were considerably affected by a decline in sales (−37%). The most significant items of steel production costs are scrap, iron ore and personnel costs, with energy costs accounting for only up to 10% of the total manufacturing costs (Figure 6).

Figure 5 | EU Steel Production Costs and Their Change Between 2008 and 2014



Source: Authors' calculations based on the Eurostat database, 2017a.

Figure 6 | Total Production Costs per Tonne of Steel (EUR/tonne of crude steel)



Source: Moya, 2016.

It is clear from Figure 6 that Russia had the lowest steel production costs; in addition to relatively low energy costs, it also has low costs of other inputs, in particular scrap and labour costs. On the other hand, the electricity prices in the EU were on an upward trend until 2012, reaching their maximum of 65.5 EUR/MWh, then falling and reaching 53 EUR/MWh in 2015. The natural gas prices were, given the lower consumption of natural gas and a smaller share of regulated costs in the end price, at the standard level. Table 4 shows that between 2008 and 2015, the profitability expressed by the EBITBA/turnover ratio dropped from 15.6% to only 5.3%.

Table 4 | Development of Prices and Basic Financial Indicators of Steel Producers in the EU

	2008	2010	2012	2013	2014	2015
Electricity prices (€/MWh)	57.65	60.21	65.53	61.18	55.59	53.03
Gas prices – median (€/MWh)	28.57	26.89	33.16	31.38	28.71	26.11
Production costs (€/t)	331.18	355.05	388.22	376.38	340.83	379.51
Turnover (€/t)	448.08	422.02	397.5	388.76	362.67	407.61
EBITDA (% of the turnover) (%)	15.6	7.0	3.1	4.6	5.8	5.3
Ratio of electricity costs to EBITDA (%)	44.2	419.2	187.3	236.6	107.9	233.1
Ratio of gas costs to EBITDA (%)	25.6	197.7	66.3	138.7	81.3	92.9
Ratio of regulated electricity component costs to EBITDA (%)	3.9	21.5	13.9	27.6	16.4	35.4
Ratio of regulated gas component costs to EBITDA (%)	0.6	2.4	3.2	9.8	6.2	6.8

Source: Author's own calculations from CEPS (2016).

Despite the lower importance of electricity prices in terms of total costs, these have a significant impact on producers' competitiveness, which is also expressed, for example, by the ratio of electricity costs to EBITDA, which in 2010, given the low profitability, reached the value of more than 419%, but in 2013 and 2015 the ratio was also high, exceeding 230%. The foregoing indicates that if electricity prices revert to the 2012 price level and can be fully reflected in steel end prices, steel producers' profitability would be jeopardised, many of them going into the red. Since the second half of 2017, these prices have begun to rise again and that risk has increased.

3.1 Analysis of changes in international steel trade

Trends in the development of steel exports and imports in USD (Tables 5 and 6, in current prices) were similar to those in the global world trade (in physical volume) but were more influenced by the volatile development of steel prices and, in particular, of the exchange rates. Between 2005 and 2015, both the EU exports and the Russian exports declined (−2% and −12.5%, respectively), with other countries registering an increase, notably the US (+38%), India (+56%) and China (+231%). Imports of steel increased in most countries, in the EU (+6%), the US (+28%), and especially in India (+134%) and Brazil (+199%). On the contrary, steel imports decreased in Japan (−4%) and China (−26%). A certain explanation of the fact that large steel exporters are also its major importers stems from the wide range of steel grades and products, with each country usually specialising in those where it is able to use its own comparative advantage or has a long-term tradition of producing them or direct links to customers.

Table 5 | World Steel Exports (mil. USD, current prices)

	2005	2010	2011	2012	2013	2014	2015
EU	29,662	39,324	48,286	45,383	39,917	39,758	29,131
China	19,278	39,565	55,462	53,873	54,726	72,291	63,804
Japan	27,506	41,974	46,568	43,784	38,865	37,377	30,307
US	11,504	17,225	20,343	20,852	19,923	19,985	15,913
Russia	18,538	23,578	25,912	25,819	21,030	24,174	16,213
Brazil	9,067	8,893	12,539	11,150	9,025	10,714	9,728
India	5,364	10,612	10,471	10,990	11,671	11,550	8,369
World	221,136	307,837	379,362	362,648	336,601	357,677	286,866

Source: Author's own calculations based on the WSA and Eurostat, 2017b.

Table 6 | World Steel Imports (mil. USD, current prices)

	2005	2010	2011	2012	2013	2014	2015
EU	27,179	33,021	44,926	32,160	31,183	33,393	28,713
China	26,341	25,054	27,165	22,826	21,443	22,473	19,530
Japan	7,228	8,701	11,862	10,119	8,195	9,342	6,975
US	30,480	30,935	40,942	44,922	39,230	49,374	39,151
Russia	3,676	7,291	10,053	8,719	8,434	7,348	4,253
Brazil	1,178	5,888	5,075	4,998	4,712	4,644	3,525
India	4,307	9,838	11,279	10,938	8,365	9,761	10,090
World	230,834	308,858	374,239	360,765	337,900	363,822	297,603

Source: Author's own calculations based on the WSA and Eurostat, 2017b.

To compare the international competitiveness of the EU manufacturing industry, the authors have used several comparative methods as well as the Revealed Comparative Advantage indicator – *RCA*. It compares the ratio of the export share of a country's manufacturing industry in the country's total exports, the share of total exports of the world manufacturing industry, and the total world exports. The world's largest manufacturing industry producers were selected from the monitored countries: EU, China, Japan, USA, Russia, Brazil and India. In general, if the value of this ratio is greater than 1, the country in question has a comparative advantage in the product:

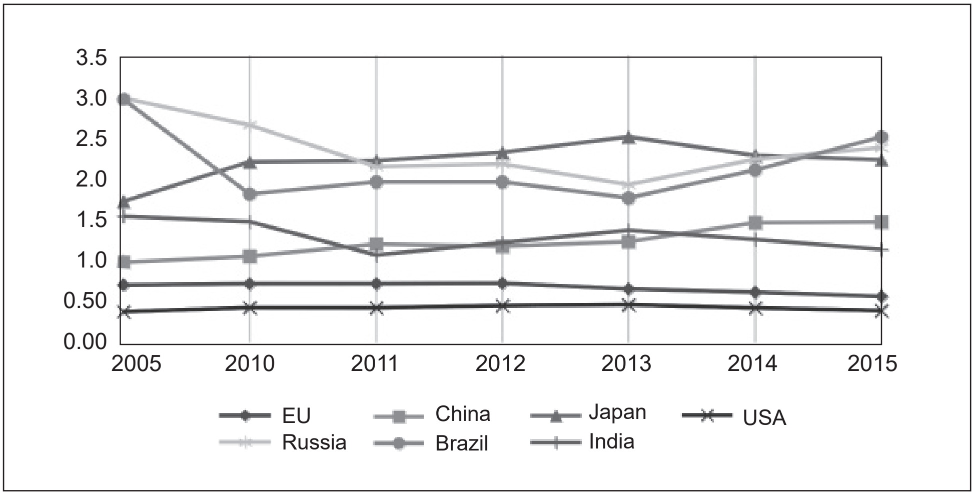
RCA calculation:

$$RCA_i = \left(X_{ij} / \sum X_j \right) / \left(X_{i\_world} / \sum X_{world} \right), \qquad (1)$$

where: RCA_i revealed comparative advantage of product *i*,
X_{ij} export of product *i* by country *j*,
$\sum X_j$ sum of exports by country *j*,
X_{i_world} world exports of product *i*,
$\sum X_{world}$ total world exports.

The development of world steel exports (Table 5) suggests they were on an upward trend after 2005 and increased by 30% until 2015. China, whose exports rose by 231% during this period and imports declined by 26% (Table 6), had the largest share in the growth of total exports. An increase in the importance of the BRICS countries is also manifested by India whose exports rose by 56% in the reporting period (imports rose by 134%). Other countries grew at a significantly lower pace, the US by 38%, Japan 10% with EU decreasing its export by 2%.

Figure 7 | RCA Indicator in Steel Production of Selected Countries/Clusters (2005–2015)



Source: Author's own calculations based on the WTO, WSA and Eurostat databases, 2017.

Figure 7 confirms that the EU and the US did not have a revealed comparative advantage (*RCA*) in steel production as these values were below 1. The EU RCA continued to fall slightly from 0.72 in 2005 to 0.8 in 2015, with the US retaining its comparative advantage expressed by *RCA* (0.40) during the reporting period. Many other countries also had a comparative advantage in steel production (*RCA* > 1). High values were, for example, reached by Japan, Brazil and Russia; Russia's results were also thanks to the low prices of domestic commodities. Various forms of export promotion and subsidies of China was the reason why the EU Commission (EC) decided, in January 2017, to impose further anti-dumping duties ranging from 30.7 to 64.9% (Baláž, 2018). This should help to reduce the negative trade balance, where the EU imports from China are four times greater than the exports. However, the preliminary data for 2017 did not confirm this effect. The negative impact of high energy prices on the competitiveness of the manufacturing industry is also seen in the development of the EU gross output and added value, with total EU sales rising by 28% between 2000 and 2014, with China's sales rising significantly faster by 622% (WSA, 2017). This led to a decline in the share of the EU gross output in the total global one. The Chinese exports increased several times compared to the growth of the EU exports, which clearly shows that the manufacturing industry in China was more competitive in satisfying the increased demand in importing economies. Based on the RCA indicator, a comparative advantage in the manufacturing industry was also maintained by China and Japan, with the latter exploiting predominantly its technological advancement and enormously high labour productivity, while the EU achieved the 3rd highest value. This comparison also confirms the large dependence of the manufacturing industry and therefore also of the steel industry on prices.

To analyse competitiveness of the EU steel industry in detail, we can make an evaluation of its energy costs using the *RUEC* (Real Unit Energy Costs) indicator.[6]

RUEC calculation:

$$RUEC = EC/VA_{current} = EC/VA_{const}*P_{VA} = EC/Q_E*P_{VA} * QE/VA_{const,} \qquad (2)$$

where: EC energy costs in standard prices,
QE consumed energy volume,
PVA value-added indicator deflator,
$VA_{current}$ value added in current prices,
VA_{const} value added in constant prices.

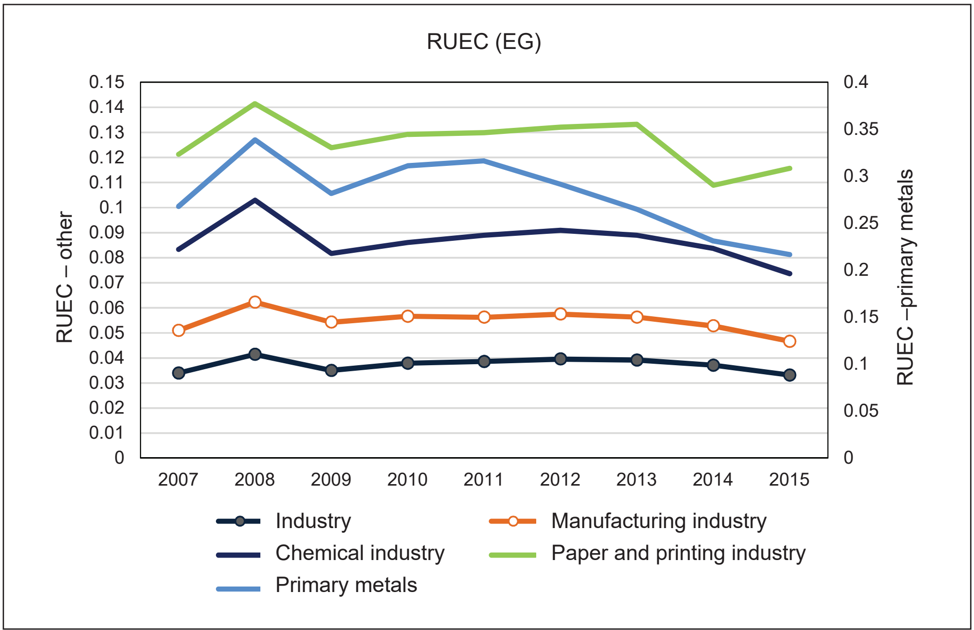
The EU industry consumes electricity and gas at the level of two thirds, therefore this survey analysed only the effect of costs of their procurement and value added on the *RUEC*(*EG*).[7]

6 *RUEC* expresses energy costs needed to achieve a value-added unit. Energy demand is calculated using the volume of consumed energy to the value added, clearing the value added of inflation and changes in exchange rates, in constant prices. Average energy unit costs are calculated using current prices, allowing to follow change in the volume and prices of consumed inputs and the capacity of the industry to reflect them in the product's prices and/or created value added.

7 *RUEC*(*EG*) stands for *RUEC* calculated only based on electricity and gas costs.

To see the different importance of these costs in individual industries, we have used it for an evaluation of the EU industry in general, and for the manufacturing industry and selected industries. Considering its structure oriented on sectors less demanding in terms of their consumption, the EU industry achieves relatively low values. In 2007–2015 it was 0.03–0.04. Manufacturing industry achieved 0.05 and primary metals (including steel industry) up to 0.28.

Figure 8 | *RUEC*(*EG*) Development in EU Industry and in Selected Industries (2007–2015)



Source: Authors' calculations based on the Odyssee database.

The analysis confirmed that electricity and gas costs account for 3–4% of the industry value added in total, 5% in manufacturing industry and up to 28% in primary metals (Figure 8). In 2007–2015, the *RUEC*(*EG*) went down across the entire EU industry. In total, it was −2.55%; −8.63% in the case of manufacturing industry and −19.17% in the case of primary metals.

4. Conclusion

High energy costs stimulate industrial enterprises to increase energy efficiency. Based on data for the period 2000–2016, a very close correlation (correlation coefficient r = −0.99) was found between electricity prices and energy intensity (kWh/€ 2005). The EU managed to reduce energy consumption in the manufacturing industry by as much as 21% over this period, thus achieving higher output than the US with comparable energy consumption. There was also a strong linear correlation (r = −0.95) between the price of electricity and the share of manufacturing industry exports in world exports (*RCA*), as well as the energy intensity. However, a negative impact was predicted on its competitiveness if electricity prices increase to EUR 150/MWh, as expected by the IEA for 2040–2050. The European manufacturing (steel) industry achieved results confirming the strong correlation between electricity and gas prices and the competitiveness of the manufacturing industry measured either through the *RCA* indicator or directly by export intensity. The analyses have confirmed the negative impact of prices on the competitiveness of the manufacturing industry on the basis of calculating a very close statistically significant negative correlation of *RCA* (−0.69) or exports (−0.95). This, *inter alia*, means that due to the expected increase in electricity prices to EUR 150/MWh by 2050, the share of EU manufacturing industry exports in the world exports will continue to decline from 32.5% to 29.2%, which will mean an export sales decline of roughly USD 184 billion per year according to the authors' calculations.

Evaluation of the EU steel (primary) industry using the Real Unit Energy Costs (*RUEC*) indicator has confirmed the declining unit consumption and rise of primary value of production by almost a fifth. It can be explained by growing value added of production, reflecting successful structural changes in the production sector and a decline of its share in the Union's overall manufacturing industry. Lower unit costs of the EU steel production have led to higher competitiveness on international markets. In this context, the question arises in what position the European manufacturing industry will be if the expected changes occur that are related to further growth in exports of cheaper steel and steel products not only from China, but also from India, Russia, Turkey or Ukraine (Arlinghaus, 2015). The steel industry, despite its high costs and decreasing revenues, has historically played an important role in the EU. However, the competitiveness of the industry keeps decreasing even despite large-scale support measures such as subsidies and anti-dumping tariffs. This also has a significant impact on the EU's manufacturing industry. We believe that the current measures concerning the imposition of such tariffs, also by the US, will prove inefficient and harmful to global trade.

Given the pressure from the cheap imports of steel to the EU, there are only two real solutions to this arising problem, namely to accelerate the growth of labour productivity, which requires enormous investments and subsidies for energy, or to gradually eliminate the steel industry and restructure it towards production with higher added value and lower input requirements. Maintaining the *status quo* will broaden the internal discrepancies within the EU, which we regard as a threat as they can fuel additional political conflicts among its members. Such a process has its side barriers consisting in fundamental modernisation and sophistication of the entire industry, which could mean that, for example, energy prices will not be important for the production process or successful exports. Undoubtedly, it can also be expected that no matter what strategy is adopted, the manufacturing industry will gradually move to countries with lower energy input prices and the EU will have to make very fundamental structural changes and focus, to a much greater extent than it has done so far, on the service sector and production with higher value added. All strategic decisions in its energy policy will also have to be made subject to this target.

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