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THE INTERNATIONAL TRADE OF EUROPEAN CHEMICAL INDUSTRY

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Abstract

In order to analyze European chemical industry, it is important to evaluate ongoing trade within EU countries. Several indicators, which are based on export and import values, are used to measure the performance and competitiveness of a chemical sector for each European country. This research includes the results of chemical industry of EU countries during the period from 2000 to 2012. The methodology of this paper is based on the application of various indicators like intra-industry trade, trade balance, import penetration indicator, composition of manufacturing exports and other relevant indicators. The basic aim of this research is to measure international competitiveness and international trade of the chemical industry of chosen countries. The main results of paper indicate international competitiveness trends detected by measuring, evaluation of the EU chemical industry particularly on foreign markets, recommendations and proposals in order to reach a higher level of international trade.

Keywords: The Chemical Industry, EU countries, Competitiveness, International Trade

Topic Groups: Industry, Economics and Business

INTRODUCTION

The chemical industry is one of Europe's largest industries. The industry on its own is worth approximately €642 bn. Moreover, the European chemical industry is the world's top exporter and importer and has known a €41.7 billion trade surplus in 2011 (Cefic, 2013).

Chemical plants transform the raw material supplied by earth or other firms into final chemical products. This industry as a whole produces an enormous amount of different final chemicals, ranging from plastics to hydrocarbons and from fertilizers to rubber. The chemical industry supplies itself, but is also vital for most of the common manufacturing industries worldwide. This diversified industry can thus be divided into different subcategories. Although comparison of trade or total production of these different subsectors between different countries within the European Union can be very interesting, we decided, mainly because of the lack of data for such subsectors, to concentrate on the total chemical industry. Consequently, the data used in the pursuit of this essay will be the aggregated data over the total chemical industry.

The chemical industry is one of the largest European manufacturing sectors and, as an enabling industry, it has a crucial role in providing innovative materials and technological solutions which largely determinate Europe`s industrial competitiveness as a whole. The industry is currently in the process of rapid structural change facing major challenges such as increased competition from emerging countries, rising energy prices, new regulations and the need for innovation.

According to EUROSTAT (2011), Bezić et al. (2011), the main features of the chemical industry comprise high product heterogeneity, the importance of innovations and R&D activities, capital intensity, market structure concentration and a high dependency on energy-generating products. The chemical industry nowadays consumes about a quarter of the output. So far, the EU chemical industry has been facing serious challenges such as globalization, increased competition from Asia, the fluctuation of exchange rate, the increase of raw material prices along with intensive regulation and standardization of the EU legislation.

Economies of scale are very important within the chemical industry. Therefore this business consists mainly of vast and financially strong firms with plants in specific and concentrated areas in order to exploit economies of scale at the fullest. As a result, the chemical industry is very unevenly spread throughout Europe, with approximately 7 prevalent countries, namely Germany, France, Italy, the Netherlands, UK, Spain and Belgium.

These countries account for about 85% of the total EU27 chemical production. Other countries produce a far smaller amount of chemical products, as can be seen below. The most famous European chemical firms are BASF (Germany), Bayer (Germany), INEOS (UK), Imperial (The Netherlands), DSM (The Netherlands), Air Liquid (France) and most of these have plants in concentrated chemical areas to exploit the economies of scale.

In the framework of the defined research problem, the basic scientific hypothesis of the paper is set up, namely, that it is possible to estimate current state of international trade competitiveness of the chemical industry within 27 EU Member countries by implementation of various international trade and competitiveness indicators.

In this relation, the basic objective of the research is to measure international competitiveness, objectively estimate international trade of the chemical sector of EU27, and to propose measures and activities for improvement of international trade competitiveness of the European Chemical industry in the selected countries in accordance with the results.

The paper consists of five systematically interrelated parts. After the Introduction, the second part of the paper presents research methodology. The third part includes analytical framework and results of international trade competitiveness based on the analysis of foreign trade activity and international competitiveness of the European chemical sector. The final part comprises proposals, recommendations and conclusions.

METHODOLOGY

Analytical approach is based on scientific results of several indicators which measure the level of international trade competitiveness of the chemical industry of the 27 EU Countries. The above-mentioned indicators have been frequently used in contemporary economic research, which evaluate economy's structural strengths and weaknesses *via* the composition of international trade flows (Bezić and Galović, 2013). In another words, these indicators address the question of trade specialization and performance in international markets. The aim of implemented methodology also shows the importance of the foreign market for European chemical industry in a country and what degree of domestic demand is satisfied by imports. Moreover, the most commonly used indicators, indices, and ratios that are to assess trade patterns and characteristics, and changes in them. Besides elementary and well known indicators, this research uses basic indicators which are suggested by OECD Statistical Database (2013) and World Bank (2013).

Some analyses of factors influencing the success or failure of efforts to promote industrialization and growth conclude that a growing level of intraindustry trade (plays an important positive role (World Bank, 2013). Intraindustry exchange produces extra gains from international trade over and above those associated with comparative advantage because it allows a country to take advantage of larger markets.

Intra-industry trade (IITR) represents the value of total trade remaining after subtraction of the absolute value of net exports or imports of chemical industry. For comparison between countries and industries, the measures are expressed as a percentage of each industry's combined exports and imports. According to OECD Statistical Database (2013), intra-industry trade of chemical industry is calculated as follows:

$$IITR_i = \left(1 - \frac{|expo_i - impo_i|}{expo_i + impo_i} \right) \times 100$$

wherein:

expo_i - export activity of sector "i"

impo_i - import activity of sector "i"

This index varies between 0 and 100. If a country exports and imports roughly equal quantities of a certain product, the index value is high. Whereas if trade is mainly one-way (whether exporting or importing), the index value is low.

The "contribution to the trade balance" or „CMTB“ makes it possible to identify an economy's structural strengths and weaknesses *via* the composition of international trade flows (OECD Statistical Database, 2013). It takes into account not only exports, but also imports, and tries to eliminate business cycle variations by comparing an industry's trade balance with the overall trade balance. It can be interpreted as an indicator of "revealed comparative

advantage" (Balassa, 1965:93; Balassa, 1978:203) as it indicates whether an industry performs relatively better or worse than the manufacturing total, no matter whether the manufacturing total itself is in deficit or surplus. If there were no comparative advantage or disadvantage for any industry i , a country's total trade balance (surplus or deficit) should be distributed across industries according to their share in total trade. The "contribution to the manufacturing trade balance" is the difference between the actual and this theoretical balance:

$$CMTB_i = \left[\frac{(expo_i - impo_i) - (expo_{manuf} - impo_{manuf}) \frac{expo_i + impo_i}{expo_{manuf} + impo_{manuf}}}{expo_{manuf} + impo_{manuf}} \right] \times 100$$

wherein:

$expo_i$ - export activity of sector " i "

$impo_i$ - import activity of sector " i "

$expo_{manuf}$ - export activity of total manufacturing sectors

$impo_{manuf}$ - import activity of total manufacturing sectors

A positive value for an industry indicates a structural surplus and a negative one a structural deficit. The indicator is additive and individual industries can be grouped together by summing their respective values: by construction, the sum over all industries is zero.

Next indicator called "Export import ratio" shows exports as a percentage of imports. EXIM ratio can be calculated as follows:

$$EXIM_i = \frac{expo_i}{impo_i} \times 100$$

wherein:

$expo_i$ - export activity of sector " i "

$impo_i$ - import activity of sector " i "

Another simple indicator is used within this paper. Hence, this indicator (TBAL) is calculated in real numbers of national currencies and highlights the trade pattern of each industry. It can be seen in the following formula:

$$TBAL_i = expo_i - impo_i$$

Trade balance is one of the macroeconomic indicators which are used to gauge the competitiveness of a sector at national level. When exports exceed imports, the balance is in surplus, and when imports exceed exports, the balance is in deficit.

Furthermore, composition of manufacturing exports of goods indicator (XSHM) shows the exports in a given manufacturing industry (in this case EU chemical industry) as a percentage of total manufacturing exports. XSHM indicator is calculated as follows:

$$XSHM_i = \frac{expo_i}{expo_{manuf}} \times 100$$

wherein:

$expo_i$ - export activity of sector "i"

$expo_{manuf}$ - export activity of total manufacturing sectors

Finally, import penetration (MPEN) indicator can be calculated as a ratio of imports to the sector's production adjusted for the foreign trade balance (difference between exports and imports) according to the following formula:

$$MPEN_i = \frac{impo_i}{prod_i - expo_i + impo_i} \times 100$$

For a given country, a value close to 100 in a certain industry, implies that domestic demand is mainly fulfilled by imports and domestic production tends to be exported (OECD Statistical Database, 2013). A value close to 0 means self-sufficient, i.e. domestic demand is mainly satisfied by domestic production. A value above 100 illustrates measurement problems which may occur when combining production and trade data. It is important to bear in mind that exports can exceed production.

RESULTS

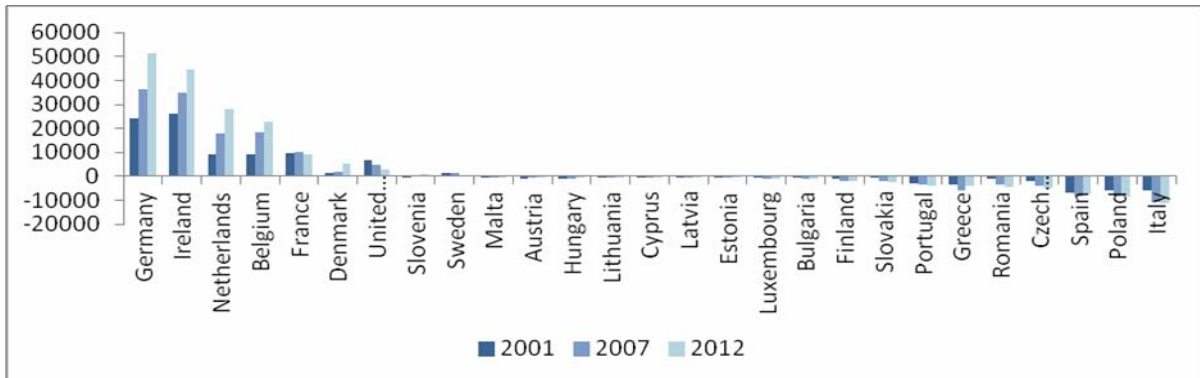
In the analysis of the outlined problem, the starting point is identification of international trade and competitiveness of the European Chemical industry of 27 EU member countries in the period between 2001 and 2012. In order to analyze European chemical sector, it is important to study ongoing trade within its countries. Several indicators, which are based on export and import, can be used to measure the performance and competitiveness of a certain sector for each country.

In a given year, the values of an indicator can differ between countries, which allow an international comparison. The value of an indicator may also differ between different years, within a different country. When evaluating at Germany for example, one can examine the evolution of these values over recent history.

In this particular study, six indicators will be calculated for the EU27 member states: IITR, CMTB, EXIM, TBAL, XSHM and MPEN. The analysis, generally speaking, considers the results of best Eurozone performer Germany and the worst Eurozone performer Greece. Only data from 2001 until 2012 is to be taken into account while calculating.

The data is extracted from Eurostat Database. Import and export tables show the member states' contribution to the EU27 trade for a certain sector, in millions of EUR. The tables of export and import show that for all countries, import and export rise steadily every year. Therefore it is relevant to follow only at 2001, 2007 and 2012 in order to clearly represent the evolution of the indexes.

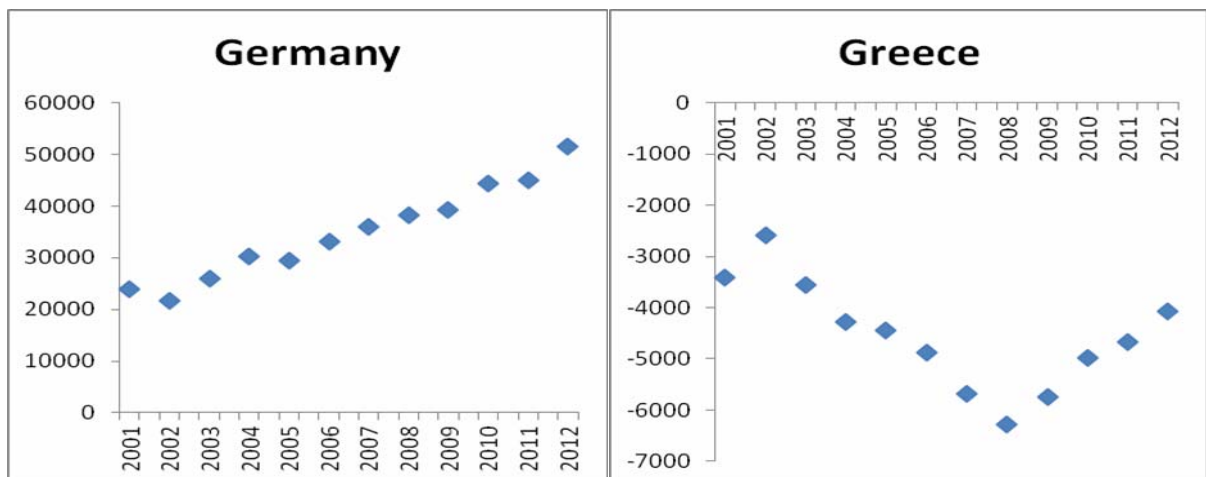
Figure 1: Trade balance (TBAL), in the years 2000, 2007 and 2012



Source: Eurostat Statistical Database, 2013

Figure 1 represents the different countries on the horizontal axis and their respective trade balance in millions of EUR on the vertical axis. Noted in absolute value, the TBAL indicator makes comparison between countries difficult. It is self-evident that countries with a larger population will have a larger trade balance, whether it is positive or negative. Due to this effect, it is important to focus on which countries have a positive or negative trade balance and possibly discover trends. Wealthy countries that are active in the chemical industry like Germany, the Netherlands and Belgium seem to typically have a positive trade balance, which means they export more than they import and have balances that are in surplus. Southern European countries which were most struck by recent crises such as Italy, Spain, Greece and Portugal all have trade balances that are in deficit. Also remarkable is that countries with positive trade balances have a rising trade balance over the last decade whereas countries with a negative trade balance have descending ones.

Figure 2: Trade balance (TBAL) for Germany and Greece in the period between 2001 and 2012

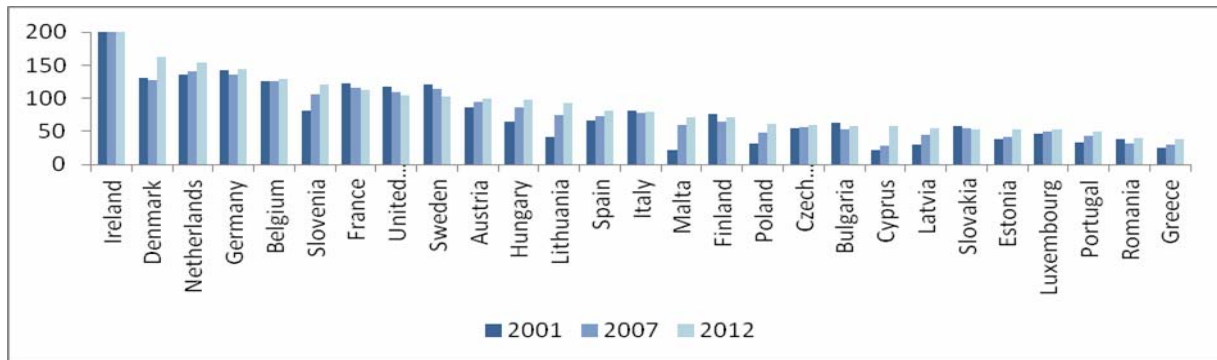


Source: Eurostat Statistical Database, 2013

Due to the population discrepancy, both countries are represented on different scales on the vertical axis in a way that volatility in TBAL can be examined. The data indeed shows that Germany's export rises proportionally faster than its import, which makes its trade balance more positive. Greece on the other hand follows an opposite trend as its import rises

proportionally faster than its export which makes its trade balance more negative. Due to the economic and financial crises, Greece's import and export grew less and eventually dropped. Its trade balance knew a turnaround in 2008 as its import dropped proportionally more. Germany suffered less; its import and export kept rising at more or less equal rates. An important cause for this phenomenon is that Germany's chemical sector mainly consists of pharmaceuticals, which are very inelastic whereas other chemical products suffered a lot due to the recent crisis. Figure 3 presents exports as a percentage of imports of the EU27 chemical manufactures in the years 2000, 2007 and 2012.

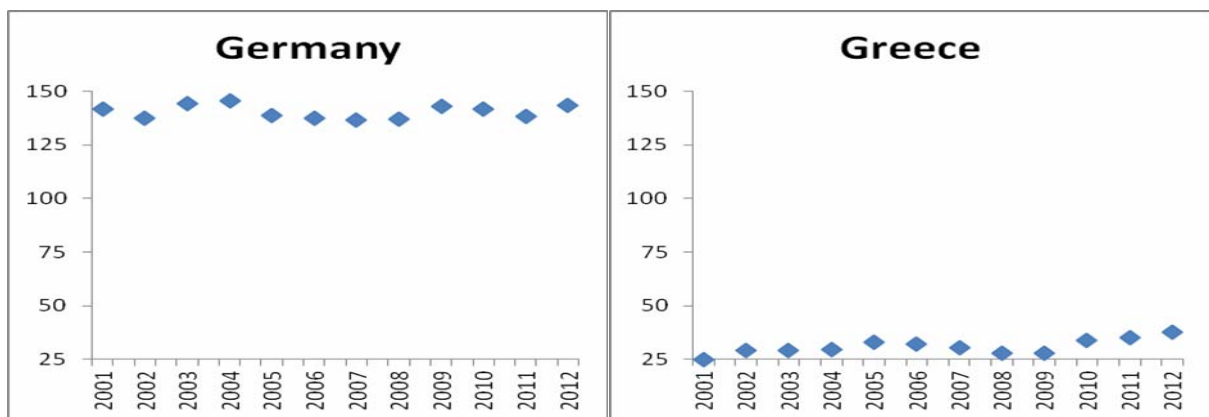
Figure 3: Export import ratio of European chemical industry in the years 2000, 2007 and 2012 (EXIM)



Source: Eurostat Statistical Database, 2013

Figure 3 shows the export import ratio of different countries in percentages. This indicator solves the population discrepancy problem and makes comparison between countries possible on the same scale. Ireland has an extremely high export import ratio of over 540 in 2012 (meaning Ireland exported 5.4 times as much than it imported in 2012) but the graph is cut off at 200 for clarity purposes. Ireland's export is so high compared to its import because it specializes in the export of pharmaceuticals. Germany, the Netherlands and Belgium again have relatively high export import ratios whereas those of Greece and Portugal are low. Furthermore, the final results of the export import ratio are presented in Figure 4.

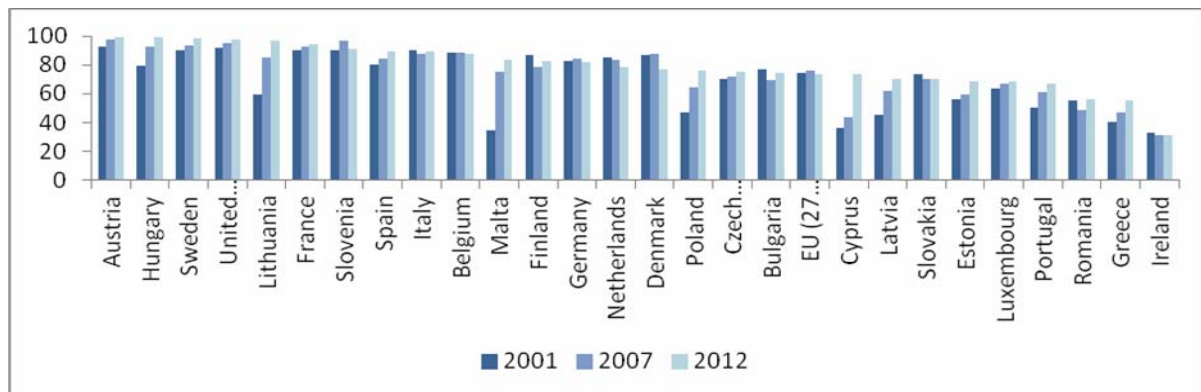
Figure 4: Export import ratio of German and Greek chemical industry in the period between 2001 and 2012 (EXIM)



Source: Eurostat Statistical Database, 2013

Germany clearly has always had a higher export import ratio but it has been stagnating at around 140% over the past decade while Greece's far lower ratio has been rising slowly but surely since 2008, from a little below 28% in 2001 to almost 38% in 2012. In addition, Figure 5 presents intra-industry trade of the chemical manufactures in the EU27 Member countries for years 2001, 2007 and 2012.

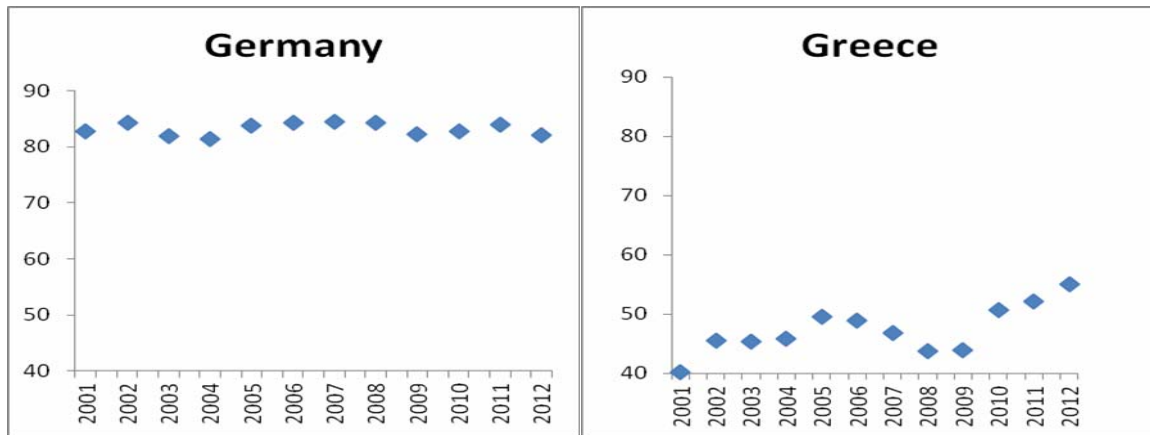
Figure 5: EU27 chemical intra-industry trade for the years 2001, 2007 and 2012 (IITR)



Source: Eurostat Statistical Database, 2013

Figure 5 illustrates the intra-industry trade of different countries in percentages. The EU27 can be seen as a mean and it shows that intra-industry trade in the EU27 member states on average has barely changed since 2001, stagnating at a value of roughly 73%. Most EU27 member states (including Spain and Italy) indeed have large indexes, meaning they all export roughly as much as they import. Ireland on the other hand has a low IITR index because they export far more than they import which has been indicated before by their extremely large export import ratio. Also Greece's IITR index is on the small side at 55% in 2012. Portugal comes from a low IITR index of 50% in 2001 but has been slowly converging towards the EU27 mean and had an IITR index of over 67% in 2012. Small countries like Malta and Cyprus seem to be more volatile which can be explained by their low GDP and therefore small chemical sector. Slight changes in their export and import can result in drastic changes in their IITR index. Figure 6 compares the results of IITR indicator for chemical industry of Germany and Greece.

Figure 6: Intra-industry trade of German and Greek chemical industry in the period between 2001 and 2012 (IITR)

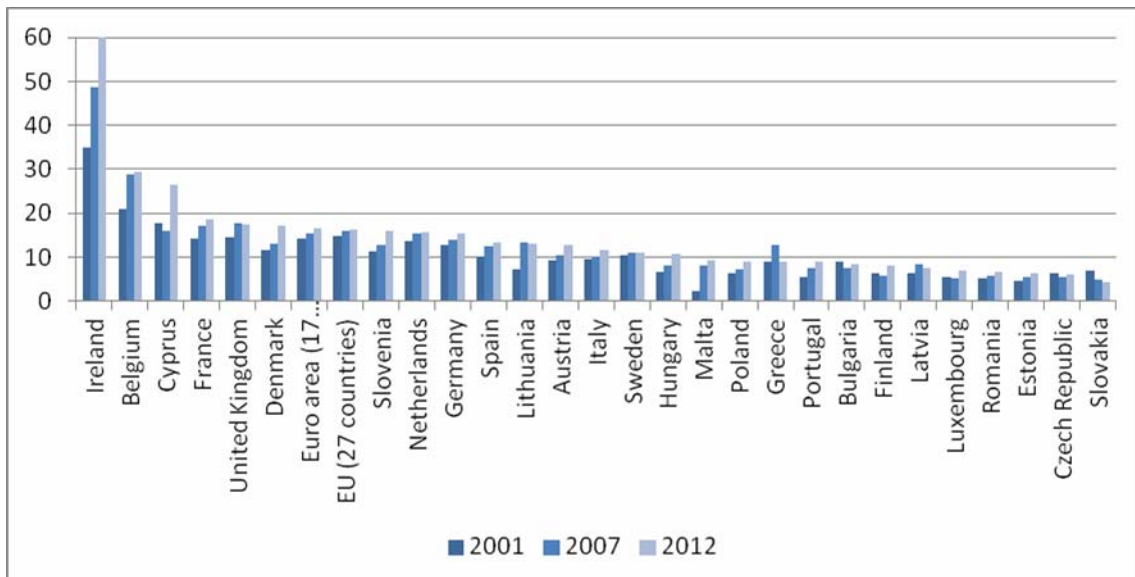


Source: Eurostat Statistical Database, 2013

Germany has a very steady IITR index which has been stagnating around 83% over the past decade, which has always been well over the EU27 mean. Greece on the other hand has always been below it but its more volatile index has been rising since the crises from under 44% in 2008 to 55% in 2012.

Figure 7 represents the composition of manufacturing exports of goods of the EU27 chemical industry in the years 2001, 2007 and 2012.

Figure 7: Composition of manufacturing exports of goods of the EU27 chemical sector in the years 2001, 2007 and 2012 (XSHM)



Source: Eurostat Statistical Database, 2013

As seen before in previous clarified indicators, Germany, The Netherlands, Belgium and Ireland are the biggest exporters of chemicals within the European Union. Their trade balance in the chemical sector for example is strongly positive, which means they export significantly more than they import. Figure 7 explains how much percentage of the total

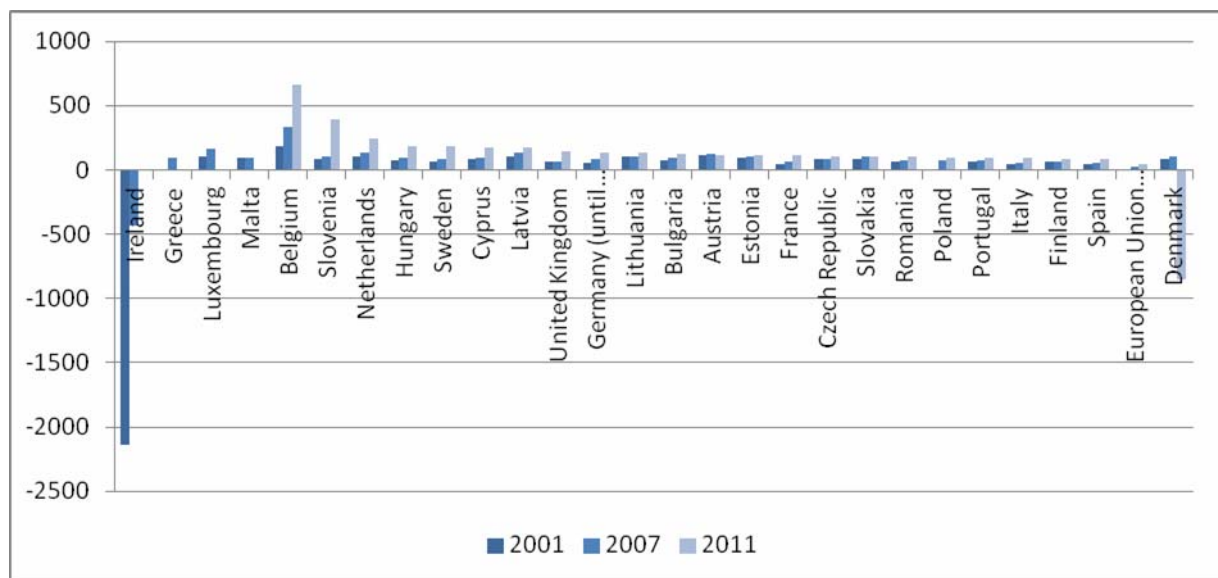
chemical production in the country is exported. The chart thus indicates that mainly Ireland, but Belgium as well, and for the last years also Cyprus, are exporting substantial parts of their total chemical production.

This tendency can mainly be explained by the surface of the countries. Ireland, Belgium and Cyprus are noticeably small countries. Due to historical and geographical advantages however, they developed a highly concentrated and specialized chemical industry. The chemicals produced by this industry are generally used in other manufacturing industries. Since the countries are relatively small and specialized in the chemical industry, the total chemical output is relatively higher than 'needed' to supplies other national industries.

Therefore a substantial part of their production can be exported and is used in other nations manufacturing industries. Germany and Netherlands for their part are bigger countries and are specialized in a wider range of manufacturing industries. This allows them to allocate more chemical output within their nation, due to higher national demand. Hence Germany and Netherlands export chemicals as well, but relatively they export less of their total production in comparison with Ireland, Belgium and Cyprus. As a side note we want to mention that for the European Union as a whole approximately 15% of the total chemical production is exported to the rest of the world, to be used in other industries.

In addition, Figure 8 illustrates the import penetration of the EU27 chemical industry in the years 2001, 2007 and 2011.

Figure 8: Import penetration of the EU27 chemical sector in the years 2001, 2007 and 2011 (MPEN)



Source: Eurostat Statistical Database, 2013

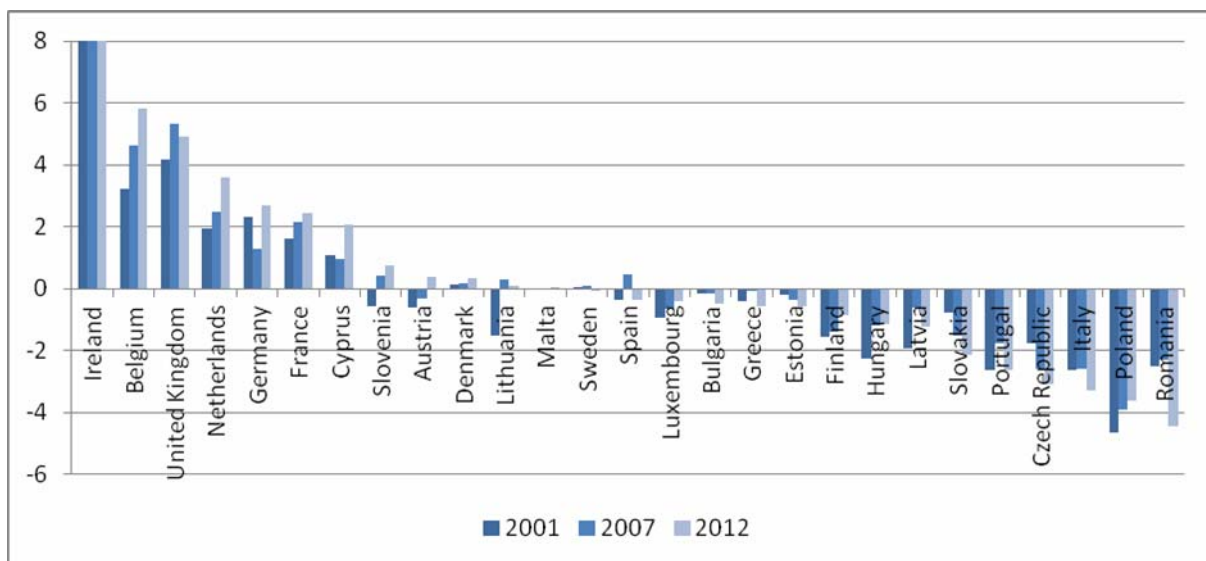
The import penetration indicator illustrates the importance of the import fulfilling the domestic demand. Unfortunately the data provided by Eurostat does not include the whole industry. Thereby it is not able to calculate the MPEN properly due to the fact that the production data of the chemical industry does not include the relevant subsectors that are included within the export and import data in the Eurostat databases. Specifically in the data

the exports of chemicals exceeds the domestic production, which of course is not possible. This results in very high and low percentages illustrated in the graph above.

Anyways, the results of the MPEN indicator show the adjusted scale in order to emphasize the other countries because some countries obtain a very high or low MPEN. Nevertheless, it has to be stressed out that for Sweden and the UK respectively the MPEN in 2007 was – 843 and – 1089 and in 2011 it was 4447 and -1630.

Furthermore, the final results of the contribution to the trade balance in European chemical sector are presented in Figure 9.

Figure 9: Contribution to the trade balance in European chemical sector in the years 2001, 2007 and 2012 (CMTB)



Source: Eurostat Statistical Database, 2013

Within the CMTB indicator authors edited the scale of the graph in order to provide a better overview of the different countries. Only Ireland has extremely high contribution to trade balance. For 2001 it was about +24 and for 2007 and 2012 it was approximately +32.

It can be noticed that Ireland has a very strong comparative advantage within the chemical sector compared to other countries. Therefore Ireland benefits of a very high structural surplus for their international trade in the chemical industry. It is also one of the biggest chemical industries and exporters of the EU27. Within the top countries of the EU27 in terms of CMTB the countries with large chemical industries and export are mainly identified. It can be pointed out that those countries are specialized in the chemical industry. As a result these chemical industries account for a great part of their trade balance.

As a middle mode, there is Spain. Spain's CMTB indicator is balancing around zero, despite the fact that Spain has a large chemical industry. This can be explained by the fact that Spain is a big importer of chemical goods. Their production is mainly used in their own manufacturing industries and the imports are used to meet national demand. These imports nullify their own industry production and export. Therefore it can be seen that Spain does not have a real comparative advantage in the chemical industry.

Observing the countries with low CTMB, it can be emphasized that the situation is getting 'worse' every year for the chemical industries trade balance of those countries. Poland however has a growing strength of her chemical industry year after year, which indicates that their chemical industry is getting a more important share in their total trade.

CONCLUSION REMARKS

As one of the largest industries globally, the European chemical industry supplies virtually all sectors of the economy, providing innovative and sustainable solutions to today's economic and environmental challenges. European chemical industry is significant in providing all manufacturing sectors, as well as the construction, health and agricultural sectors, with essential products and services.

It is wealth and employment generator for millions of European citizens over the years. In the European Union, it represents the leading manufacturing sector in terms of value added per employee. The chemical industry is benefiting from its historic advantages of innovation, long-standing customer relationships, an efficient network of SMEs and large companies and a highly-skilled workforce.

As mentioned in the introduction, the chemical sector is quite concentrated and unevenly spread in order to achieve economies of scale. Analyzing the indicators, it can indeed be seen that a small number of countries are very active in the chemical sector, such as Germany, Belgium, France, Ireland and the UK.

It is remarkable that these countries all have important and big ports. In and around these ports large concentrated chemical industry is located. This makes shipping of large amount of chemical product convenient. Hereby it is possible to achieve economies of scale for inbound and outbound transport. Skilled workforces are also pooled in the surrounding areas, making it easier to find appropriated employees.

For the coming decades, any remarkable change it is not expected. Due to the needed economies of scale to survive in this industry, countries need to invest substantially in infrastructure to enable the possibilities to achieve these economies and stimulate the growth of the chemical industry.

Historically the chemical industries have grown in Western Europe, where GDP per capita is typically larger. This gives these countries a more attractive position for the chemical industry in these countries. It is probable that due to those barriers of entry the geographical concentration of the chemical industry will remain as it is.

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