W200.2: Final Project

Section 2, Fall '17
Team 4

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1. Introduction

For our project, we chose to explore MIT's Observatory of Economic Complexity ("OEC"), a database which gathers product trade data, e.g. imports and exports of goods, by country for each year. The data is presented in absolute value of trades and divided by the products that were traded, further sliced into years.

From this data, we were aiming to look at some long-time trends that could be deciphered from ebb and flow of imports and exports in the European region, particularly in the light of major diplomatic and economic integration such as formation of European Monetary Union.

2. Questions to be Explored

The specific questions we seek to answer with this data are :

1. What is the overall trend of European countries regarding exports and imports, within the European region?
    a. Which countries have been the biggest exporters within Europe?
    b. Which countries have been the biggest importers within Europe?
    c. How have these individual countries' exports and imports looked over time?

2. Relative beneficiaries of European integration across sub-groups, including regions
    a. e.g. EMU vs EEA, PIGS and country types.

3. What has happened to the UK's exports since its joining the European market?

3. Datasets Utilized

The primary dataset used for this project was “Product Trade between Origin and Destination Country by Year (bilateral)” that tracked the trade between countries from 1962 to 2014.

The original size of the dataset was 117,815,053 rows and 6 columns but this consisted of complete 250 regions. We were mainly interested in European countries.

The main columns/features of the dataset utilised are:

Column Name	Description	dtype
year	The year in which given trade occurred	int64
origin	The three letter country code from where the trade for a certain product originated (the exported)	object
dest	The three letter country code that was the destination of said trade of product	object
sitc	The product name code that is being traded, as per **Standard International Trade Classification (SITC)**	int64
export_val	The value in US dollars ($) of trade - exported by country of origin	float64
import_val	The value in US dollars ($) of trade - imported by country of origin	float64

Apart from this dataset, a separate file is used consisting of country codes against their respective names. This file is utilised to reconcile the codes with country names and replace country names in the main dataset so that codes don’t have to be looked up for when analysing graphs. This country codes dataset has following columns:

Column Name	Description	dtype
id	Five character country code with 3 characters for country and 2 for continent	object
id_3char	Three character country code	object
name	Complete name of the country	object

4. Initial Data Cleaning & Exploration:

Data Cleaning:

The columns of interest for our purposes were year, origin, dest, export_val and import_val.

The dataset initially consisted of 117,815,053 rows and 6 columns but the number of rows would be decreased when European subset would be considered. However, a sanity check was conducted for the whole dataset before proceeding.

1. 'year' column:

The total number of unique values were checked and it was found that this column consisted of 53 unique values, which makes sense since the data is from 1962 to 2014 (both inclusive).

2. 'Origin' and 'dest' column:

This column consisted of the three-digit country codes. The unique regions represented were 250, out of which the European regions would be isolated (see next heading, 'Transformations on initial data'). It was checked if any country code exceeded three characters. Found 0 such results.

Same check was conducted for the destination column and no country code found exceeding 3 characters.

3. 'export_val' column

The column consisted of dollar amount of trade of product exported by country of origin. This value was in float64. The maximum, minimum and average value was checked.

The maximum trade for a single product in a given year was $308,300,000,000 (exported in 1980) for product sitc code 3330. That product is Crude Petroleum. Minimum value was $0 (item not exported). Average value was $2,644,242.

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4. ‘import_val’ column

Similar sanity checks were done for import column: maximum, minimum and average value was checked.

Maximum was $308,300,000,000 (imported in 1980 for product code SITC 3330). Minimum was $0 and average was $2,632,792.

Transformations on initial data:

1. Removing unwanted columns

The first step in transforming the initial dataset was to get rid of unwanted columns. For the sake of our initial analysis, we did not need product codes (as we wanted to look at just the raw export and import numbers). So a new dataframe was constructed with only the requisite columns required, removing the ‘sitc’ column.

2. Converting export and import values into billions of US dollars

Since the values for export and import were in raw US dollars ($), it was important to scale them down so that we have smaller numbers to work with. For this purpose, the raw values were divided by 1,000,000,000 to get the value in billions of dollars. The columns were divided by this number and new columns were formed as a result, called ‘export_in_bil’ and ‘import_in_bil’. The raw value columns were gotten rid of and moving forward, only the billion-dollar value columns were considered for analysis.

3. Creating European countries bloc

Since the focus of our analysis was going to be European countries, we created three lists: EU countries, the EEA bloc and one trading partner (‘Switzerland’). These three lists were combined into a big list, called ‘Total’. This big list was then utilized to compare with the country codes dataset and a ***.isin*** function was utilized to filter out only European countries, in both origin and destination. The country codes were then replaced by actual country names so that final presentation could be better, and we don’t have to look up countries by code.

4. Adding new columns

A new column was added in this dataset which calculated Net value. This value was calculated by subtracting import_in_bil from export_in_bil. This column would show who

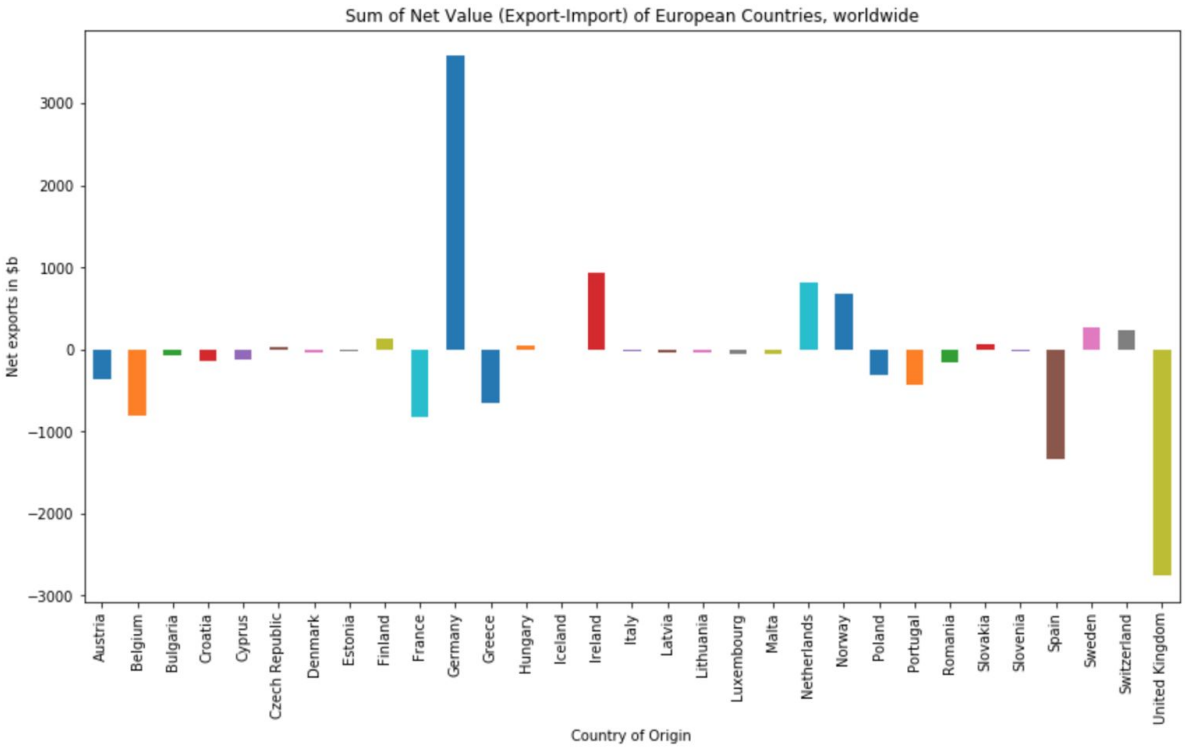
was the net importer and net exporter for any given year for any given product. Negative value would mean net import for a certain product and summing up that for the whole year would give us a glimpse for any country over the whole year.

5. Our Data Story/Results

Question No. 1: Overall trend of European Net Export

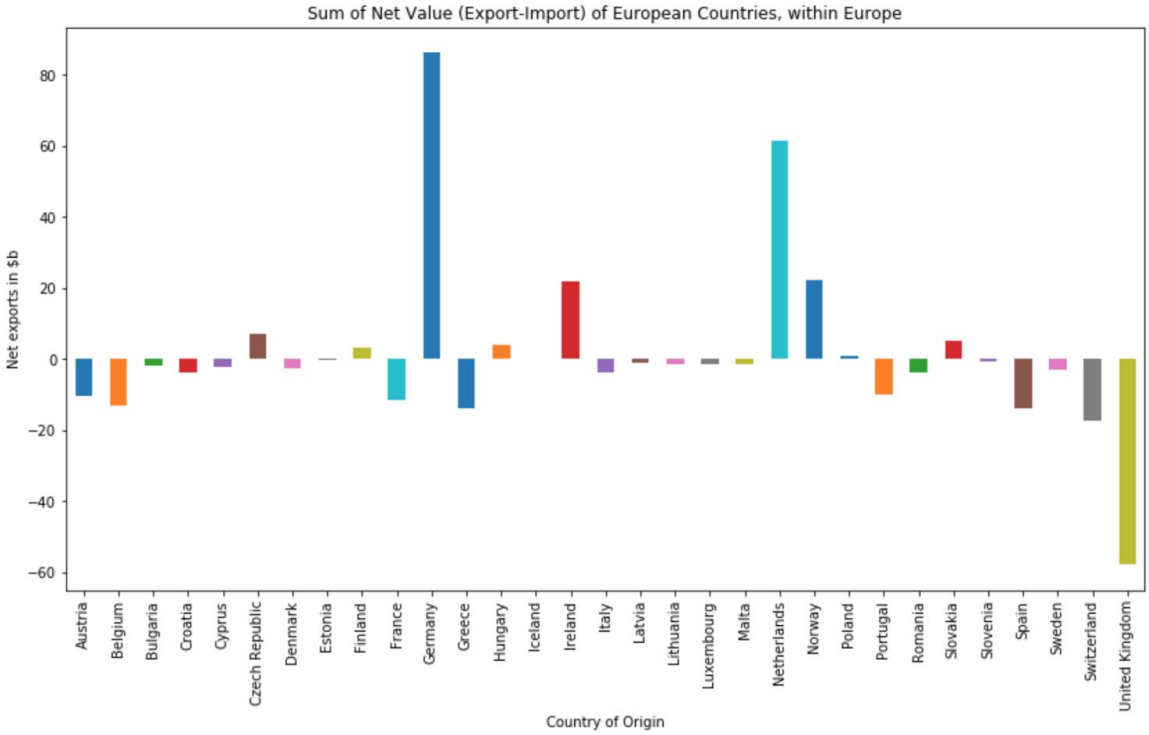
Worldwide:

The first parameter that was utilised to look into the overall trend of net imports and exports of European countries was the sum of Net values over the entire dataset timeframe (1962 to 2014). This was achieved by summing the net value of exports minus imports for all the countries for all the years, for all the products. The graph is shown below:



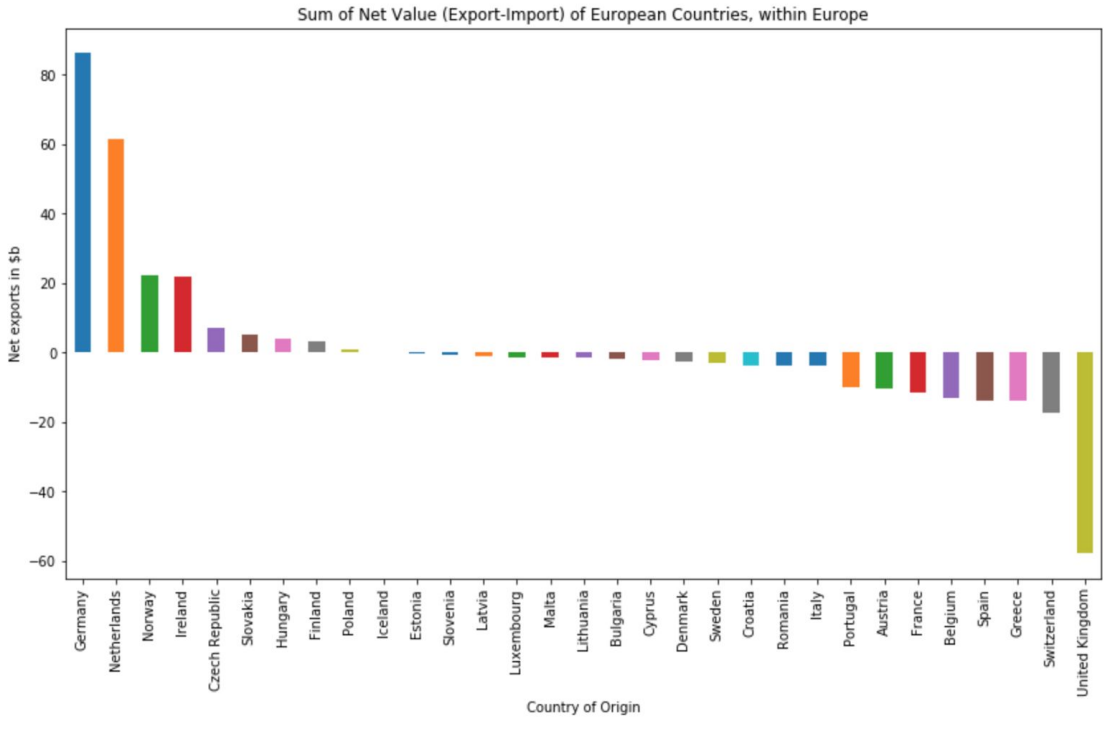
As can be seen in the graph, Germany has been the biggest exporter throughout this time period, and United Kingdom has been the biggest importer.

Within Europe:



The graph above shows the same net export data, but for trade by European countries within Europe only.
As can be seen from this chart, Germany still leads the way in terms of net exporters and UK is still the biggest overall importer.

Question No. 1, a & b: Biggest Exporters and Importers within Europe



Further digging down into the data set, and arranging it in descending order of sum of net exports, it is easy to see who are the three biggest exporters and importers within Europe, amongst the European countries.

Biggest Net Exporters: Germany, Netherlands, Norway
Biggest Net Importers: United Kingdom, Switzerland, Greece

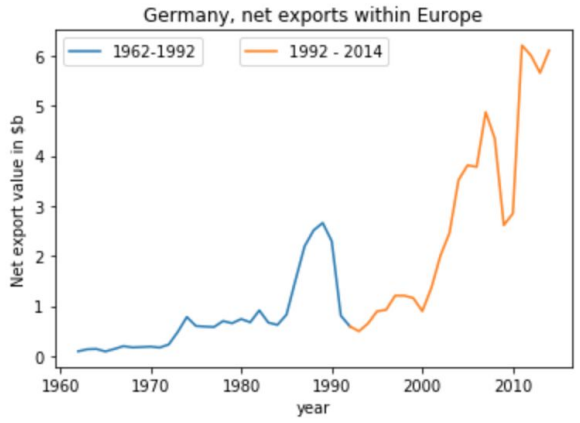
Question 1, c: Trends of Individual Countries

Now, we look how these top net exporters and importers have traded over time.
We will look at the time period from 1962 to 1992 and 1992 to 2014. 1992 was chosen because it is the year when the *Economic and Monetary Union (EMU)* was founded. This is an umbrella term for the group of policies aimed at converging the economies of member states of the European Union (EU). The policies in EMU also cover non-EU countries.
First we will look at biggest net exports

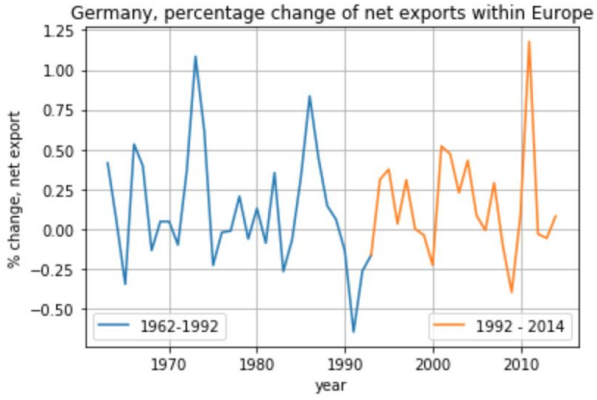
Biggest Exporters:

a) Germany

Starting from Germany, we'll be looking at net trade value (Exports-Imports).

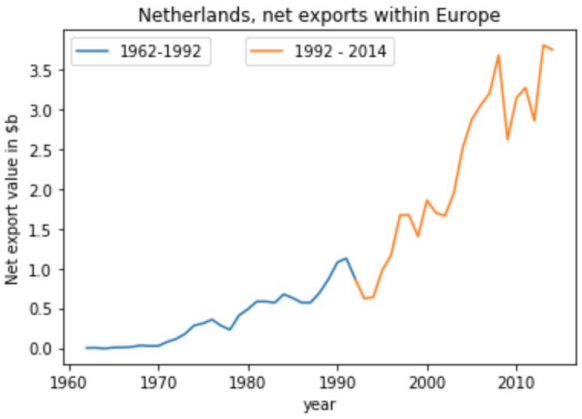


As shown in the graph, Germany had a huge uptick in net exports in recent years after a peak shown in late 1980s (possibly due to fall of Berlin Wall). Immediately afterwards, in the early 1990s there was a slight downward trend that started picking up slowly and ever since Germany has been on the rise, barring one major downward trend of net exports (mid 2000s).



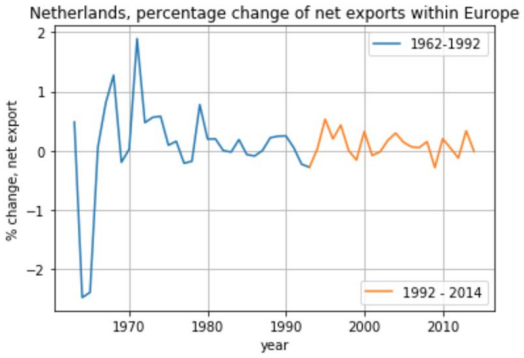
An interesting thing can be deduced from percentage change in exports data. This shows the up and down mobility of export by Germany and as can be seen that despite increasing and decreasing erratically throughout the years, mostly the percentage change has remained on the positive side, and the positives are much higher than the negatives, meaning that exports have always increased over imports.

b) Netherlands



Same analysis was applied to Netherlands, the net exports and percentage change graph was analysed, shown below:

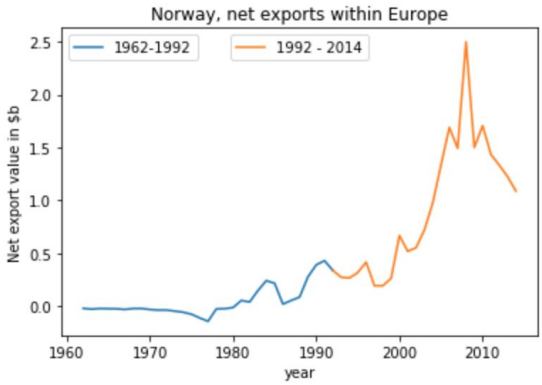
The same trend that was seen with Germany can be seen here, the net exports are on the upwards, and since 1992 and implementation of EMU, the trade has gone further up for Netherlands.



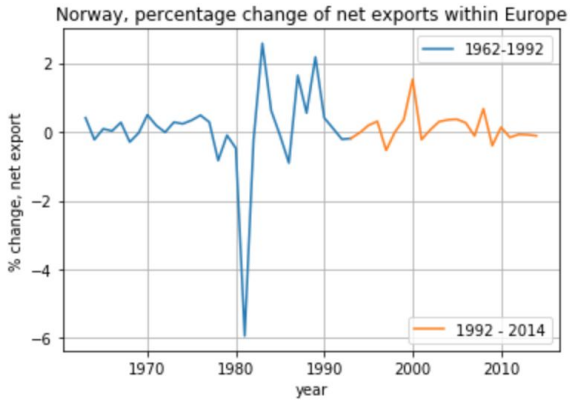
The graph for percentage change of net exports tells a similar story. More positive increase in percentage of net exports is seen as compared to negative growth, and that points towards a general increasing trend of trade.

c) Norway

Similar analysis was conducted for the third biggest net exporter, Norway.



The surprising thing about Norway that came about was that despite being historically one of the biggest net exporters in Europe, there has been a sharp decrease in net export value in recent years, as is demonstrated by the downward trend since late 2000s.

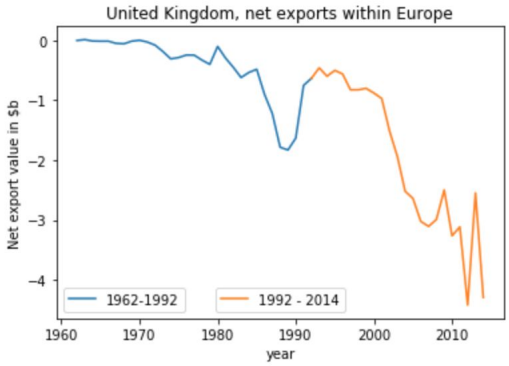


For the percentage change graph, it is evident that it recent years, the net change is veering close to 0 and even less. From a period of high percentage change from early 80s to late 80s, Norway hasn't seen a tremendous increase in net export and the trend is on the slowing end in more recent years.

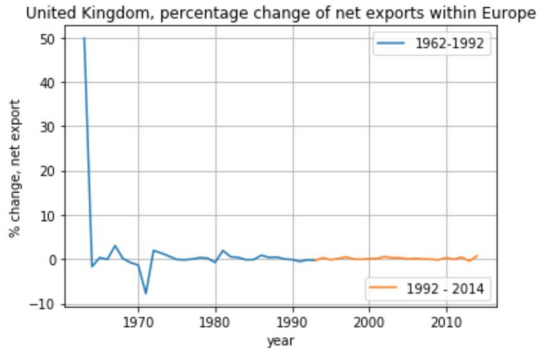
Biggest Importers:

Now we turn our attention to the three biggest importers

a) United Kingdom



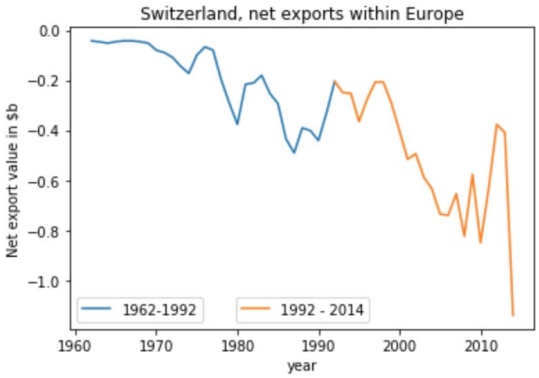
Looking at the graph of net exports of United Kingdom, it is easy to see that throughout the years, and specifically recently they have been moving towards a trend of net import. This trend has accelerated since the inception of EMU, which makes sense since the to and fro trade of goods would become much easier after that. There was a slight decrease in import from UK recently, but that did not last and now the line is again moving downwards.



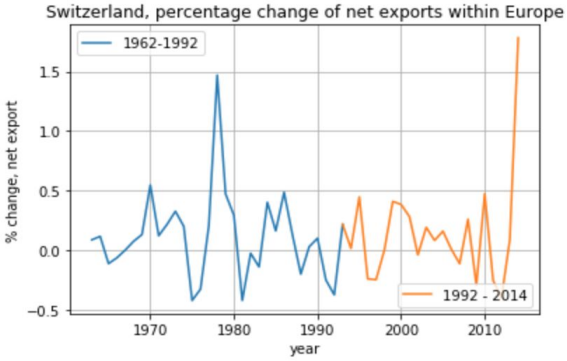
The percentage change shows a slightly less drastic picture. The spike shown in the earlier image is going from 1962 to 1963 when there was a huge increase in exports for UK, but it level off in later years, as is shown from the graph.

Even the later years from this graph show small incremental percentage changes, close to 0, while the absolute net values are decreasing much more steeply. This shows that even though the values might have been burgeoning, the relative net export wasn't as sharp as one would believe.

b) Switzerland

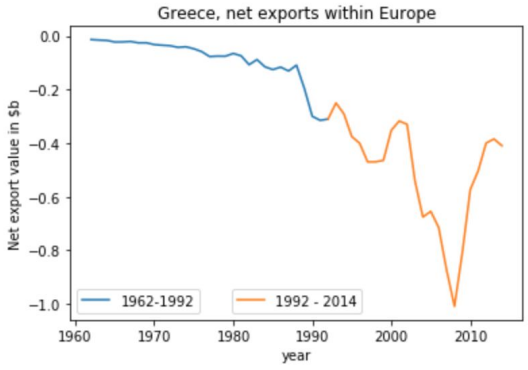


For Switzerland, a similar drastic decrease in net export is shown post-1992, with one slight spike towards late 2000s. Generally the trend has been on the increasing import side. However, the absolute values are not as big as UK's.

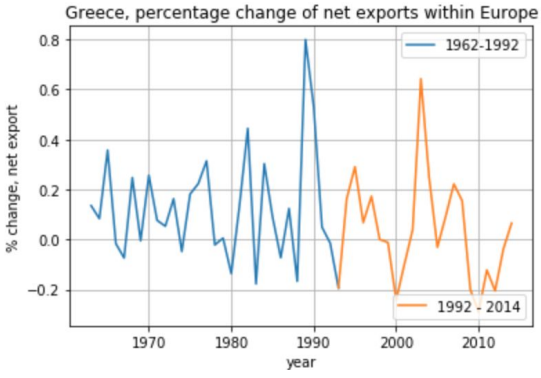


The percentage change graph shows a slightly different and more erratic picture than the simple downward trend shown by the net export values. This shows that despite being on the net importer side, the percentage change in net exports over time has been much more capricious. The average change is close to 0, but positive changes have been present throughout the trading time, both before and after 1992.

c) Greece



The story for Greece is similar, but there is a slightly different trend towards the end. Since 1992 Greece has increased its import, which is evidenced by net negative export value, however since late 2000s to up until 2014, there was a marked increase in net export value.



The percentage change in net exports graph shows a much more erratic nature with high positive changes and also considerable negative changes. Since 1992, Greece has seen spikes in positive changes in net exports, but more periods of negative exports have been around than the other way.

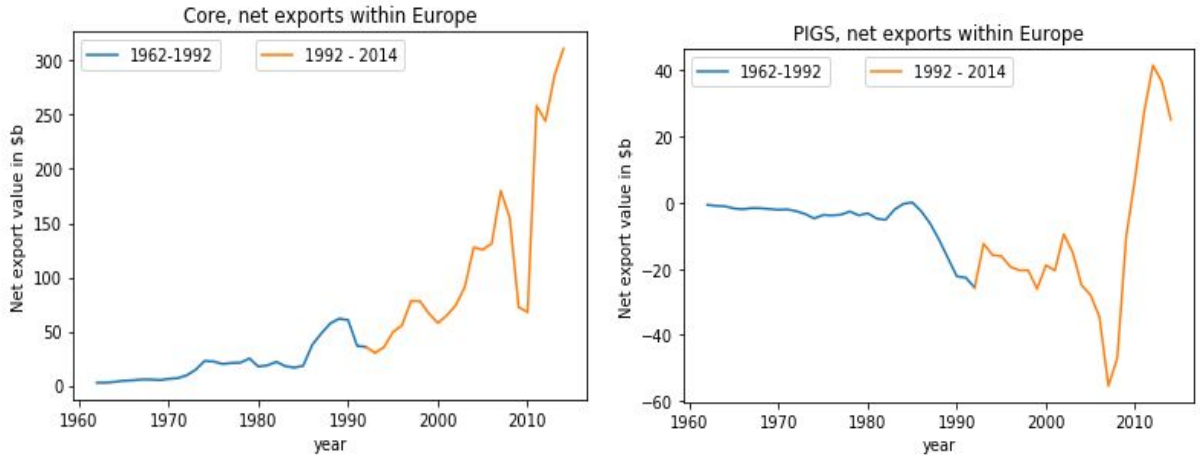
Question 2: Trends for Groups of Countries

Following on the analysis from Question 1, we seek to uncover groups of countries which may have benefited as a result of monetary integration through the EMU.

Over the past decade, there have been multiple financial "bailouts" of ***PIGS (Portugal, Ireland, Greece, Spain)*** countries by Core *(Belgium, France, Luxembourg, Italy, Netherlands, and Germany)* countries. Focusing on these country groups, we see significant changes in net exports across these groups within Europe after monetary integration.

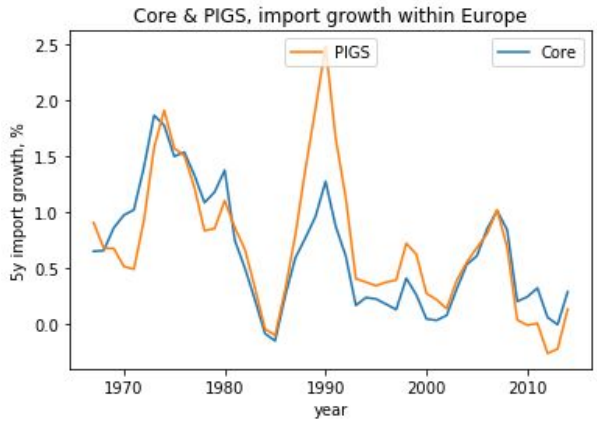
Particularly, we see that net exports grew rapidly for Core countries after the creation of the EMU while PIGS country net exports grew slowly then declined into 2009.

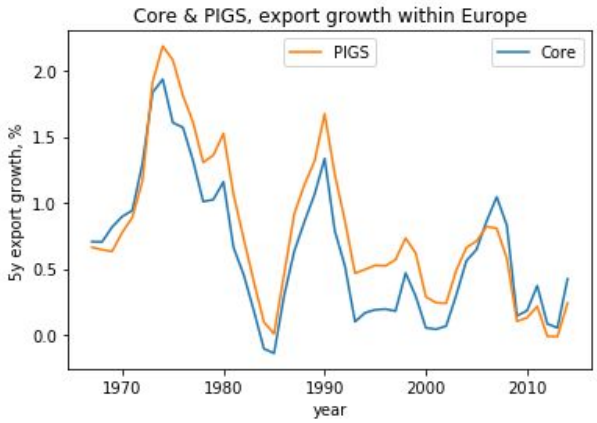
Net Exports Within Europe, Pre-Post EMU (Core and PIGS)



Looking more deeply into the causes of net export divergence, we can attribute this to the increased reliance of PIGS countries on European imports (see Exhibit below). This suggests that monetary integration may have had a perverse impact which perpetuated wealth disparity within the Union.

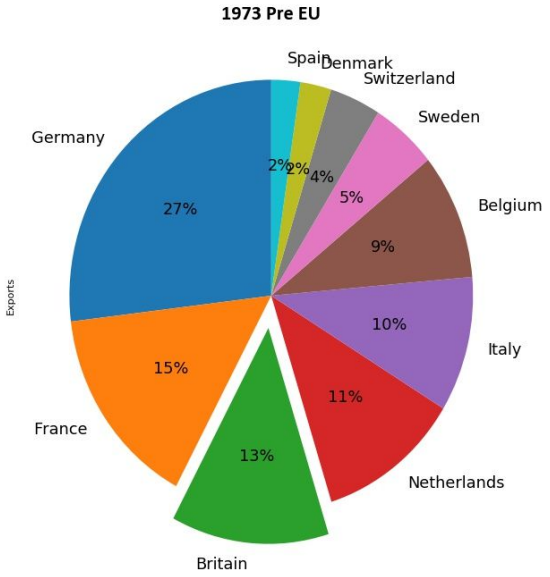
5Y % Rolling Export and Import Growth Within Europe, Core and PIGS

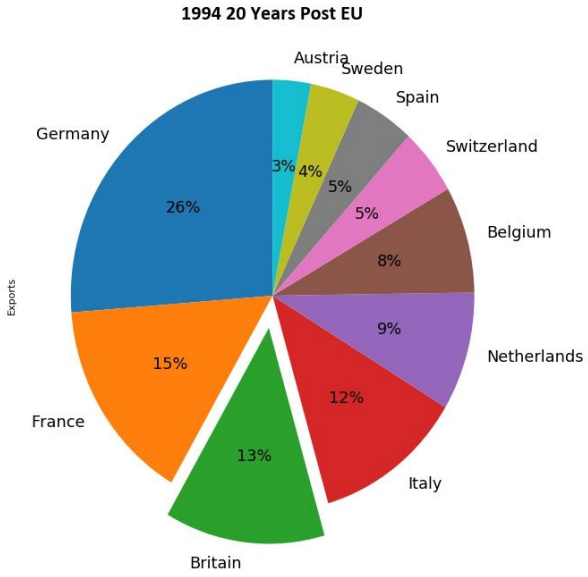




Question 3: Changes to Intra-European Trade

The UK's admission to the EU at the beginning of 1973, appears to have little impact on its trading position within the EU, indeed 20 years after the UK joined, the shares of total export remained highly consistent

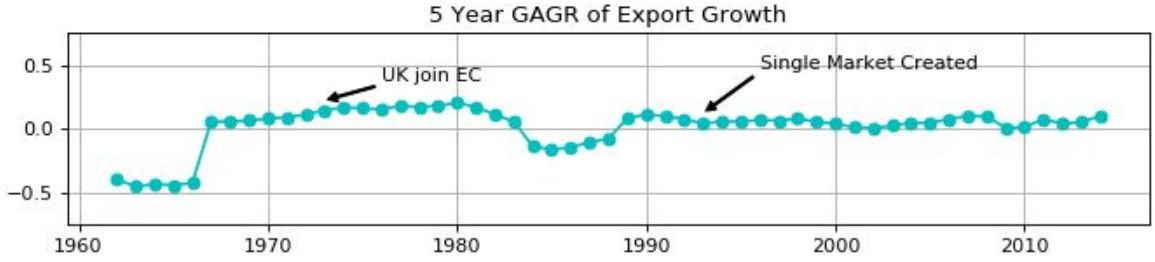




Further evidence that the UK has not benefited significantly, at least from a trade perspective for the Union: the growth rates in the UK's exports and imports did not see a significant spike after the UK joined the EC or the Monetary Union was formed.


Imports Y/Y Growth
0.5
0.0
−0.5
1960
1970
1980
1990
2000
2010


Exports Y/Y Growth
0.5
0.0
−0.5
1960
1970
1980
1990
2000
2010


5 Year GAGR of Export Growth
UK join EC
Single Market Created
0.5
0.0
−0.5
1960
1970
1980
1990
2000
2010


Net Exports-Imports Y/Y Growth
2
0
−2
1960
1970
1980
1990
2000
2010