The European Union's Global Goods Transport and Trade Relations and their Implications

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Abstract

Trade and transit have always played an important and prominent role in the life of humanity. Trade was already of great importance in ancient times, and the Industrial Revolution brought about significant changes, with the invention of the steam engine revolutionising transport and allowing goods to be transported not only in response to seasonal needs (e.g. after harvest, harvesting, etc.). The development of waterways and railways, in addition to roads, made it possible to transport goods over long distances more easily and quickly. From this point onwards, goods were constantly moved for trade by the various modes of transport, giving rise to the development of transport as a new service industry. All these processes played an integral role in developing the supply chains and trade routes we know today. In the present research, to map global trade trends and linkages, the trade relations between the European Union, China and the USA were first examined, and then, using correlation analysis and linear regression, the typical economic and trade indicators in the European Union were analysed.

Keywords

freight performance, trade relation, Europen Union, China, autocorrelation

1 Introduction

Logistics, especially freight transport, has become a part of everyday life. It only takes a few days for a consumer in Hungary to be able to purchase a product manufactured on another continent, such as America or Asia, within a short period, which affects not only the individual but also many areas of the other region. In addition to logistical factors, these regions are also of particular importance from a social or environmental point of view and are unavoidable in increasing the competitiveness of economies and the growth of businesses. The mapping of these processes and the analysis of their effects can be essential for the strategic and operational decision-making of a country or economic region. (Filina-Dawidowicz et al., 2022) As a result of globalization, consumer demands have raised increasingly high expectations for manufacturers, so a well-developed logistics distribution network and stable supply chains were needed to meet the demands. Globalisation increases the volumes, frequency and distance of transport, so without a constantly evolving logistics system, the system would not work. (Faust, 2023) It also enables the creation of sustainable systems to address the ever-increasing climate risks.

(Marczis et al., 2023) Among other things, it creates it through the circular economy, which contributes to the creation of a new era of globalisation, and the essence of globalisation is now clearly assigned to the global and universal nature of knowledge. (Gervai et al., 2023)

Global trade values have steadily increased in absolute and relative terms for the past 70 years, most notably since the 1990s, when global exports surged as developing economies rapidly industrialized and manufacturing was displaced. This trend is particularly true for the Asian region and China. (Bernek, 2023) The value of global exports exceeded 1 trillion dollars for the first time in 1977, and by the mid-2000s, more than 16 trillion dollars worth of goods had already been exported. In the same period, the combined share of trade in goods, imports and exports in world GDP increased from 18% to 52% (Fig. 1). The growth can be seen most clearly in the increase in the volume of international, primarily containerized transport. Before World War II, international trade was dominated by a relatively narrow segment of products, such as agricultural commodities and natural resources (mining products and fuels).
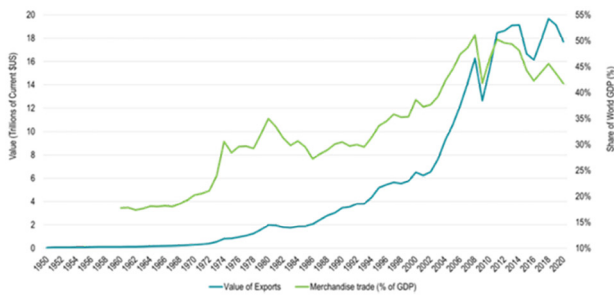
Fig. 1 World trade in goods from 1960 to 2020 (Rodrigue, 2020)

During this period, industrial products accounted for approximately 40% of the world's merchandise exports, and raw materials and products from agriculture accounted for approximately 60%. After the World War, manufactured goods represented an increasingly large proportion of the value of international trade, rising from 44.7% of exports in 1955 to 74.8% in 2000 (Rodrigue, 2020).

The COVID-19 epidemic has had a different logistical influence on different countries and regions, but it is undeniable that it has had a powerful impact and that there have been significant disruptions to international deliveries. The epidemic started in China, a country that has practically become an indispensable part of the world's supply chains; the supply chains and transport routes linked to the country were stopped entirely thanks to the health measures; this was especially true for sea transport, as the main ports were immediately closed as a first step (e.g. in Shanghai in 2022), thereby preventing the spread of the virus. Thanks to all these, 2020 also saw a slight decline in shipping (Gonzalez et al., 2022). However, by 2021, the freight volumes before the outbreak of COVID were measurable, as it turned out later. The epidemic and the accompanying closures have particularly markedly affected urban logistics, thus generating new challenges in this area. New situations have affected this area, such as a reduced number of physical contacts and the transformation of the population's shopping habits. E-commerce purchases suddenly jumped, and the actors involved in trade also had to adapt, although it cannot be denied that logistics companies experienced growth thanks to this (Castillo et al., 2022).

Apart from the COVID-19 epidemic, the Russian-Ukrainian conflict that erupted in February 2022 also has a clear impact on logistics and freight transport. Previously well-established transport routes have ceased to exist, and raw materials or semi-finished products from these countries have suddenly become unavailable products, causing, or still causing, severe difficulties in networks (Lin et al, 2023). It is important to point out, in the spirit of scientific sophistication, that the theoretical research conducted in this field is currently poorly identified due to the sensitivity of the topic (few or unreliable data are available, making it difficult to verify their authenticity) and the shortness of the time that has passed.

2 The EU and China's trade relationship

Thanks to the international division of labour and global supply chains, some countries have specialised in producing certain goods. The growing mobility of goods and people has meant that infrastructure capacity such as motorways, airports, ports and railways has had to be constantly upgraded and expanded to keep up with demand. This is also needed because China, the EU's second largest trading partner behind the US (European Parliament, 2019), is far ahead of the latter. Trade routes tend to come directly from China, crossing the Asian continent, or are implemented within the EU to connect regions better and facilitate the movement of goods, but it is important to note that maritime transport is still dominant. An excellent example of the importance of China's connectivity with Europe is the New Eurasian Land Bridge (also known as One Belt One Road – OBOR) (Holzner et al., 2018) (Fig. 2).

The central countries covered by the initiative are Russia, Mongolia, India, Pakistan, Kazakhstan, Egypt and most European countries, with a particular focus on Hungary. The New Silk Road aims to promote inter-regional connectivity and to link West and East by transporting goods, data, services and people. In addition to connecting these countries by land, the project includes a network of ports along the maritime route, with the main bases starting in China and ending in the EU. Along the way, the cargo ships will also pass through smaller economies, mainly in Africa, via the Gulf of Aden, crossing the Red Sea via the Suez Canal to the Mediterranean. Major European ports, including ones in Spain, France, Italy and Greece, are affected. The countries bordering the Adriatic Sea

1. The New Eurasian Land Bridge Economic Corridor

2. The China – Mongolia – Russia Economic Corridor

3. The China – Central Asia – West Asia Economic Corridor

4. The China – Indochinai Peninsula Economic Corridor

5. The China – Pakistan Economic Corridor

6. The Bangladesh – China – India – Myanmar Economic Corridor

Fig. 2 The six economic corridors (Huang, 2016)

are becoming increasingly important on the new routes, as they have a lot of development and growth potential. (Holzner et al., 2018) Fig. 3 shows that the EU-China trade relationship has been steadily strengthening and growing in recent times, mostly in terms of imports.

EU exports from 2011 to 2021 were at the lowest point in 2011 and the peak in 2021 in % terms. Imports to the EU were lowest in 2016 at 96% and highest in 2021 at 128%. Exports from China were lowest in 2011 and highest in 2021, at around 177% (Eurostat, 2023a). A more detailed analysis shows that there has indeed been an increase in the last period but that the balance and the higher growth rate are more in favour of China. This is shown in Fig. 4.

The new routes are designed to facilitate connectivity - a greater flow of people, goods and services, with less bureaucratic border crossings and customs checks. This can have positive economic, social and political effects but can also have unwelcome risks, such as disruptions in global supply chains, the spread of epidemics, or changes in geography linked to climate change, and increased carbon emissions (Ali et al., 2023) digital threats, and changes in regulatory environments, which the last two years have highlighted to the maximum (Zhong, 2023). With this in mind, the World Health Organization published a study in 2004 to highlight the problems that these trends could cause (Saker et al., 2004). At the time of publication, the authors had no idea that, almost 15 years later, the COVID-19 pandemic would be an excellent example of this. The Russian-Ukrainian conflict, which began in February 2022, also
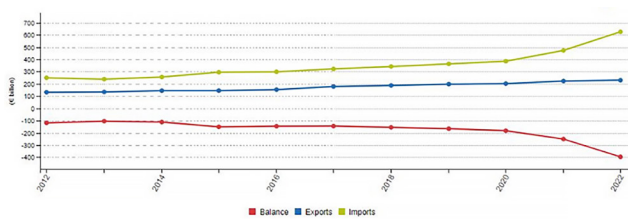
highlighted the vulnerability of these routes, as it drastically reduced the rail freight growth between China and Europe. Compared to previous years, rail freight traffic between China and Europe increased by only 2% in the first half of 2022. The main reason is that Western sanctions prevent rail transit traffic from passing through Russia and Belarus, even though 95% of rail freight traffic until the start of the war was transported along the Northern Eurasian corridor (China – Kazakhstan – Russia – Belarus – Poland – Germany – France - Spain) (Bernek et al., 2023).

3 The EU and US trade relationship

The EU and the USA have the most significant and strongest bilateral trade and investment relationship worldwide, which indicated the full integration of the links between the two economic communities. Although China overtook the EU as the largest source of goods imports in 2021, the US remains the EU's most significant trade and investment partner, and this relationship has grown steadily in recent years (Fig. 5).

The EU-US trade and investment relationship has remained strong despite the economic challenges associated with the Covid-19 epidemic. In 2020, EU companies exported €353 billion worth of goods, almost €2 billion more than in 2018, and more than 164,000 EU companies exported to the US, including almost 93,000 SMEs (Fig. 6). Full US investment in Europe is three times the value of that in Asia and about eight times the EU's investment in India and China.

Fig. 3 EU-China trade between 2012 and 2022 [%] (Eurostat, 2023a)

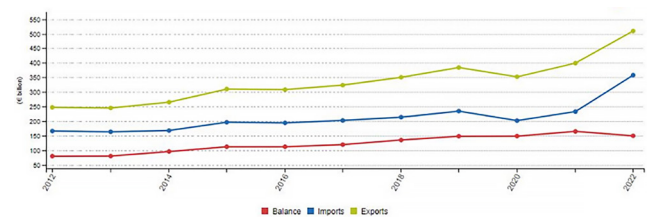**Fig. 5** EU-US trade relationship between 2012 and 2022 [%] (Eurostat, 2023b)

Fig. 4 Change in the EU-China trade relationship compared to 2011 [%] (Eurostat, 2023a)
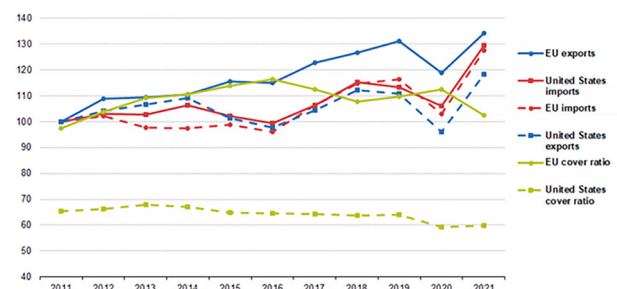

Fig. 6 Change in the EU-US trade relationship compared to 2011 [%] (Eurostat, 2023a)

EU and US investments are essential catalysts for transatlantic relations. The US and EU economies together account for approximately half of the world's GDP and nearly a third of world trade (European Commission, 2023).

Examining the EU and the US from 2011 to 2021, exports from the EU were at their lowest value in 2011, while they were at their peak in 2021. Imports to the EU were at their lowest point in 2016 at 96% and peaked at 128% in 2021, which was also in line with China. Exports from the United States were the lowest in 2020 and the highest in 2021, as well as imports, supporting the pandemic situation also revealed in the literature research. (Eurostat, 2023b).

4 Correlation analysis of global trade trends in Europe

In the following, mathematical-statistical tools have been used to explore the relationships between the data collected from the EU perspective, calculated using seven indicators, examining global trade trends from the EU perspective. These are GDP, GDP per capita, exports, imports, merchandise trade performance and volumes, and R&D in terms of gross domestic expenditure. As a first step, the development of the indicators was examined in terms of how they have changed in % since 2007 (the indicators under consideration are fully available in the Eurostat database from this year onwards) (Fig. 7)

The graph shows that the 2008 crisis impacted almost all indicators, culminating in 2009. Only R&D did not show a significant decline, which can be explained by the fact that support for the sector remained as important as ever due to the crisis. Compared with the base year, there is a decrease in the volumes and performances of goods transported, although it is essential to note that the data series under examination excludes bulk goods. The consequences of the COVID-19 epidemic are best felt in the case of products intended for export, which highlights the
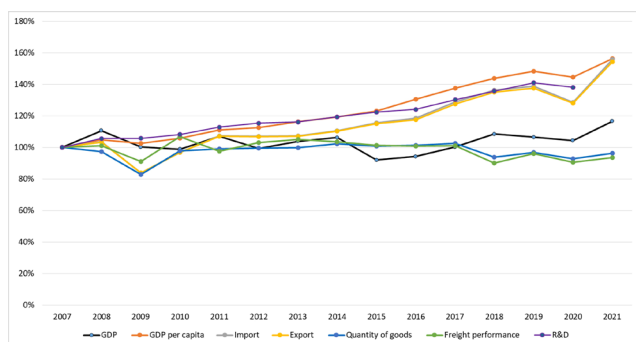

Fig. 7 Development of EU economic indicator numbers between 2007 and 2021 in % terms

fact that countries have imposed several restrictions on their epidemic prevention measures, which, among other things, may have prevented the quantity and free circulation of products intended for circulation. The correlation between the data was examined as a first step in examining the correlations. In addition to linear regression, correlation analysis is one of the standard statistical tools that can usefully help to explore the relationship between two variables. Correlation coefficients vary between –1 and 1. The further the value is from zero, the greater the linear relationship between the variables. A coefficient of 1 or –1 may show a maximum relationship in the extreme case. If the coefficient is 0, it means that the variables have no linear relationship, but they can be of a different type (Washington et al., 2011)

- $0 \leq r < |0.3|$ -low-strength connection,
- $|0.3| \leq r < |0.7|$ -medium strength of connection,
- $|0.7| \leq r < |1|$ -strong connection.

Correlation analysis has been used to analyse Europe's global trade trends, which are presented in Table 1.

Green indicates a strong association, yellow is a medium association, and red is a weak association. It can be read from the table that GDP per capita values are closely related to import, export and R&D values, while GDP is not. All this may indicate that these values can generate positive growth in the proportion of the population, but do not necessarily generate growth in other economic indicators, and have no relationship with R&D when measured by economic performance alone. However, about R&D, it is essential to underline that it is strongly correlated not only with GDP per capita but also with import and export values, so if an economic region has the possibility or the intention to invest in this area, it will increase trade intensity. In Table 2, a linear regression of the highly correlated value pairs has been calculated.

The equations describing the regression relationship in Table 2 show that exports and imports simultaneously increase each other's performance in a positive direction, and that they are the most closely related. The weakest relationship is found for R^2 between the volume of goods and the performance of goods transport, suggesting that the interaction between the two indicators is less significant from a linear growth point of view.

5 Summary

New routes and trade links are constantly the subjects of political rhetoric today, as they significantly impact large-scale financial resources, investment decisions,

Table 1 Correlation values of economic indicators in the EU

	GDP (Million US$)	GDP per capita	Import (Euro)	Export (Euro)	Quantity of goods (thousand t)	Freight performance (tkm)	R&D
GDP (Million US$)	1.000						
GDP per capita	0.367	1.000					
Import (Euro)	0.476	0.960	1.000				
Export (Euro)	0.478	0.959	1.000	1.000			
Quantity of goods (thousand t)	−0.179	0.034	0.181	0.182	1.000		
Freight performance (tkm)	−0.398	−0.498	−0.413	−0.411	0.712	1.000	
R&D	0.124	0.992	0.935	0.935	0.055	−0.423	1.000

Table 2 Linear regression assessment of strongly correlated indicators in the EU

Indicators	Equation describing the relationship	R^2
Import – GDP per capita	$y = 68.1x - 98931$	0.92
Import – Export	$y = 1.0x + 56644$	1.00
Import – R&D	$y = 0.1x + 90723$	0.87
Export – GDP per capita	$y = 68.0x - 39608$	0.92
Export – R&D	$y = 0.1x + 85114$	0.87
Quantity of goods – Freight performance	$y = 0.2x + 34791$	0.51
R&D – GDP per capita	$y = 6.9x + 74243$	0.98

debt risk-taking (which also affects the sovereignty of a country) or even social perception. A good example is the OBOR initiative, which brings overall productivity gains for Chinese companies and additional revenues for Europe. All this can lead to much more complex transport systems, which the EU as a larger entity can explore by looking at the interrelationship of our trade indicators such as imports and exports, GDP and GDP per capita, the value of spending in R&D, and the transport of goods, showing its link to China and the US. The research showed that GDP per capita values are closely related to import, export and R&D values. At the same time, the same indicators no longer show a close relationship with GDP, which can be explained by the fact that these values can result in a positive increase in the population proportion. The same statement is not necessarily true if only the economy is strictly examined. Measuring the economy's performance alone does not necessarily generate import, export, or R&D growth. These results can help, for example, in the formulation of regional development policies, in the determination of potential development directions, in the establishment of trade relations, or the examination of economic measures projected onto individuals. At the same time, it was also revealed that the R&D sector mostly indirectly benefits society and economies. Overall, globalisation processes are still underway today. They are bringing about several changes in the design and development of models, including transport provision. Freight transport routes are becoming increasingly important due to globalisation, increased international production flows, and continuous logistical changes, especially in optimising supply chain efficiency and sustainability.

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