

## **Effects of the Global Financial Crisis on the V4 – Western Europe trade relations**

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*The aim of the research is to explore the development of trade relations between the Visegrád countries and their major Western European partners since accession to the European Union. The topic is currently an important one, as the Visegrád region is highly dependent on Western European countries, especially in the area of foreign trade. The research analyzed how the 2008-2009 global economic crisis and the subsequent sovereign debt crisis in Europe affected these trade relationships, i.e. did it cause significant changes in levels of relationship and/or trends. To answer this question, this paper used a time-series analysis method called Interrupted Time Series Analysis. As a result, statistically significant changes in the level and trend of foreign trade relations between the Visegrád countries and their Western European partners were detected. Finally, a more detailed breakdown of product groups also revealed which product groups are most responsible for slowing down the growth of trade relations.*

*Keywords: Visegrád, trade, export, crisis*

### **1. Introduction**

One of the most-cited facts of international economics is that international trade grew much faster than global GDP in the last few decades, until the global financial crisis in 2008–2009. Since then, the growth rate of international trade cannot exceed the growth rate of the global production. This paper aims to analyze the foreign trade relations of the Visegrád countries in the context of “trade slowdown”. The subject of this paper is the international trade of the Visegrád region with the EU-15, the so-called old member states. The reason for this is the fact that the vast majority of exports and imports of the Visegrád countries head to and come from this region, even though the role of Asian countries – especially China – is becoming more and more important. In the first part of the paper, I collect the most relevant literature and its findings in this topic. In the second part of the paper, I present the methodology and its results in connection with the slowdown of trade growth between the Visegrád countries and the EU-15 region. After this, I present the trade profiles of the Visegrád countries and identify the main product groups that are responsible for the sluggish trade growth of the region. In the last section, I present my conclusion with respect to the literature and the empirical findings, as well as the limitations of the study.

## **2. Background**

Global trade growth has slowed significantly since the global financial crisis. During the crisis there was a sharp collapse, and shortly after it recovered to its pre-crisis level, but since then the yearly average growth of trade has not been able to reach pre-crisis figures. Between 1985 and 2007, global trade grew twice as fast as global output, but after the crisis the growth of global trade has not been able to exceed the growth of global output (IMF 2017). There is still no consensus in the literature about the factors and especially their weights underlying this sluggish trade growth. It is quite clear however, that both cyclical (short term) and structural (long term) factors have contributed to the phenomenon.

### *2.1. Cyclical factors*

The first and foremost cyclical factor that the literature identifies is the weak demand in advanced economies after the crisis period (Constantinescu et al. 2015, Ollivaud and Schweltnus 2015). For example, in the US and the Eurozone, GDP levels are respectively 8% and 13% lower than would be suggested by historical average growth rates, which causes a 20% deviation from the trend in import volumes in both areas (Constantinescu et al. 2015). In addition to weak demand, private investment has been subdued in advanced and emerging economies since the global financial crisis and the European debt crisis (IMF 2015). Another short-term factor is uncertainty, as emphasized by Taglioni and Zavačka (2013). They employ a VAR model to estimate the effects of uncertainty. Their findings show that the negative effect of uncertainty on trade is higher for trade relationships more focused on durable goods. Conversely, countries specialized in non-durable and investment goods are not affected by uncertainty. A recent study of the European Central Bank claims that financial frictions may also play an important role in the trade slowdown after the global financial crisis. It states that the finance-trade nexus may involve both cyclical and structural effects. The cyclical component involves variations in financing conditions and the availability of trade finance. The study concludes that tighter financial conditions do indeed have a restrictive effect on international trade, especially in the most credit-dependent sectors. However, there is hardly any evidence of long term – structural – effects (ECB 2016).

### *2.2. Structural factors*

An important factor is the changes in the pace of income convergence across countries. In particular the faster income convergence after 2000 may explain the rapid expansion of world trade, and the slowdown of the convergence after the global financial crisis may eliminate this driver (Constantinescu et al. 2015). Another important factor is the changes in the composition of world income, such as the relative importance of investment and consumption. Constantinescu et al. (2015), Boz et al. (2014), Bank of Japan (2016) argues that the decline in investment – which is the most trade-intensive component of GDP – may be one possible explanation for lower trade growth after the GFC.

In addition, changes in the composition of world trade can also explain some of the sluggish trade growth in the recent years. Constantinescu et al. (2015) emphasizes that the relative changes between durable and non-durable goods may have also contributed to the slowdown of world trade. Another main cause of the slower trade growth is the slower pace of expansion of global value chains. Like Constantinescu et al. (2015), Bank of Japan (2016) states, as production fragmented internationally in the 1990s, there was a rapid surge of trade in parts and components, but this has decelerated in the 2000s. Crozet et al. (2015) employs gravity modeling to analyze the effect of global value chains on recent trade slowdown, and their estimation results suggest that while global value chains used to boost trade growth significantly before the crisis, this effect vanished after 2008.

A recent study of the European Central Bank finds that, for example, major car manufacturers have reduced their domestic production and shifted production towards export markets, which again dampens international trade growth (ECB 2016). Last but not least, the changes in international trade regime, namely the renaissance of protectionism, is another significant part of the slow trade growth. According to the European Central Bank, trade growth in the 1990s and 2000s was boosted by widespread trade liberalization policies and tariff reductions. Average tariff rates decreased by three-quarters to less than 10 percent among emerging economies and halved to below 2.5 percent among advanced economies. The study also mentions that in the future there will be less room to boost trade growth by these measures. The study also emphasizes that non-tariff measures are on the rise. These non-tariff measures such as export subsidies, domestic clauses in public procurement and restrictions on licensing, technology transfer, and FDI restrict or distort trade flows, however, their effect is often hard to quantify precisely (ECB 2016). Constantinescu et al. (2019) measures the effect of the trade war between the USA and China. The study shows that the so called “tit-for-tat” tariffs between the world biggest economies alone accounted for about 2 percent of world merchandise trade. They also point out that increasing tariffs between the USA and China not only reduces trade but is also diverting it (mirroring trade creation versus trade diversion in the case of reducing tariffs).

### **3. Impact of the 2008–2009 global economic crisis on the European Union and the Visegrád region**

The size of the decline in world trade for 2009 has been widely estimated by various international organizations (WTO – 9%, World Bank – 9.7%, OECD – 16.5%, 32% in the first quarter of 2009). However, there is no argument in the literature that European Union trade was hit particularly hard by the global financial crisis. Furthermore, this effect was different in magnitude among the member states. The biggest drop in trade volume was in the “new member states”, i.e. Central and Eastern European countries (in which we there was a 30-40 percent decline). This is due to the fact that during the years preceding the crisis, these countries were highly integrated into the value chains of the European Union, significantly increasing intra-industry trade in semi-finished products. As a result, the Central and Eastern European countries were highly dependent on the performance of the EU-15, in

particular Germany (Curran et al. 2009). In addition, the global automotive sector in the last quarter of 2008 and the first quarter of 2009 suffered the largest decline of all industries (–14% in Q4 2008 and –49% in Q1 2009) (Escaith 2009). Trade between the Visegrád countries and the EU-15 increased dynamically between 2001 and 2018. However, the period October 2008–December 2012 was characterized by turbulence, which was clearly a sign of the global financial crisis that started in the United States and resulted in the subsequent European debt crisis. It is thus clear that after the initial shock, the impact of the crisis on intra-regional trade was prolonged in the European Union. In addition, it is almost impossible to isolate the effects of the crisis and the existing literature usually does not undertake it.

#### 4. Methodology

The research methodology is based on the Interrupted Time Series Analysis (ITSA) method. In ITSA, the dependent variable is observed several times before and after a certain event/intervention. Prior to the analysis, the event/intervention is expected to interrupt the level (i.e., time series mean) and/or trend (slope of the time series fitted to the time series) of the dependent variable, thereby causing a structural break (Linden 2016). One of the main assumptions for most statistical models is that the observations are independent and uncorrelated (see the Gauss-Markov theorem for OLS). However, this assumption is almost always violated in the vast majority of time series. The closer the observations are to each other in time, the more likely they are not independent of each other i.e. they are autocorrelated (Wooldridge 2013). The most commonly used method for filtering out the effect of autocorrelation is to incorporate its effect into the model. By doing this we can estimate the effect of the examined intervention (the effect of GFC on trade) by controlling the effect of autocorrelation. Thus an Autoregressive Moving Average (ARMA) model will be employed in this paper which was developed by Box and Jenkins (White 1985, Velicer and Fava 2003).

Instead of OLS, the models will be estimated with generalized least squares (GLS). I use the UN COMTRADE and Trademap.org databases for the analysis. The time series range from January 2004 to November 2018 on a monthly basis. The crisis period is defined – in accordance with the main literature on the topic – from October 2008 to December 2012. By removing the crisis period from the time series, the models still have 116 observations each.

The employed model in general form is the following:

$$x_t = \alpha_0 + \beta_1 time_t + \beta_2 level + \beta_3 trend_t + \sum_{i=1}^p \alpha_i x_{t-i} + u_t + \sum_{i=1}^q \phi_i u_{t-i} \quad (1)$$

$x_t$ : dependent variable

$\beta_0$ : intercept

$\beta_1$ : the slope before the crisis

$\beta_2$ : dummy variable, which is 0 before the crisis and 1 after the crisis; post crisis difference in level

$\beta_3$ : post crisis slope

$\alpha, \phi$ : coefficients of delayed variables and residual terms

$p, q$ : values of delays (based on the ACF and PACF correlograms)

$u_t$ : residual.

Altogether eight parallel cases will be investigated, specifically: exports and imports of Hungary; exports and imports of Slovakia; exports and imports of the Czech Republic; exports and imports of Poland.

## 5. Hypotheses

In line with the methodology, the hypotheses to be tested is as follows:

- H1. The global economic crisis has caused a significant change in the level of trade of all Visegrád countries with the EU-15.
- H2. The global economic crisis has caused a significant change in trends in trade relations between the Visegrád countries and the EU-15, both statistically and economically.

## 6. Results

### 6.1. Hungary: Export

According to the model, in the case of Hungarian exports all variables are highly significant. The Level variable shows the percentage point decrease in trade after the crisis as a result of the GFC, assuming that without the crisis event, international trade would have grown at the same pace as in the pre-crisis period. As can be seen, the estimated percentage change is quite high for the Level variable. As Wooldridge suggests, at this magnitude the  $\% \Delta y \approx 100 \Delta \log(y)$  approximation is inaccurate. To fix this issue we need a correction which is the following:  $\% \hat{\Delta} y = 100 [e^{\hat{\beta}_2} - 1]$ . This correction will be also necessary in the following subsections. Accordingly, in January 2013 the total value of exports to the EU-15 was 39.329 percentage points lower than would have been possible without the crisis event. The Time variable shows an average increase of 0.8443 percentage points in total exports to the EU-15 from one month to another before the crisis. The Trend variable is intended to represent the difference between the pre-crisis and the post-crisis trend. This means that the post-crisis trend is 0.3094 percentage points lower than before the crisis. The total value of exports to the EU-15 increased by 0.5349 percentage points. The vertical dashed line (at October 2008) marks the beginning of the crisis, while the gray area represents the whole crisis period until January 2013. The red dashed line is the so-called counterfactual, which illustrates how the value of exports would have developed without the crisis event. From Appendix: Figure A-3 to A-10 it is shown, how the level of export and import values and the trend of export and import value growth have decreased as a result of the crisis event.

Table 1

AIC	<b>-456.6377</b>
BIC	<b>-409.8267</b>
Observations	<b>116</b>

Source: own construction

Table 2

HU_exp_TRADE	Value	Std. Error	p-value
Intercept	14.779788	0.008562353	0
Time	0.008443	0.000335554	0
Level	-0.499706	0.025509907	0
Trend	-0.003094	0.000370079	0

Source: own construction

## 6.2. Hungary: Import

The imports of Hungary from the EU-15 show a similar picture. The output of the model shows that in January 2013 the total value of imports were 41.8 percentage points lower than would be assumed without the crisis event. Before the crisis, the total value of imports increased by a monthly average of 0.8108 percentage points while after the crisis it decreased by 0.2570 to 0.5538 percentage points.

Table 3

AIC	<b>-450.4257</b>
BIC	<b>-428.397</b>
Observations	<b>116</b>

Source: own construction

Table 4

HU_imp_TRADE	Value	Std. Error	p-value
Intercept	14.721849	0.01318058	0
Time	0.008108	0.00049181	0
Level	-0.541324	0.03806909	0
Trend	-0.002570	0.00055441	0

Source: own construction

### 6.3. Slovakia: Export

In the case of Slovakia, the total value of exports in January 2013 was 59.9267 percentage points lower than would be assumed without the crisis. The total value of exports increased by a monthly average of 1.8362 percentage points. This fell to 0.5291 percentage points after the crisis.

Table 5

AIC	<b>-315,2538</b>
BIC	<b>-301,4859</b>
Observations	<b>116</b>

Source: own construction

Table 6

SK_exp_TRADE	Value	Std. Error	p-value
Intercept	13.912452	0.01837486	0
Time	0.018362	0.00069566	0
Level	-0.914460	0.05359075	0
Trend	-0.013071	0.00077918	0

Source: own construction

### 6.4. Slovakia: Import

The imports of Slovakia after the crisis were 50.2896 percentage points lower than the assumed time series without the crisis. The average monthly increase during the pre-crisis period was 1.4341 percentage points, which fell to 0.6721 percentage points after the crisis.

Table 7

AIC	<b>-347.851</b>
BIC	<b>-334.083</b>
Observations	<b>116</b>

Source: own construction

Table 8

SK_imp_TRADE	Value	Std. Error	p-value
Intercept	13.826834	0.01596627	0
Time	0.014341	0.00060448	0
Level	-0.698958	0.04656604	0
Trend	-0.007620	0.00067705	0

Source: own construction

### 6.5. Czech Republic: Export

Czech exports to the EU-15 were 47.00 percentage points lower in January 2013 than they would have been without the crisis. The monthly increase in the total value of exports was 1.2970 percentage points on average before the crisis and 0.655 percentage points on average after the crisis.

Table 9

AIC	<b>-442.7692</b>
BIC	<b>-420.7405</b>
Observations	<b>116</b>

Source: own construction

Table 10

CZ_exp_TRADE	Value	Std. Error	p-value
Intercept	14.978221	0.01276760	0
Time	0.012970	0.00047857	0
Level	-0.635022	0.03698864	0
Trend	-0.006420	0.00053843	0

Source: own construction

### 6.6. Czech Republic: Import

Total imports of the Czech Republic from the EU-15 were 44.2475 percentage points lower in January 2013 than would have been assumed without the crisis. The average monthly growth rate before the crisis was 1.0288 percentage points, which fell to 0.5988 percentage points after the crisis.

Table 11

AIC	<b>-500.4292</b>
BIC	<b>-478.4005</b>
Observations	<b>116</b>

Source: own construction

Table 11

CZ_imp_TRADE	Value	Std. Error	p-value
Intercept	14.979866	0.02092231	0
Time	0.010288	0.00073924	0
Level	-0.584249	0.05823508	0
Trend	-0.004300	0.00085053	0

Source: own construction



### 6.7. Poland: Export

Polish total exports of goods to the EU-15 were 44.475 percentage points lower after the crisis period than the counterfactual. Before the crisis, exports of goods increased by a monthly average of 1.3341 percentage points. After the crisis, this fell to a monthly average of 0.7174 percentage points.

Table 12

AIC	<b>-376.1413</b>
BIC	<b>-345.8518</b>
Observations	<b>116</b>

Source: own construction

Table 13

PL_exp_TRADE	Value	Std. Error	p-value
Intercept	15.090480	0.01491915	0
Time	0.013341	0.00055353	0
Level	-0.588337	0.04292549	0
Trend	-0.006167	0.00062542	0

Source: own construction

### 6.8. Poland: Import

Total imports of goods of Poland were 57.556 percentage points lower in January 2013 than the estimated value of the assumed crisis-free time series. The average growth rate of total pre-crisis imports was 1.488 percentage points per month. After the crisis, this fell to a monthly average of 0.6376 percentage points.

Table 14

AIC	<b>-446.6457</b>
BIC	<b>-410.849</b>
Observations	<b>116</b>

Source: own construction

Table 15

PL_imp_TRADE	Value	Std. Error	p-value
Intercept	15.211827	0.01521324	0
Time	0.014880	0.00052361	0
Level	-0.856983	0.04151546	0
Trend	-0.008504	0.00060791	0

Source: own construction

## **7. Summarized results**

According to the results, Hungary's trade in goods was the least affected by the 2008–2009 global financial crisis and the European sovereign debt crisis, both on the export and import side. However in Hungary, the pre-crisis average monthly growth rate was also the lowest among the Visegrád countries. Exports and imports of goods of Slovakia, the Czech Republic, and Poland increased at a higher average rate and thus the crisis also caused a greater change in levels and trends, assuming that the pre-crisis growth rate would have been the same had the crisis not occurred.

Slovakia had the highest monthly average export growth rate in the Visegrád region before the crises. However, the crisis hit the level and growth rate of exports of goods of Slovakia the most. Thus Slovakia ranked from first to last in terms of the average monthly growth rate of exports of goods to the EU-15 among the Visegrád countries. From January 2013 Poland had the highest average monthly growth rate of exports of goods to the EU-15.

Commodity trade in the Czech Republic was also significantly reduced by the crisis on both the export and the import side, yet it is characterized by an average decline compared to other countries in the Visegrád region.

In terms of the region's imports of goods, Poland recorded the highest monthly average growth rate in the pre-crisis period. Nevertheless, the crisis caused the highest decline in the case of Poland in terms of level and trend change. Still, Poland's post-crisis growth rate of imports of goods is the second highest in the Visegrád region, topped only by Slovakia. The summarized results are shown on the following table:

## **8. Main partners and trade composition of the Visegrád countries**

The Visegrád countries are highly open regarding their export/ GDP ratio. Based on the databases of Eurostat and UN COMTRADE, the export/GDP ratios of the Visegrád countries are shown on Appendix: Figure A-1. The export share in GDP of Hungary, Slovakia, and the Czech Republic rose similarly from 56.5%, 59%, and 50% in 2001 to 78.5%, 89%, and 82.5% in 2018, respectively. The export/GDP ratio of Poland also rose significantly from 18.5% to 44.5% during this period. It is important to emphasize that Poland is an exceptional case in the Visegrád region both in terms of land area and population and thus in most economic indicators. For example, its nominal GDP is higher than that of the other three Visegrád countries combined. Thus, although Poland has a lower share of total exports and imports relative to GDP, it is nominally the largest exporter and importer of the region. Germany is by far the biggest trade partner of the Visegrád countries accounting for about 22–32 percent of total exports and 20–26 percent of total imports in all cases. In fact the value of trade between Germany and the Visegrád region exceeded the value of trade between Germany and France by about 71.4 percent in 2018. As a result, the economic performance of the region is highly dependent on the performance of the German economy. In the past 10 years, the V4 economies have benefited greatly from the prosperity of the German economy. Through manufacturing and the automobile industry, the expansion of German multinational

companies has led to a major development in the Visegrád region. However, as the researchers of the Hungarian Institute of Foreign Affairs and Trade claim, the real question in the future will be the extent to which the Visegrád countries can surpass their current „assembly plant” role, relying on their own development, R&D capacity, and education systems (Tulok et al. 2018).

According to the data of the International Trade Centre (Appendix: Table A-1) for the year 2018, it is quite clear that the EU-15 represents more than 50% (in the case of the Czech Republic it is even about 60%) of the total trade (exports and imports combined) of the Visegrád countries. In the case of Slovakia, the second biggest trading partner is the Czech Republic which is not a surprise considering the common history of the two countries. However, for the Czech Republic although Slovakia is the third biggest trading partner, it is not as significant as the other way around. Another interesting fact is that in the case of the Czech Republic and Poland, China appears to be among the top five trading partners, but it is mainly because of its strong position on the imports side. In the following section I will focus on the trade relations of the Visegrád countries with the EU-15 since as it was proved, it represents more than half of all trade in value. According to the database of the International Trade Centre, the Visegrád countries have a very similar pattern of foreign trade (Appendix: Table A-2). The three biggest commodity categories, namely *Electrical machinery and equipment and parts thereof, sound recorders and reproducers, television ...; machinery, mechanical appliances, nuclear reactors, boilers, parts thereof; and vehicles other than railway or tramway rolling stock, and parts and accessories thereof* are identical. In the case of Hungary and Slovakia these three commodity groups accounted for more than 30% of total exports and more than 25% of total imports. In the case of the Czech Republic they accounted for more than 35% of total exports and about 20% of total imports. As for Poland, these ratios are a bit smaller, 24 percent and 18 percent respectively. Considering the trade relations of these countries only with the EU-15, it can be stated that exports and imports are even more concentrated around these commodity groups. A more detailed breakdown of product groups reveals that Hungary exports to the EU-15 mainly spark-ignition reciprocating or rotary internal combustion piston engine, and vehicles with spark-ignition internal combustion reciprocating piston engine of a cylinder capacity more than 1,500 cm<sup>3</sup> but not more than 2,500 cm<sup>3</sup>. Furthermore, automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form, and machines for processing such data represents a significant role among export products. The most imported products include parts of internal combustion piston engines and parts of passenger cars with the above mentioned parameters and electronic integrated circuits and parts thereof.

Slovakia mainly exports television projections and passenger cars with a cylinder capacity of more than 1,000 cm<sup>3</sup> but not more than 1,500 cm<sup>3</sup> and of 1,500 cm<sup>3</sup> but not more than 2,500 cm<sup>3</sup>. Its largest import products are the parts and gearboxes needed for the industrial assembly of the aforementioned vehicles and their accessories and telephone sets, incl. telephones for cellular networks or for other wireless networks; other apparatus for the transmission or reception of voice, images

or other data, incl. apparatus for communication in a wired or wireless network [such as a local or wide area network]; and parts thereof.

The most exported products of the Czech Republic - similarly to Slovakia - are passenger cars with a cylinder capacity of more than 1,000 cm<sup>3</sup> but not more than 1,500 cm<sup>3</sup>, and passenger cars with a cylinder capacity of more than 1,500 cm<sup>3</sup> but not more than 2,500 cm<sup>3</sup>, and parts and accessories of these products. In addition, vehicles with a cylinder capacity of up to 1,000 cm<sup>3</sup>, which is the power category most typical of motorcycles, can be found among the most exported products. The largest import products are electronic integrated circuits, components for the industrial assembly of the aforementioned power vehicles and automatic data-processing machines and units thereof, magnetic or optical readers, machines for transcribing data onto data media in coded form, and machines for processing such data.

As for Poland, the largest export products are vehicles with a cylinder capacity of more than 1,000 cm<sup>3</sup>, but not more than 1,500 cm<sup>3</sup>, as well as television projectors and automatic data processing machines (e.g. laptops, notebooks) weighing less than 10 kg. The largest import products are passenger cars with a cylinder capacity of more than 1,500 cm<sup>3</sup> but less than 2,500 cm<sup>3</sup> and with a cylinder capacity of more than 1,000 cm<sup>3</sup> but not more than 1,500 cm<sup>3</sup>. Furthermore, parts of internal combustion piston engines and parts of passenger cars with the above mentioned parameters represent a significant part of the imports.

## 9. How did trade relations alter as a result of the crises?

The Bank of Japan (Nakajima et al. 2016), created a comprehensive study of the effects of the global financial crisis on world trade. One part of the study deals with the sectoral pattern of the trade slowdown across countries. As for geographical areas, they analyzed China, Japan, ASEAN, the US, the UK, Latin America, the Euro zone, and the G7. According to their study, there was a significant slowdown in every product category they analyzed. The study compared the pre-crisis growth trends to the post-crisis growth trends and the conclusion was that capital goods (except transport equipment), intermediate goods, and consumer goods (durable) exhibited the largest slowdowns.

Following up on this study I have created an analysis of the Visegrád countries' trade relations with the EU-15 (from Appendix: Figure A-11 to A-18). The greater the downward deviation from the 45-degree line revealed by a goods category, the more it contributes to the slowdown of trade after the crisis (2013–2018), compared with the pre-crisis period (2002–2007). The size of the dots represents the percentage share of the given commodity group in the total trade. Although the study of the Bank of Japan created their own product categories, in this study I used the Harmonized Commodity Description and Coding System (HS), which is used by the International Trade Centre from which the database was downloaded. I analyzed the ten most exported and imported commodity groups (2-digit classification) in the case of each Visegrád country.

In the case of the exports of Hungary the biggest decrease was exhibited by the *pharmaceutical products* group and the *optical, photographic, cinematographic,*

*measuring, checking, precision, medical or surgical...* commodity groups. The other product groups showed a moderate slowdown and the *vehicles other than railway or tramway rolling stock, and parts and accessories thereof* category even showed an acceleration after the crisis. On the import side there was no acceleration in the case of any commodity group in the top ten. The biggest deceleration was in the *aluminium and articles thereof* and the *mineral fuels, mineral oils and products of their distillation; bituminous substances* product categories.

The case of Slovakia is an interesting one. On the export side all of the top ten product groups showed a slowdown. Especially the *electrical machinery and equipment and parts thereof; sound recorders and reproducers, television...* product group revealed a deceleration, as the second most exported product category of Slovakia. But also the most exported product group e.g. *vehicles other than railway or tramway rolling stock, and parts and accessories thereof* category showed a significant slowdown. However, on the import side, the situation is rather mixed. The most imported product group e.g. *electrical machinery and equipment and parts thereof; sound recorders and reproducers, television...* product group growth rate showed a significant acceleration as well as the *furniture; bedding; mattresses, mattress supports, cushions and similar stuffed furnishings* product group. The *machinery, mechanical appliances, nuclear reactors, boilers; parts thereof* commodity group growth rate also seemed to accelerate after the crises. Nevertheless the other product groups' growth rate decreased significantly, especially the *iron and steel* and *optical, photographic, cinematographic, measuring, checking, precision, medical or surgical...* commodity groups.

In the case of exports of the Czech Republic to the EU-15, the only commodity group that showed an accelerated growth rate after the crisis was the *furniture; bedding; mattresses, mattress supports, cushions and similar stuffed furnishings* product group. All the other commodity groups including the three major ones decelerated significantly. On the import side, the second most imported commodity group e.g. *electrical machinery and equipment and parts thereof; sound recorders and reproducers, television...* product group growth rate accelerated slightly. Huge deceleration was revealed by the *mineral fuels, mineral oils and products of their distillation; bituminous substances*, and the *iron and steel* product categories.

In the case of Polish exports, the only product group that accelerated after the crises was the *wood and articles of wood; wood charcoal* group. A huge decrease was shown by the *meat and edible meat offal* commodity group. On the import side, the *electrical machinery and equipment and parts thereof; sound recorders and reproducers, television...* product group revealed acceleration and also the *pharmaceutical products* group accelerated slightly. The greatest decrease was showed by the *mineral fuels, mineral oils and products of their distillation; bituminous substances* and *iron and steel* product categories.

## **10. Conclusion**

This paper examined the trade relations of the Visegrád countries with the EU-15 and the impact of the 2008–2009 global financial crisis and the subsequent European sovereign debt crisis on these relations. Two closely related research questions have been formulated in this context. The first one is whether the crises have caused a significant change in the level and trend of trade relations of the examined regions. The other is which product groups are the most responsible for the slowdown. The paper synthesized the existing literature and contributed to it by approaching the problem with a relatively unusual methodology. In addition to this, the geographical area analyzed is also rarely examined in the broader literature.

In the paper it was shown that the global financial crisis caused a significant (both statistically and economically) level and trend decrease in the trade relations of the Visegrád region with the EU-15. In terms of commodity exports Slovakia revealed the most serious negative effects. In the case of imports of goods, Poland had the highest level and trend decline. In the region, Hungary had the least negative effects, and the Czech Republic revealed average deceleration of trade growth. Thus, both hypotheses were justified.

A more detailed breakdown of product groups has been also analyzed in order to show how the top ten most traded commodity groups contributed to the slowdown of trade. It has been revealed that apart from one or two exceptions, all the commodity groups show a deceleration in growth rate as a result of the crises. The only exception in this question was the case of the imports of Slovakia, where in addition to significant decelerations there were also significant accelerations. This finding confirms the first part of the paper, where my model showed that the growth rate of imports of Slovakia decreased the least among the Visegrád countries.

## **11. Limitations of the study**

The most striking limitation of the research is the assumption that without the crises, foreign trade would have grown at the pre-crisis growth rate. This assumption is due to the nature of the methodology, but there is no econometric model that does not make any preliminary assumptions. However, this assumption only threatens the validity of the “level” difference, it has nothing to do with the „trend” change.

Another limitation is that I did not control for price effects when I analyzed the specific commodity groups’ contribution to the total trade slowdown in the second part of this paper. This is due to the fact that there is no such data I could have used for that correction. In most studies inflation or some kind of price indices are used, but in my opinion these methods do not solve the problem either.

## References

- Wooldridge, J., M. (2013): *Introductory Econometrics: A Modern Approach*, 5th Edition. South-Western, Cengage Learning, Mason, USA, ISBN-13: 978-1-111-53104-1.
- Linden, A. (2016): Threats to validity in single-group interrupted time series analysis. *J. Eval. Clin. Pract.* 2017, 23, 413–418. <https://doi.org/10.1111/jep.12638>.
- Tulok, P. – Sáringer, J. – Perényi, Zs. – Remete, B. – Márky, Z. (2018): *A visegrádi négyek jelentősége, struktúrája és értékei*. Külügyi és Külgazdasági Intézet, Budapest, Magyarország, ISBN 978-963-7039-48-5.
- Constantinescu, C. – Mattoo, A. – Ruta, M. (2015): *The global trade slowdown*. In *The Global Trade Slowdown: A New Normal?*, ed.: Bernard Hoekman, VoxEU.org eBook, Centre for Economic Policy Research (CEPR).
- Ollivaud, P. – Schwellnus, C. (2015): *Does the post-Crisis weakness of global trade solely reflect weak demand?* In *The Global Trade Slowdown: A New Normal?*, ed.: Bernard Hoekman, VoxEU.org eBook, Centre for Economic Policy Research (CEPR).
- International Monetary Fund (2015): *World Economic Outlook: Uneven Growth—Short- and Long-Term Factors*. ISBN: 978-1-49837-8-000, Washington (April).
- Taglioni D. – Zavacka V. (2013): *Innocent Bystanders – How foreign uncertainty shocks harm exporters*. European Central Bank, Working Paper Series No. 1530, April 2013.
- ECB (2016): *Understanding the weakness in global trade – What is the new normal?* European Central Bank, Occasional Paper Series, No. 178, September 2016.
- Nakajima, J. – Takatomi, K. – Mori, T. – Ohyama, S. (2016): *Slow Trade: Structural and Cyclical Factors in Global Trade Slowdown*. BOJ Reports & Research Papers, International Department, Bank of Japan, December 2016.
- Boz, E.- Bussière, M. – Marsilli, C. (2014): *Recent slowdown in global trade: Cyclical or structural?* In *The Global Trade Slowdown: A New Normal?*, ed.: Hoekman, B. VoxEU.org eBook, Centre for Economic Policy Research (CEPR).
- Crozet, M. – Emlinger, C. – Jean, S. (2015): *On the gravity of world trade's slowdown*. In *The Global Trade Slowdown: A New Normal?*, ed.: Hoekman, B. VoxEU.org eBook, Centre for Economic Policy Research (CEPR).
- Velicer, W. F. – Fava, J., L. (2003): *Time Series Analysis*. In Schinka, J. – Velicer W. F. (Eds.), *Research Methods in Psychology* (581–606). Volume 2, *Handbook of Psychology* (I. B. Weiner, Editor-in-Chief.). John Wiley & Sons, New York.
- Curran, L. – Escaith, H. – Hallaert, J-J. – Barfield, C. – Evenett, J. S. – Koopmann, G. (2009): *The impact of the financial and economic crisis on world trade and trade policy*. *Intereconomics*, 44, 5, 264–293, October, 2009.
- Escaith, H. (2009): *Trade Collapse, Trade Relapse and Global Production Networks: Supply Chains in the Great Recession*. MPRA Paper No. 18274., Munich University, Germany.
- White, J., B. (1985): *The assessment of intervention effects in time series processes*. University of Massachusetts.  
[https://scholarworks.umass.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=2605&context=dissertations\\_1](https://scholarworks.umass.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=2605&context=dissertations_1) (2019.02.05).

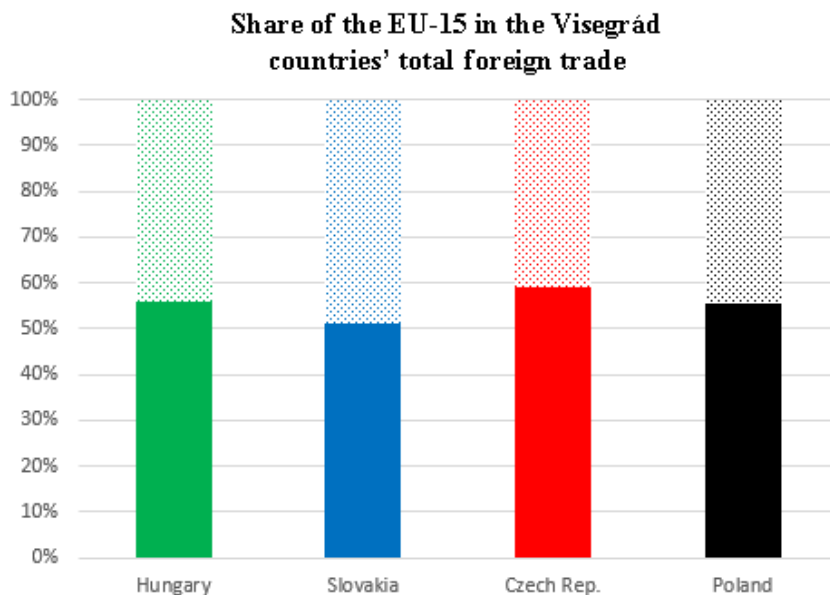
**Appendix**

Figure A-1 Exports of goods as % of GDP in the case of the Visegrád countries



Source: www.trademap.org

Figure A-2 Share of the EU-15 in the Visegrád countries' total foreign trade in 2018



Source: www.trademap.org



*Table A-1 Main trade partners and their shares in total trade of the Visegrád countries, based on 2018 data*

<b>Hungary</b>		
<b>No.</b>	<b>Partner country</b>	<b>% in total</b>
1.	Germany	26.63%
2.	Austria	5.40%
3.	Slovakia	5.08%
4.	Poland	4.97%
5.	Italy	4.94%
<b>Slovakia</b>		
<b>No.</b>	<b>Partner country</b>	<b>% in total</b>
1.	Germany	21,06%
2.	Czech Republic	13,83%
3.	Poland	7,24%
4.	France	5,15%
5.	Italy	4,60%
<b>Czech Republic</b>		
<b>No.</b>	<b>Partner country</b>	<b>% in total</b>
1.	Germany	30.25%
2.	Poland	7.44%
3.	Slovakia	6.60%
4.	China	5.06%
5.	Netherlands	4.76%
<b>Poland</b>		
<b>No.</b>	<b>Partner country</b>	<b>% in total</b>
1.	Germany	25.24%
2.	China	6.32%
3.	Russia	5.22%
4.	Czech Republic	4.87%
5.	Italy	4.82%

Source: [www.trademap.org](http://www.trademap.org)

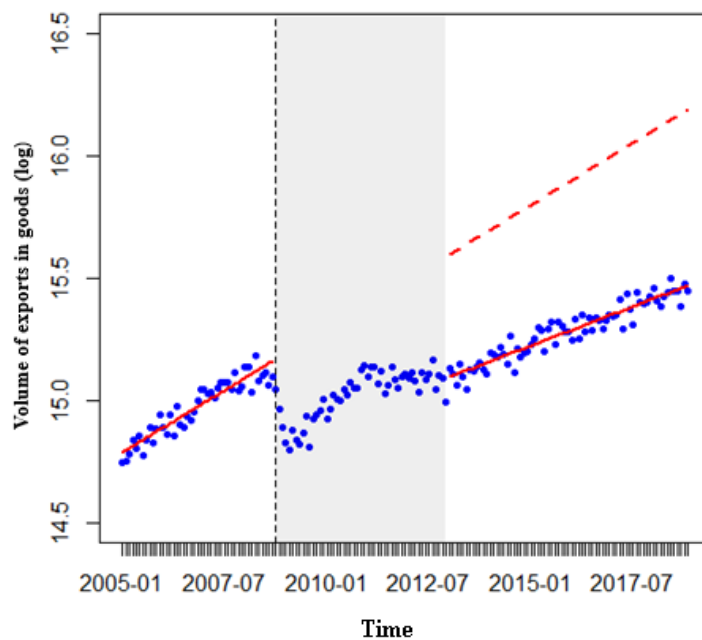
Table A-2 Most exported and imported commodities of the Visegrád countries by HS 2-digits categories, based on 2018 data

<b>Hungary</b>					
<b>Export</b>			<b>Import</b>		
<b>Product label</b>	<b>Value</b>	<b>%of total</b>	<b>Product label</b>	<b>Value</b>	<b>%of total</b>
Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	13,410,580	12.78	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	10,421,463	10.48
Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	11,994,334	11.43	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	9,235,574	9.29
Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	10,850,653	10.34	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	6,654,162	6.69
Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical ...	2,514,396	2.39	Plastics and articles thereof	3,132,661	3.15
Pharmaceutical products	2,099,144	1.99	Pharmaceutical products	3,089,302	3.11
<b>Slovakia</b>					
<b>Export</b>			<b>Import</b>		
<b>Product label</b>	<b>Value</b>	<b>%of total</b>	<b>Product label</b>	<b>Value</b>	<b>%of total</b>
Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	15,648,922	19.59	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	8,226,547	10.32
Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	8,479,628	10.62	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	7,023,045	8.81
Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	5,666,476	7.09	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	4,936,311	6.19
Rubber and articles thereof	1,339,195	1.68	Plastics and articles thereof	1,783,714	2.24
Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral ...	1,304,360	1.63	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral ...	1,721,031	2.16

Czech Republic					
Export			Import		
Product label	Value	%of total	Product label	Value	%of total
Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	23,504,980	13.71	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	12,079,726	7.71
Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	23,076,358	13.46	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	10,323,094	6.59
Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	20,929,018	12.20	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	9,522,399	6.08
Articles of iron or steel	4,076,397	2.38	Plastics and articles thereof	5,570,768	3.56
Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; ...	3,634,739	2.12	Iron and steel	2,949,659	1.88
Poland					
Export			Import		
Product label	Value	%of total	Product label	Value	%of total
Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	17,777,565	8.02	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	15,770,839	6.96
Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	17,715,486	7.99	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	14,703,195	6.49
Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	15,944,714	7.19	Plastics and articles thereof	9,336,171	4.12
Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; ...	8,633,668	3.89	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	9,226,613	4.07
Plastics and articles thereof	7,103,881	3.20	Iron and steel	4,809,560	2.12

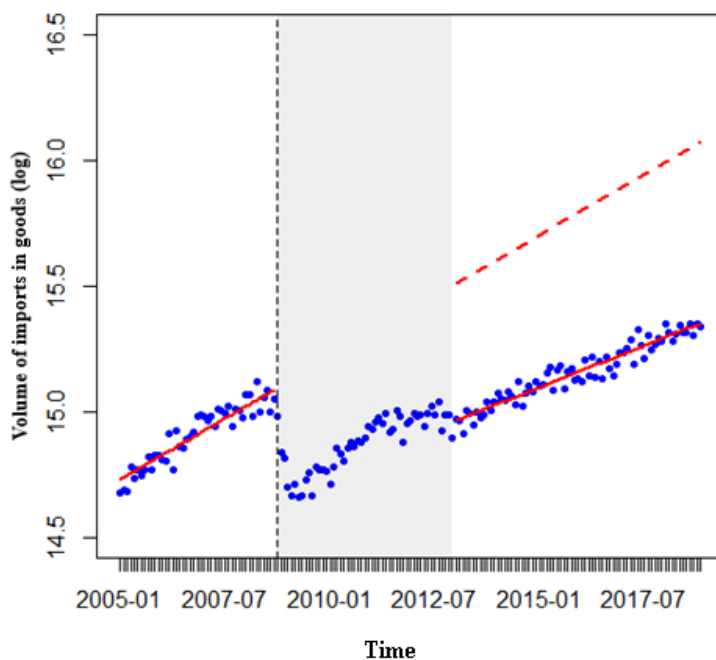
Source: [www.trademap.org](http://www.trademap.org)

Figure A-3 Exports of Hungary and the applied Interrupted Time Series Model



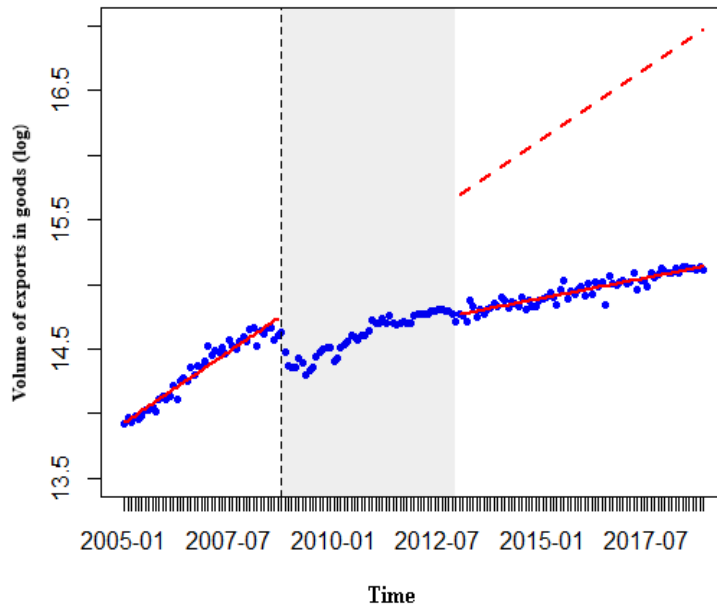
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Figure A-4 Imports of Hungary and the applied Interrupted Time Series Model (R plot)



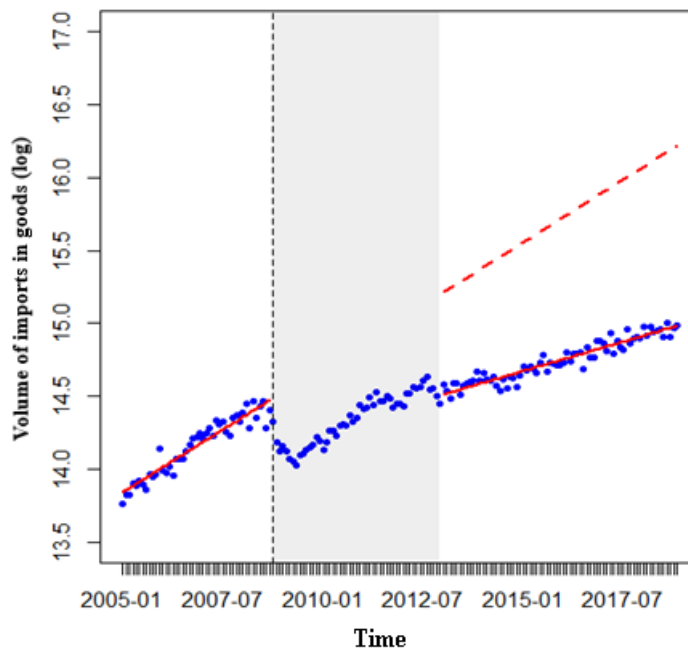
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Figure A-5 Exports of Slovakia and the applied Interrupted Time Series Model (R plot)



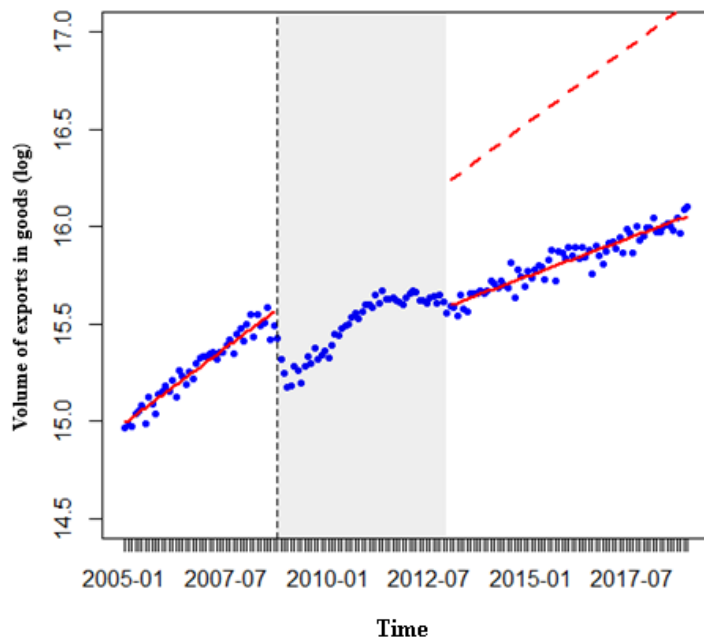
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Figure A-6 Imports of Slovakia and the applied Interrupted Time Series Model (R plot)



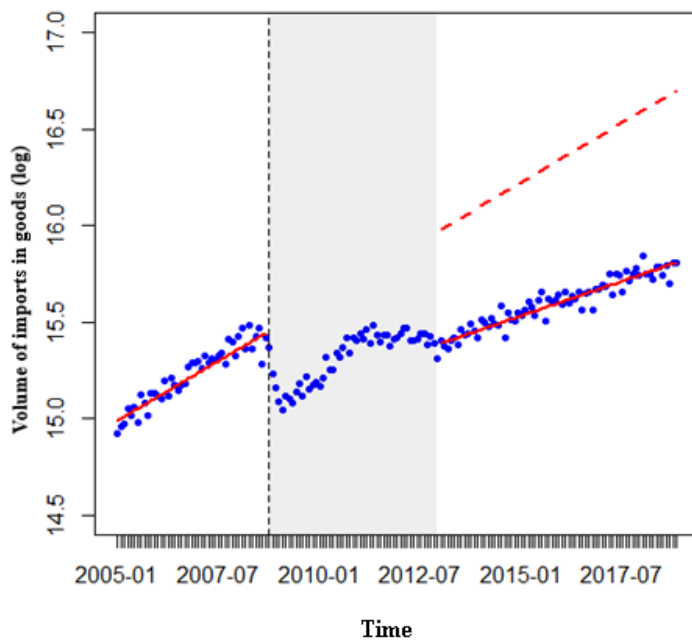
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Figure A-7 Exports of the Czech Republic and the applied Interrupted Time Series Model (R plot)



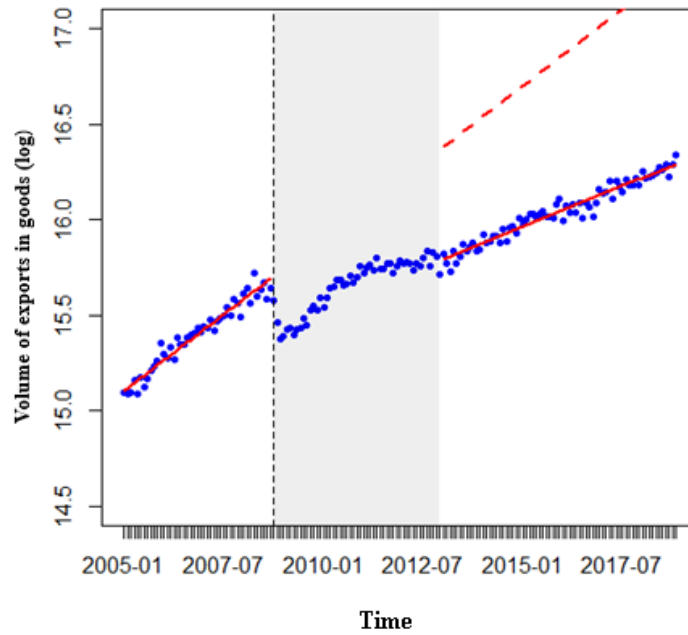
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Figure A-8 Imports of the Czech Republic and the applied Interrupted Time Series Model (R plot)



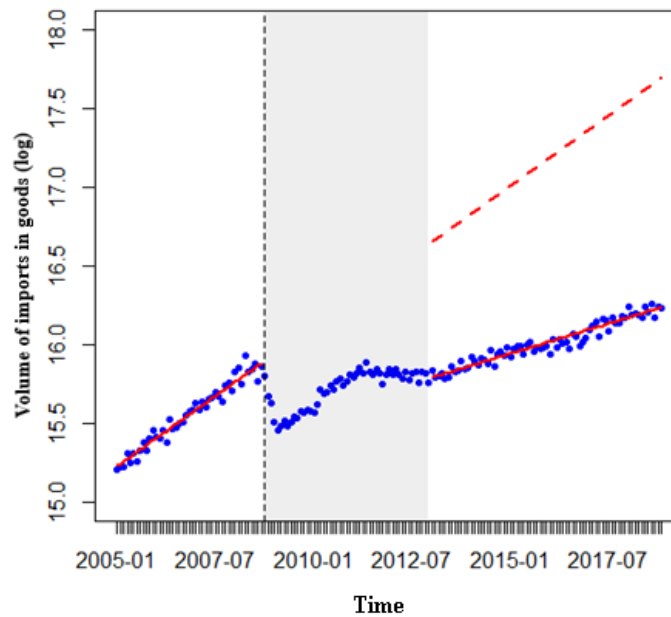
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Figure A-9 Exports of Poland and the applied Interrupted Time Series Model (R plot)



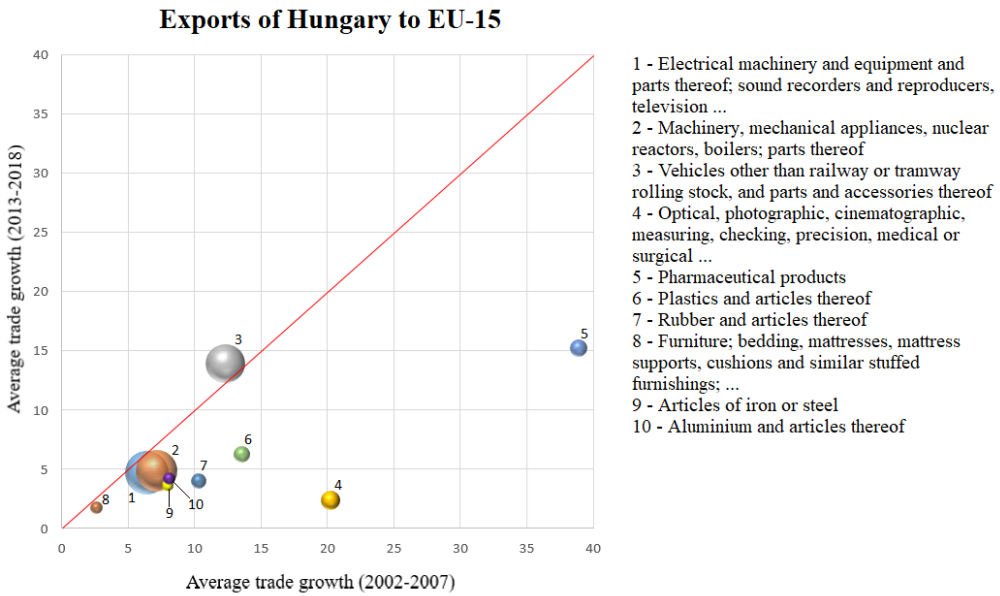
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Figure A-10 Imports of Poland and the applied Interrupted Time Series Model (R plot)



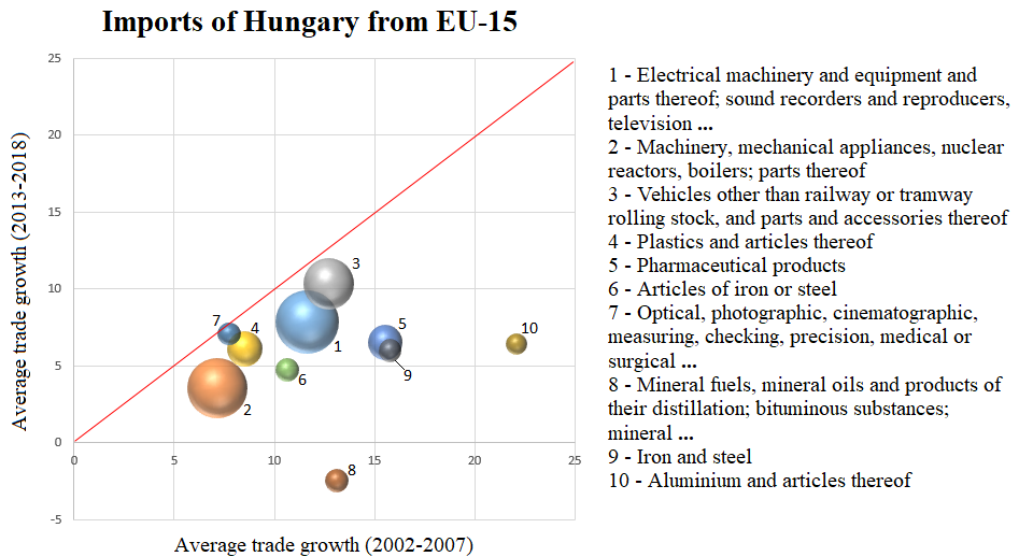
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Figure A-11 Contribution of the 10 most exported commodity groups at HS 2 digits level to the trade slowdown of Hungary



Source: www.trademap.org

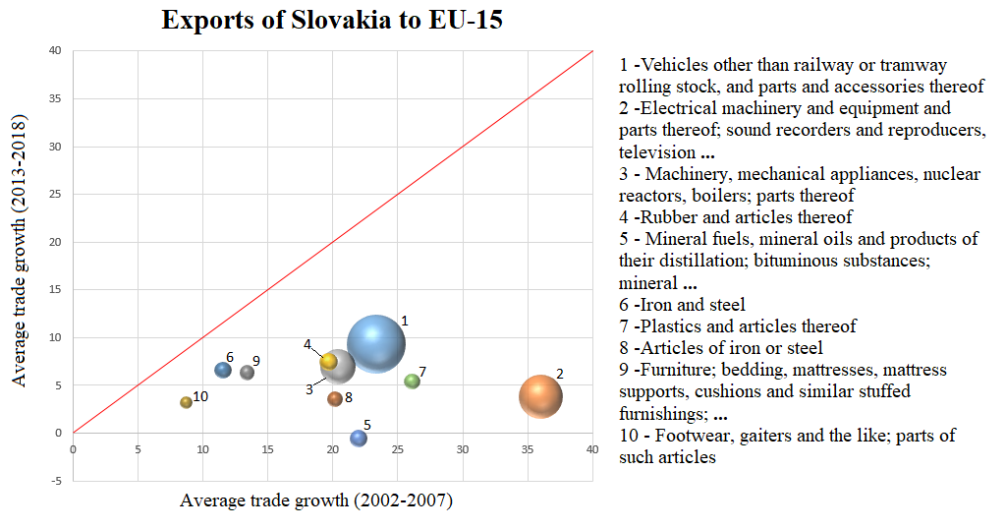
Figure A-12 Contribution of the 10 most imported commodity groups at HS 2 digits level to the trade slowdown of Hungary



Source: www.trademap.org

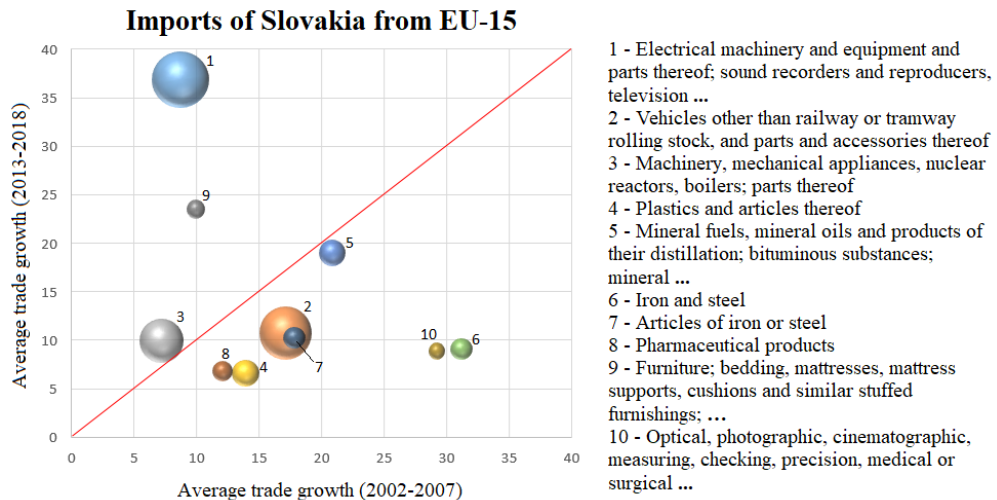


Figure A-13 Contribution of the 10 most exported commodity groups at HS 2 digits level to the trade slowdown of Slovakia



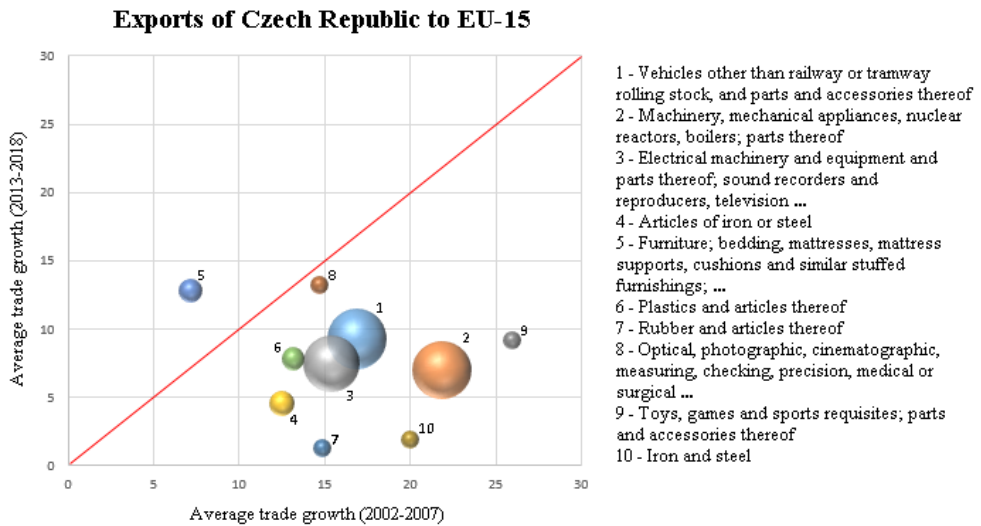
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Figure A-14 Contribution of the 10 most imports commodity groups at HS 2 digits level to the trade slowdown of Slovakia



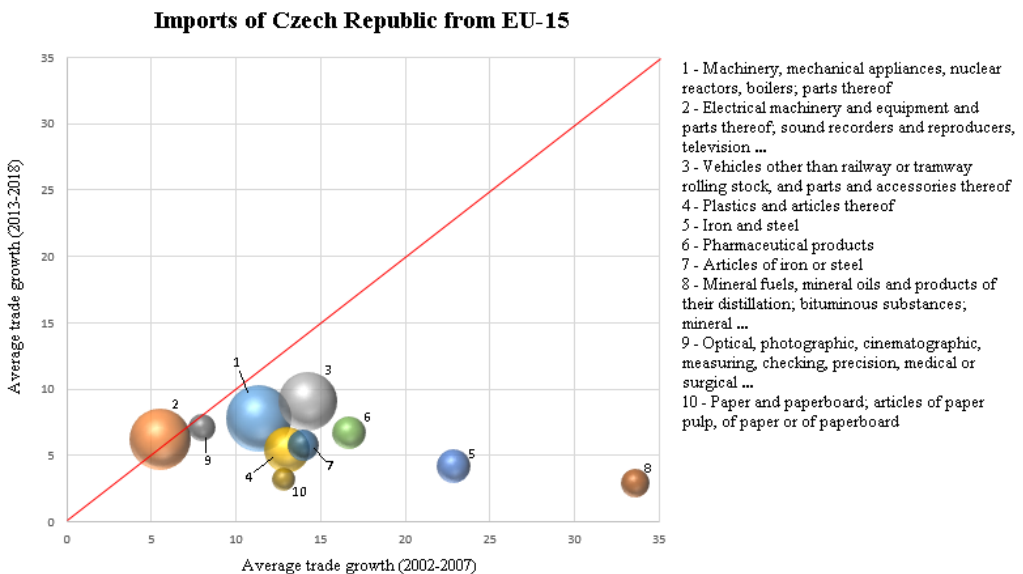
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Figure A-15 Contribution of the 10 most exported commodity groups at HS 2 digits level to the trade slowdown of the Czech Republic



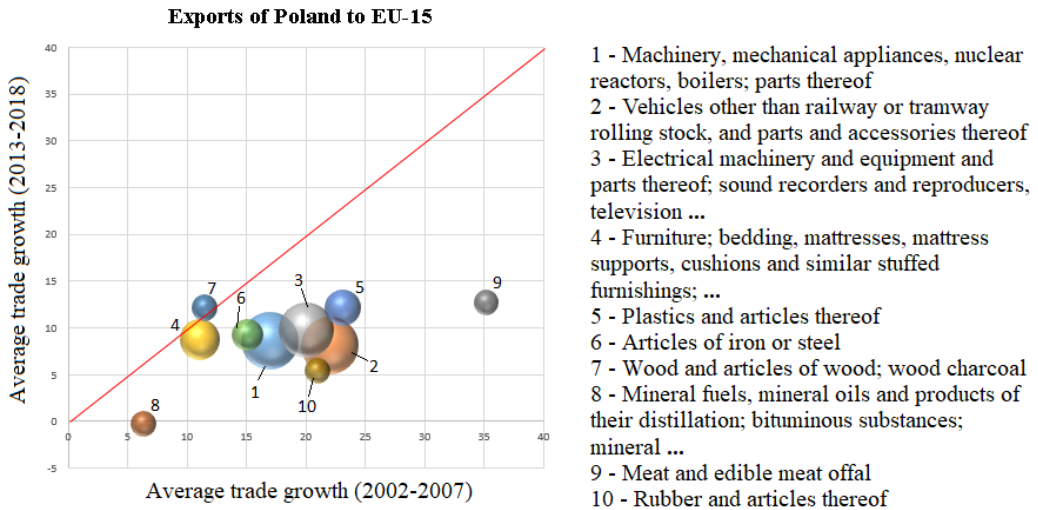
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Figure A-16 Contribution of the 10 most imported commodity groups at HS 2 digits level to the trade slowdown of the Czech Republic



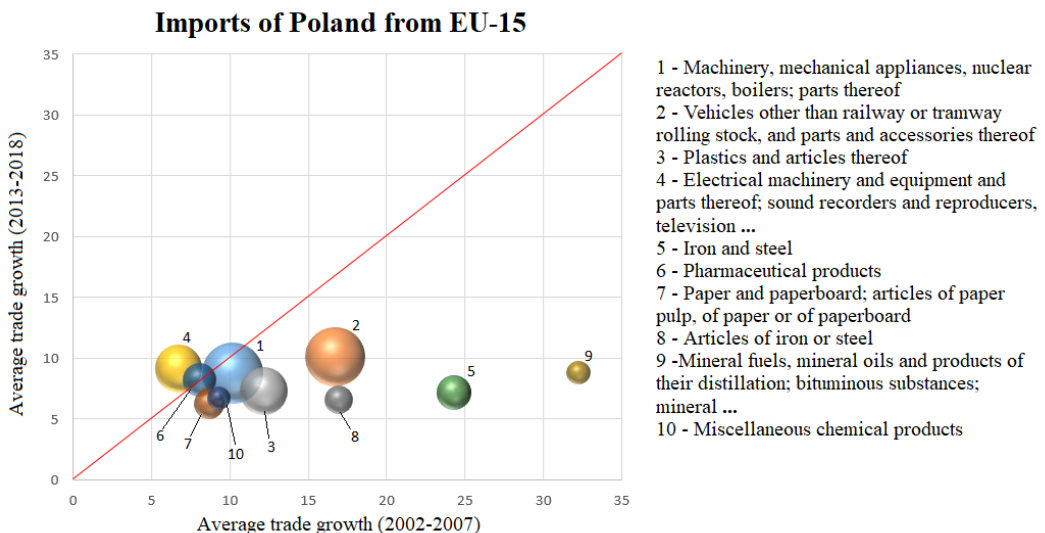
Source: www.trademap.org

Figure A-17 Contribution of the 10 most exported commodity groups at HS 2 digits level to the trade slowdown of Poland



Source: www.trademap.org

Figure A-18 Contribution of the 10 most imports commodity groups at HS 2 digits level to the trade slowdown of Poland



Source: www.trademap.org