

Dirty industries' competitiveness in EU's new members

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Abstract

Purpose – Despite the success in achieving the objectives for the use of renewable energy sources, the EU's competitiveness is not at the desired level. In particular, the largest decreases in fossil-type energy intensity were observed in last 13 members of EU, namely, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia. The purpose of this paper is to trace how these countries protect the competitiveness of their dirty (energy-intensive) industries.

Design/methodology/approach – The study employs revealed comparative advantage (RCA) indices to measure the comparative advantage (CA) of EU-13 in dirty industries for the period 1995-2014 and assesses these indices in the framework of EU's climate policy.

Findings – Some policies which make industries to adapt EU's 20-20-20 targets are forcing industries. In order to compete, these industries are leaving Europe and looking elsewhere. In this study the authors found that, particularly chemicals and non-metallic mineral manufactures resulted in a weakening of their CA over the years in some of these members. Similarly it is found that the RCA indices of iron and steel and non-ferrous metals are decreasing.

Originality/value – The study addresses the EU-13's position in terms of their competitiveness and find the connection with the EU's climate policy through their RCAs of dirty industries.

Keywords European Union, Revealed comparative advantage, Climate policy, Energy policy, Energy-intensive industries

Paper type Research paper

Introduction

Global warming has been an important issue for a long time. It is clear that unlimited burning of fossil fuels is the cause of this agenda. Therefore, in an attempt to address this phenomenon many countries try to reduce the consumption of fossil fuels. In other words, polluted industries that use fossil fuels are under the spotlight. Despite the above common belief, there is still no consensus about the relationship between policy implications on most energy-intensive industries (i.e. dirty industries) and their comparative advantage (CA). In the literature some empirical studies find strong evidence on positive relationship between polluted and energy-intensive industries and their competitiveness while some studies do not find any significant relationship. For example, James Tobey (1990) did not find any statistically significant relation between net exports of each country's dirty industries and the level of stringency of a country's environmental policies. After a decade, according to European Commission (2014) staff working paper called as "Helping Firms Grow," energy intensity is negatively but insignificantly related to exports. On the other hand, Low and Yeats (1992) tested the relationship between pollution-intensive products and revealed comparative advantage (RCA) for 109 countries during the period of 1965-1988. They found an increase in RCA of dirty industries in developing countries (in Eastern Europe, Latin America and West Asia) as the pollution haven hypothesis argues. Lucas *et al.* (1992) have found that the poorest but closed developing countries such as Benin, Chad, Eritrea, Ethiopia, Gambia, Malawi, Uganda and Sudan have the highest



pollution intensity growth. In a similar way Abimanyu (1996) also found dirty industry expansion in developing countries using RCA analysis. However, Cole *et al.* (2004) showed that US (as a developed country) RCA in polluting sectors is neither lower, nor falling more rapidly than in any other manufacturing sector. So they argued that polluting industries have special characteristics such as using specific physical and human capital and these characteristics makes developing countries less attractive as a motive for resettlement. Finally, Lehr and Maxwell (2000) pose a question about whether traditional CA may lead to increased global pollution or not. Based on their findings, it is clear that pollution preferences matter in determining the overall impact of trade on pollution.

Hence the question in this study is whether the competitiveness of the so-called dirty industries of EU's last new members increase or not while their fossil fuel consumption changes. Following this brief introduction, we first present the general picture of EU's last new members' (hereafter EU-13) energy and fossil fuel consumption and its share in EU's total consumption. This part also provides an overview of the energy intensity of EU-13 which is a measure of the energy efficiency of a country's economy; it means the amount of energy which is needed to produce a unit of GDP[1]. Similarly, in terms of industry, energy intensity of the industry is defined as the energy required to produce a material from its raw form, per unit material produced. Although the definitions vary, some industries which have higher energy consumption per unit of output are called as dirty or polluted industries and almost the same industries tend to show up on various lists. These industries are: iron and steel, non-ferrous metals, industrial chemicals, pulp and paper, and non-metallic mineral products. In the second part of the study we focus on these dirty industries' situation of EU-15 and EU-13 separately and calculate the RCA figures of these industries for just EU-13. The last part analyses the relevance of calculated the RCA figures and energy efficiency in dirty industries of the group of EU-13 countries.

Overview of the EU and EU-13 energy consumption

EU is one of the most responsive regions on global warming and sustainable energy. Despite the share of fossil fuels (coal, lignite, oil and natural gas) in gross inland consumption of the EU-28 declined from 83.0 percent in 1990 to 73.8 percent in 2013, the dependence ratio is still very high. This heavy dependency based on the imported fuels; 53.2 percent of total gross inland energy consumption of all energy products was from imported fossil fuels. Net import accounted for 58, 28 and 14 percent of gross inland consumptions of oil, gas and solid fuels[2]. Among members, the least dependent Member States are Estonia (11.9 percent), Denmark (12.3 percent), Romania (18.6 percent), Poland (25.8 percent), the Netherlands (26.0 percent) and the Czech Republic (27.9 percent). The highest dependency rates belong to Malta (104.0 percent), Luxembourg (96.9 percent), Cyprus (96.4 percent) and Ireland (89.1 percent) (Eurostat, 2015) (Table I).

BELG	DENM	GERM	IRE	GRE	SPA	FRA	ITA	LUX	NETH	AUS	PORT	FIN	SWE
77.5	12.3	62.7	89.0	62.1	70.5	47.9	76.9	96.9	26.0	62.3	73.5	48.7	31.6
UK	BUL	CZ	EE	CROAT	CYP	LATV	LIT	HUN	MAL	POL	ROM	SLOVN	SLOVK
46.4	37.8	27.9	11.9	52.3	96.4	55.9	78.3	52.3	104.1	25.8	18.6	47.0	59.6

Source: Eurostat (2015)

Table I.
Energy dependency
of EU-28, percent
(2013)

Since they are more dependent on fossil fuels, the EU has adopted targets for increasing the use of renewable energy sources and decreasing the consumption of fossil fuels. According to Eurostat data, the consumption of solid fuels and petroleum products has decreased and its share in total consumption fell from 65.1 percent in 1990 to 50.6 percent in 2013[3]. According to International Energy Agency data, in 1990 the EU-28 members was responsible for 19 percent of the total world CO₂ emissions from fuel combustion; the new members (EU-13) was responsible 24.5 percent of these emissions. In 2013 these figures have decreased to 10.3 and 19.4 percent, respectively (International Energy Agency, 2015). During the same period, the share of renewable in gross inland consumption increased from 4.3 percent in 1990 to 11.8 percent in 2013; actually it is a far away from its target. On the one hand, the EU tries to reduce fossil fuel consumption while also reducing the energy intensity and trying to make more efficient and clean production. During the 2000s, an overall energy efficiency gain in EU-28 has increased from 1.1 percent in 2001 to 24 percent in 2012. In particular, the energy efficiency gain in manufacturing industry has increased from 1.8 percent in 2001 to 16.9 percent in 2012. Among EU-28 members, new member countries such as Bulgaria, Poland and Estonia are at the top of the list on energy efficiency (Table II).

As a result of these efforts, first the EU has been moved significantly toward previous “twenty-twenty targets”. EU’s 2020 climate package sets three crucial targets in terms of energy consumption which are; 20 percent cut in GHGs emissions (from 1990 levels), 20 percent of EU energy from renewable sources and 20 percent improvement in energy efficiency[4]. At the same time, following this future plan in *Horizon 2020*, the European Commission tries to re-design market-oriented pre-competitive R&D and innovation in advanced manufacturing activities via the private-public partnership mechanism. To strengthen the plan, EU has approved the Energy Efficiency Directive on October 25, 2012. The new directive covers all end-use sectors except transport and it puts new targets on energy consumption. In 2014, the EU has agreed to review its policy framework on energy and climate policy by 2030 and the EU targets have radically changed; 40 percent cut in GHGs emissions, the share of renewable energy in final energy consumption increased to 27 percent and improving energy efficiency to 30 percent. Actually all these activities are part of the Energy Union Strategy project which is coordinated by European Commission to provide secure, sustainable, competitive and affordable energy. Besides the targets on GHGs emissions from all primary energy sources, there are some other proposals which include a cut of up to 95 percent in carbon emissions, a minimum target of 10 percent for the use of bio fuels, improving energy relations with the EU’s neighbors (especially with Russia) and developing technologies in renewable energy areas. In that sense, the EU cut greenhouse gas emissions by 18 percent in between 1990 and 2012 and increased the share of renewable in the EU energy consumption from 8.5 percent in 2005 to 14.1 percent in 2012 but it decreased to 11.8 percent in 2013 (Table III).

Table II.
Energy efficiency
gains in
manufacturing
industry of
EU, percent

BELG	DENM	GERM	IRE	GRE	SPA	FRA	ITA	LUX	NETH	AUS	PORT	FIN	SWE
39	19.3	11.6	28.1	19.1	12.3	10.7	12.3	33.4	27.5	9.2	18.4	15.8	16.1
UK	BUL	CZ	EE	CROAT	CYP	LATV	LIT	HUN	MAL	POL	ROM	SLOVN	SLOVK
20.6	51.7	17.4	47.1	20.4	37.3	43.3	43	38.6	18.2	49.3	16.4	19.4	40.3

Source: www.odyssee-mure.eu/publications/efficiency-by-sector/industry/ (accessed January 25, 2016)

In the context of transition to a more competitive but sustainable path, the EU countries need to decrease their energy intensities (i.e. increase the energy efficiencies). When we look at figures in Table IV, energy intensities in the US and China are higher than EU-27 and Japan. In other words, China, as the world's largest energy consumer country, is the least energy efficient country among these countries.

On the other hand, the cost of energy in the output is another crucial variable for strengthening competitiveness of any country. The data shows that EU and USA are becoming close in terms of energy cost share in gross output; but China has the highest level as expected. In terms of total economy both countries' figures are 4.6 percent in 2011 and around 3 percent for manufacturing (Table V). However, from the Table V we can see that energy-intensive industries such as chemicals, basic and fabricated metals and non-metallic minerals industries in the USA and EU have lowest cost shares as others have been driven by higher costs (Table VI).

The trend in energy intensity over time has also been down for EU; during the same period, a decrease in energy intensity is observed in almost all EU members; the least energy-intensive countries in the European Union are after Ireland, Malta, Lithuania, Cyprus, Poland, Denmark and UK, but the most energy-intensive countries are Finland,

Table III.

Share of renewable in gross inland energy consumption percent (2013)

BELG	DENM	GERM	IRE	GRE	SPA	FRA	ITA	LUX	NETH	AUS	PORT	FIN	SWE
6.2	24.2	10.3	6.2	10.7	14.7	9.0	16.5	3.6	4.2	29.6	23.5	29.2	34.8
UK	BUL	CZ	EE	CROAT	CYP	LATV	LIT	HUN	MAL	POL	ROM	SLOVN	SLOVK
5.0	10.8	8.5	12.7	16.2	6.1	36.1	18.1	8.3	1.5	8.7	17.2	16.5	8.2

Source: http://ec.europa.eu/eurostat/statisticsexplained/images/8/83/Share_of_renewables_in_gross_inland_energy_consumption%2C_2013_%28%25%29_YB15.png (accessed January 10, 2016)

Table IV.

Energy intensities (TJ per million \$ of value added in PPPs 2005), 1995 and 2009

	Total economy		Manufacturing ^a	
	1995	2009	1995	2009
EU-27	10.5	7.8	12.2	9.1
EU-15	9.8	7.6	11.0	9.4
EU-12	15.8	9.7	23.4	7.8
China	20.4	13.6	26.4	13.3
Japan	9.5	8.3	11.2	9.9
USA	13.1	9.0	16.4	11.1

Note: ^aNot included NACE rev 1-23: coke, refined petroleum and nuclear fuel

Source: WIOD (2014, p. 197)

Table V.

Energy cost share in basic prices (in percent of gross output)

	Total economy				Manufacturing ^a		
	1995	2000	2007	2011	1995	2000	2007
EU-27	3.0	3.2	4.1	4.6	2.3	2.2	2.8
China	5.2	5.9	7.7	7.7	4.4	4.7	5.7
Japan	2.8	3.3	4.8	5.1	2.9	3.3	4.6
US	2.8	3.6	4.6	4.6	2.3	2.8	3.1

Note: ^aNot included NACE rev 1-23: coke, refined petroleum and nuclear fuel

Source: WIOD (2014, p. 194)

Table VI.

Energy cost shares
by manufacturing
industry in basic
prices (in percent of
gross output)

	EU-27		China		Japan		USA	
	1995	2011	1995	2011	1995	2011	1995	2011
Food and beverages	1.7	2.5	1.3	1.5	1.5	2.3	1.8	2.0
Textile and products	2.2	3.1	1.2	2.2	2.2	3.3	1.7	2.2
Leather and footwear	1.1	1.4	0.5	1.2	1.6	2.0	1.2	0.8
Wood and products	2.0	2.8	3.1	3.1	1.9	2.5	2.1	3.1
Pulp, paper and printing	2.5	3.2	3.8	3.6	3.4	4.8	2.4	3.2
Coke, ref. petr. and nuc. fuels	47.8	62.0	56.9	72.2	20.8	47.0	62.2	67.9
Chemicals and Products	4.4	7.4	9.9	18.9	6.8	13.1	5.9	7.8
Rubber and plastics	2.5	3.5	2.8	3.3	3.1	3.3	3.0	2.5
Other non-metallic mineral products	5.6	7.4	10.5	15.5	9.2	16.8	4.6	5.8
Basic and fabricated metals	3.7	4.1	7.7	9.8	4.4	10.2	3.3	4.2
Machinery	1.2	1.3	2.8	3.5	1.2	1.5	1.1	1.0
Electrical and optical Equip	1.0	1.1	1.3	1.4	1.6	2.2	1.3	0.5
Transport equip	1.2	1.1	1.8	1.6	1.2	1.6	0.7	0.8
Manufacturing, nec	1.4	2.1	1.9	1.9	2.0	3.0	1.2	0.8

Source: WIOD (2014, p. 195)

Sweden, Bulgaria and Luxembourg. However, the largest fall is lately observed in some new members such as Poland (−10.0 percent), Slovakia (−8.6 percent), Lithuania and Romania. Only Slovenia showed a lower decline of energy intensity of −2.8 percent per annum. Despite these positive improvements in the figures of energy intensity in the EU, the new member countries (EU-13) still have higher values in 2013 (Table VII and Figure 1).

On the other hand, in most of the EU-13 countries, after the dramatic decline in energy intensity it is expected that the RCA figures of these countries exhibit better performances. Because it is widely accepted that competitiveness will be enhanced when industry consumes less energy. In other words, the more energy intensity means lower RCA figures. However the discussion on energy efficiency and industrial competitiveness is regarded with the concepts of technological capability, innovative capability and/or absorptive capacity. It means countries need such capacities if they

Table VII.

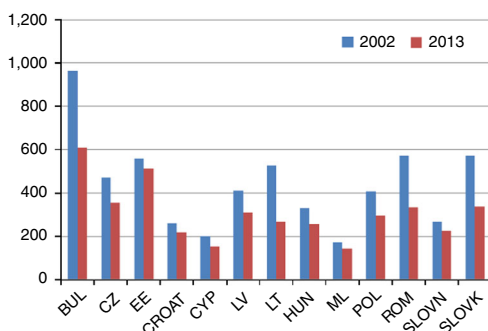
Energy intensity of
EU-13 countries,
2002-2013

	BUL	CZ	EE	CROAT	CYP	LV	LT	HUN	ML	POL	ROM	SLOVN	SLOVK
2002	962.9	471.5	558.9	261.1	200	410.6	528.8	330.1	174.1	409.3	572.8	267.2	575.3
2003	942.0	475.8	571.2	265.1	212.4	405.4	499.1	324.2	190.1	407.7	567.7	262.6	546.7
2004	866.2	465.7	550.8	255.0	191.2	382.2	474.6	306.6	196.1	387.1	515.9	259.2	512.7
2005	849.4	431.2	501.8	246.7	186.7	355.2	415.4	311.1	197.1	377.3	491.3	255.0	494.4
2006	823.5	413.6	444.7	235.9	186.2	332.0	377.9	297.7	180.5	373.0	471.4	241.0	452.6
2007	759.9	391.3	464.6	235.0	185	309.6	374.8	290.6	184.3	349.2	441.5	225.5	387.6
2008	711.7	371.1	468.7	223.5	188	305.9	363.2	285.9	177.0	335.9	409.9	230.6	375.7
2009	661.4	364.4	491.3	230.6	186.3	357.1	389.6	289.7	163.8	319.2	387.4	227.8	362.2
2010	668.8	374.1	546.3	230.6	178.8	357.1	389.6	294.1	166.8	327.4	394.6	231.0	369.3
2011	705.5	353.9	505.3	231.9	174.8	333.5	299.1	281.6	164.3	314.0	393.7	230.5	349.3
2012	669.9	355.7	478.4	225.6	167.5	328.6	292.1	268.7	171.3	298.0	378.9	227.5	329.3
2013	610.6	353.8	512.7	219.5	154.1	310.6	266.4	256.6	143.6	294.7	334.7	225.8	337.2
% change	−36.5	−25.0	−8.2	−16.0	−23.0	−24.3	−49.6	−22.2	−17.5	−28.0	−41.5	−15.4	−41.3

Note: kg of oil equivalent per 1000 euro

Source: <https://datamarket.com/data/set/lagh/energy-intensity-of-theeconomy/#ds=laghlyjx=5.e.b.z.1.d.m.v.n.10.7.c.u.g.i.x.f.p.a.r.17.w.8.2.o.k.18.h.4.l.y.t.3&display=choropleth&map=europe&classifier=natural&numclasses=5&s=90o>

Figure 1.
Dramatic decline in
energy intensity in
EU-13 countries,
kgoe/000 euro



Source: Data from Table VII

want to increase their energy efficiency and decrease their energy intensities. So the energy intensity is an important but not the only factor to strengthen competition. On the other hand external conditions have also affected Europe's energy-intensive industries. A focus on the transition toward a shale gas would allow competition in a different path. As a result of this, the dynamics of energy prices in the USA have changed but not in Europe. Energy prices have still have a significant share in energy-intensive industries therefore investment in these industries has decreased in the EU. During the 2000s, average annual total investment of energy-intensive industries in the EU has decreased by 15 percent but this figure has increased in China by 97 percent, in the USA by 13 percent and in Japan by 11 percent.

The following part of this study aims to calculate the RCA figures of energy-intensive industries in EU-13 countries which are on the path of energy efficiency.

Competitiveness of dirty industries in EU-13

Examining the period from 2000 to 2008, the share of the industrial sector in final energy consumption of EU-28 has been increasing but after 2008 the trend has been downward steadily. Overall period, between 2000 and 2013, the share of industry in final energy consumption has decreased from 331.9 to 276.6 mtoe. According to Eurostat, of the major sectors, the largest fall in energy consumption between 1990 and 2013 took place in the industry sector; for example, between 2005 and 2013 energy consumption in the industry sector fell at an average rate of 20. percent. Again according to the same source, this was largely the result of a shift toward less energy-intensive manufacturing industries (EEA, 2015). Therefore, at this point it is important to ask whether these industries' CA increase or not. In other words, the RCAs were calculated to analyze whether or not the EU-13 countries' specialize on energy-intensive products.

In the reminder of this part, empirical results for calculating the RCA of six energy-intensive industries are presented (Table VIII). These six industries cover around two-third of total consumption.

In the case of six energy-intensive industries, almost all new members' RCA figures have been decreasing, i.e. losing their competitiveness. So when these countries' dirty industries become "clean" (in other words increase their energy efficiency or decrease their energy intensity) then they are losing their CA. Particularly the RCA figures of two largest energy consuming industries (Chemicals and Iron and Steel) have declined for almost all members.

According to European Commission industrial competitiveness report, some EU-13 countries such as Estonia, Lithuania, Latvia, Czech Republic, Hungary, Poland,

Table VIII.

RCA figures
of selected most
dirty industries in
EU-13 countries,
2000 and 2013

	BUL	CZ	EE	CROAT	CYP	LV	LT	HUN	ML	POL	ROM	SLOVN	SLOVK
<i>2000</i>													
5	1.08	0.76	0.60	1.34	0.00	0.68	1.02	0.65	0.17	0.70	0.62	1.17	0.85
64	0.41	1.07	1.03	1.18	0.49	0.61	0.53	0.72	0.02	1.72	0.34	2.78	2.37
66	0.86	2.28	0.68	1.99	1.00	0.47	0.77	0.62	0.09	1.11	0.90	1.23	1.27
67	3.4	1.87	0.45	0.46	0.04	2.73	0.47	0.52	0.005	1.48	3.45	1.37	4.11
68	5.50	0.60	1.39	1.11	0.92	1.45	0.15	0.92	0.10	2.16	2.04	2.10	1.40
69	0.77	3.20	1.63	1.18	0.30	0.63	0.62	1.06	0.35	2.48	0.77	2.25	1.50
<i>2013</i>													
5	0.27	0.55	0.61	0.99	0.00	0.59	1.09	0.95	1.16	0.82	0.49	1.40	0.41
64	0.80	0.17	1.17	1.34	0.21	0.85	1.10	1.23	0.09	2.46	0.48	1.95	1.37
66	1.00	1.00	0.92	2.08	1.57	0.85	0.64	0.80	0.11	1.05	0.25	0.80	0.74
67	0.98	1.33	0.55	0.42	0.20	1.46	0.34	0.51	0.05	0.97	1.46	1.10	2.02
68	6.41	0.66	0.32	1.00	0.84	0.58	0.10	0.46	0.01	1.75	0.78	1.26	1.08
69	0.84	2.51	1.63	1.82	0.12	1.22	1.21	1.05	0.22	2.24	1.22	1.90	1.63

Notes: The numbers on the left column represent the SITC classification. SITC 5: chemicals and related products; SITC 64: paper, paperboard and articles of paper pulp, of paper or of paperboard; SITC 66: non-metallic mineral manufactures; SITC 67: iron and steel; SITC 68: non-ferrous metals; SITC 69: manufactures of metals

Source: Authors' own calculations

Romania and Slovakia have modest but improving competitiveness. However some of them such as Slovenia, Bulgaria, Croatia, Malta and Cyprus have stagnating or even declining competitiveness. Now we examine the dirty industries' competitiveness for each EU-13 country in a detailed fashion.

In Bulgaria the manufacturing sector accounted for 22.3 percent of the gross value added however among manufacturing industries the share of chemicals and pharmaceuticals has decreased from 22.0 percent in 2008 to less than 15.7 percent in 2011. This information is supported by the RCA figures of Bulgarian chemicals sector which is decreased from 1.08 in 2000 to 0.27 in 2013. Bulgaria is the most energy-intensive country in the EU with low energy and resource efficiency (see Table VII). The manufacturing sector in the Czech Republic is very important and the share of the industry is 27.0 percent of value added in 2014. The energy intensity of the Czech Republic has been declining over recent years but still remains high when compared to other EU countries. During the years of 2000s, the dirty industries of Czech Republic have lost their competitiveness.

In Estonia the share of manufacturing in value added is 16 percent and high-value added sectors are increasing their share. Estonia has specialized in capital-intensive industries; particularly wood products such as paper, paperboard and articles of paper pulp, of paper or of paperboard (SITC 64) have increased its RCA figures from 1.03 in 2000 to 1.17 in 2013. The specialization in such energy-intensive industries is verified by energy intensity figures of Estonia; between 2000 and 2013, the energy intensity of the country has decreased by 16 percent.

In Croatia the share of the manufacturing sector in value added is 15 percent. In 2000 except iron and steel, all energy-intensive industries have higher RCA figures. Despite the country's efforts to use more renewable energy in total energy consumption, these energy-intensive industries have still high RCA in 2013.

The main problem of Cyprus is the highest electricity prices which reduce the competitiveness of industries in the country. During the years of 2000's only the

non-metallic mineral manufactures has CA, the other energy-intensive industries have no advantage.

The manufacturing sector's contribution to the Latvian economy decreased from 14 percent in 2013 to 12 percent in 2014. Among the top-ten export products of the country are wood, metals, chemicals and machinery. In 2000 iron and steel and non-ferrous metals (SITC 67 and 68) are the only two industries have CA; in 2013 non-ferrous metals lost its RCA while the metals products have increased competitiveness.

Manufacturing industry in Lithuania has 19 percent in share in value added. Lithuania has a strong RCA in wood and wood products, paper, refined petroleum, chemicals, rubber and plastics.

From Table VII it is observed that the most dramatic decline in the energy intensity occurred in Lithuania. However, this change has not reflected on the RCA figures of the country's energy-intensive industries. Thus, from 2000 to 2013, the RCA figures of three energy-intensive industries (SITC 5, SITC 64 and SITC 69) have increased.

The share of manufacturing industry in the total value added of Hungary is 24 percent in 2014 which shows a strong performance among EU-13 members. In 2013, paper, paperboard and articles of paper pulp, of paper or of paperboard industry and metals products industry have strong RCA while in 2000, manufactures of metals is the only industry among these dirty industries. Malta is not so strong in manufacturing industry, however the country has gained RCA in chemical industry particularly pharmaceuticals (Table VIII).

Poland's share of manufacturing in total value added is 18 percent in 2014 and it is above the EU's average. However the performance of the country's energy efficiency is so weak. Despite the decrease in energy intensity, all energy-intensive sectors have competitiveness in the whole economy. On the other hand Romania has good performance in manufacturing industry; the country's energy-intensive figures have been decreasing dramatically since 2000, in 2013 in terms of energy intensity, Romania is the fourth biggest country among the other EU-13 countries. Among these dirty industries, non-ferrous metals lost its competitiveness, but the manufacture of metals gained RCA in 2013. On the other hand Slovenia has strong RCA in most energy-intensive industries and the energy intensity of the country has decreased by 15 percent during 2000-2013; however the country still shows a high level of energy intensity. Finally the industry of Slovakia is one of the most competitive industries among EU-13. The energy intensity of the country has dramatically decreased during the period; as a result of this change Slovakia has lost RCA in some energy-intensive industries such as chemical and non-metallic mineral manufactures. Despite the fall in energy intensity, Slovakia is one of the most energy-intensive member countries.

Conclusion

The policy shift in accordance with European Union's 20-20-20 targets have forced to change the behavioral patterns of the industries in Europe and to find new ways to compete for the firms in the realm of their own industries. The 20-20-20 targets-based change in the industries could be branded with the motto "Exit from Europe" and it is inevitable that these industries will be eventually looking for new locations other than Europe. In this study, our findings suggest that the CAs of some energy-intensive industries such as chemicals and non-metallic mineral manufactures, iron and steel, and non-ferrous metals have been getting weaker for EU's last member countries during the period of interest. The apparent weakening in EU-13's aforementioned dirty industries might be considered as an early stage of a dramatic fall in terms of their competitiveness.

Notes

1. That is energy use divided by value added.
2. Overview of the European energy system, www.eea.europa.eu/data-and-maps/indicators/overview-of-the-european-energy-system-3/assessment (accessed January 13, 2016).
3. Eurostat: consumption of energy, http://ec.europa.eu/eurostat/statisticsexplained/index.php/Consumption_of_energy (accessed January 10, 2016).
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