“The bilateral trade imbalances between the EU and China: Structure and trends”

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THE BILATERAL TRADE IMBALANCES BETWEEN THE EU AND CHINA: STRUCTURE AND TRENDS

Abstract

The EU and China are among the largest economies affecting the global economy and each other. The paper aims to determine the structure and trends in the trade relations between the EU and China from the perspective of trade imbalances. Net export index (–29% in 2021) and the difference between export and import growth rates (–9% in 2016-2021) were calculated as the indicators of competitiveness of the economies relative to each other. Correlation coefficients and regression models were used to estimate the effects of several factors on the net export index. The EU has a surplus in services trade with China (21% of the trade), but it does not cover a much larger bilateral merchandise trade deficit (–36%), which exists in most member states. Machinery and vehicles are the most important traded items. The net export index shows that the European Union is more competitive than China in nonfuel minerals, food, vehicles, pharmaceutical products, intellectual property, computer, travel, and sea transport services. The effect of the real exchange rates on the trade imbalances is not robust due to the large difference in regression coefficients for the real exchange rates based on consumer prices and unit labor costs. In recent years, the trade balance was not significantly affected by industrial output growth trends in the EU and China (except for the COVID-19 pandemic crisis when the relative competitiveness of China in its trade with the EU improved at least in the short run).

Keywords international trade, foreign supplies, competitiveness, trade balance, product structure, services, exchange rate, EU member states

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INTRODUCTION

China has become an increasingly important trade partner for many countries. Cheap labor was China's original competitive advantage, which has evolved into something more by exploiting economies of scale and active international marketing. This led to a global redistribution of production activities in favor of China, which created an image of a great competitor for it. On the other hand, producers and consumers can benefit from cheaper intermediate and consumer products. This raises the issue of how efficient trade with China is under existing imbalances between exports and imports.

The gravity approach explains massive trade between the giant economies of the EU and China despite distance. The dual role of China for the EU as a market and source of supplies is worth further analysis, especially the new trends in recent years. The COVID-19 pandemic crisis raised the issue of dependency on extra-EU imports from few sources and discussions on their diversification and the policy of open strategic autonomy. Although the EU is often treated as one of the three largest economies of the world, it consists of several national economies. Therefore, various member states of the EU and industries may also have their own incentives considering their individual competitiveness, trade, and production structure.

1. LITERATURE REVIEW

The importance of the EU and China as global actors and the growing importance of bilateral trade in recent decades were the reason for the increasingly growing number of research studies on this topic in both economies. Researchers analyzed mutual dependence on bilateral trade with variation by product and the member states, trends in the industrial structure of exports and imports, bilateral trade balance and its structure, and environmental impacts. Some works have focused on factors of the EU-China trade, including development levels, transportation costs, trade regulation and facilitation, and exchange rate trends.

The EU-China bilateral trade flows were continuously growing in the 21st century with interruptions in 2009 and 2012–2013. In 2014, China depended more on exports to the EU (which accounted for 15% of its exports) than the EU depended on China (3.5%). The dependence on imports differed much less (12.5% and 8%) (Bekkers et al., 2016). But Baláž et al. (2020) argued that analysis of the EU-China trade as a whole is oversimplification because few member states dominate in this trade. In 2016, China was the most important trade partner only for Germany among the EU countries (10% of its imports). Its share was larger than 10% only in the Czech Republic and Poland. There were no EU member states where China was among the top 3 trade partners by exports. Except for Germany, trade with the majority of the EU countries is marginally significant for China. 70% of the Chinese bilateral trade with the EU was concentrated in Germany, France, the United Kingdom, Italy, and the Netherlands. Yilmaz (2020) said that the largest EU exporters to China were Germany, the United Kingdom (before Brexit), and France. The largest importers were the Netherlands, Germany, and the United Kingdom. In relative terms, the member states that depended the most on Chinese imports were the Czech Republic, the Netherlands, Germany, and the United Kingdom.

Nevertheless, the substitution effect between the EU-China trade and intra-EU existed. An increase in the EU member states' share of trade with China leads to a decreasing share of trade with other EU member states. This effect is stronger for exports to China than for imports and for the core member states than for the EU periphery, for exports and imports of consumer and intermediate products than for exports of capital goods (Chen et al., 2021). During the pandemic, dependencies on imports (including from China) revealed the vulnerability of supplies. In 2019, about one-tenth of the EU exports went to China (especially in Germany 15% and Finland 12%), and one-fifth of its imports originated in China (especially in Luxemburg 43% and Czechia 36%). This leads to a discussion on whether the optimum level of globalization has already been achieved and to recommendations to diversify supplies, practice near-shoring (reorientation of some supplies to neighboring countries in Europe), or re-shoring and achieving open strategic autonomy (Grübler, 2021).

Kaaresvirta et al. (2023) provided a detailed view of the dependence of the EU on China in imports of specific products. It was high in some product groups: machinery and equipment (40-49% in 2020-2021), textiles and household goods. For example, 70% of imported mobile phones, 92% of laptops, 80% of motorcycles and mopeds, and 65% of furniture were supplied by China. But there are also many sectors with low dependence. For example, despite growing agri-food exports to China, its share as a market for these EU products was only 2% (Pawlak et al., 2016). The EU is the most important services trade partner for China, and China is the second largest one for the EU (Baláž et al., 2020).

In 2018, the industrial structure of the bilateral trade was mostly based on machinery and vehicles (53%). It was the dominant group of products both in the EU and Chinese bilateral exports. Trade in services was equal to only 1/10-1/5 of merchandise bilateral trade volume (Yilmaz, 2020). China mainly exports high-tech electronic and electrical and low-tech manufactured goods to the EU in exchange for importing medium-tech products from the EU, which is based on their better competitiveness in those sectors (Tang et al., 2024). As for agricultural products, the EU exports mainly products for which China lacks soil and water resources or high-value quality food. And China exports more labor-intensive agri-food goods (Pawlak et al., 2016). Comparative advantage indices also show

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specialization in agricultural exports: meat, dairy products, and other animal-originated products, wool, and vegetable textile fibers in the EU, and animal-originated products, vegetable-plaiting materials, silk, wool, and vegetable textile fibers in China (Li & Andreosso-O'Callaghan, 2020). Despite the overall better competitiveness of the EU in services trade (Baláž et al., 2020), China's competitive positions are better in low-skilled labor, and less knowledge- and capital-intensive services. There were also growing positions of China in some European services markets in the preceding years (manufacturing services on physical inputs owned by others, maintenance and repair services, construction services) and improving positions in R&D services and some business services. Comparative disadvantages include travel, financial, ICT, and intellectual property services (Ambroziak & Stefaniak, 2022).

There was an increasing similarity of the bilateral EU-China trade structure and its decreasing complementarity (Li, 2008). Baláž et al. (2020) underlined that the trade between the EU and China is less complementary than that between the EU and the US. In 2016 the EU-China trade complementarity index value 56.7 indicated moderate complementarity. The value of the EU-US trade complementarity index was 77.3.

Several studies focus more specifically on the trade balance, which is also an important indicator of trade efficiency. The bilateral trade deficit of the EU with China had been increasing before stabilization in 2009 (Bekkers et al., 2016). In 2018, only three member states had a trade surplus with China: Germany, Finland, and Ireland. All the other EU countries had a trade deficit, especially the Netherlands, United Kingdom, and Italy (Yilmaz, 2020). On the other hand, Baláž et al. (2020) estimated that among the 5 largest EU member states only the overall trade balance of France significantly depended on the bilateral trade balance with China.

As for the product structure of the trade deficit, the EU-China export-to-import ratio reveals that the largest sources of the EU trade deficit with China were automatic data processing machines, telecommunications equipment, baby carriages, parts and accessories of office machines, household type equipment, apparel, and footwear and furniture. The EU was the most competitive in motor cars and vehicles, medicaments, aircraft, and measuring equipment. The most balanced trade was in electrical apparatus, electronic tubes, valves, and electric equipment (Yilmaz, 2020). The EU is an increasingly important food importer to China (the 3rd largest) because population and especially income growth in China stimulated demand for quality food such as originating in the EU. This caused a trade surplus of the EU in this sector after 2012 (Kostadinov, 2017).

The issue of measuring trade balance encounters some difficulties. China has had a surplus in trade with the EU after 1997, especially after joining the WTO. However, there was a gap in the value of the surplus according to Chinese statistics ($19.1 billion in 2003) and Eurostat (64.2 billion) largely due to technical reasons such as exchange rate and customs clearance method used. The discrepancy reduced after the EU enlargement in 2004. In relative terms, the EU trade deficit with China reached 52% of the trade volume in 2008 and 34% in 2012. It was the largest source of the overall EU trade deficit under lower labor costs and high capacity of China to attract foreign investments. Meanwhile, it was calculated that 1/3 of the Chinese exports to the EU were based on imports after adjustment by value-added (Xin, 2014). The dependence of Chinese exports on imported components decreased so it relies more on domestic intermediate products than before (Bekkers et al., 2016). Xuemei et al. (2019) also pay attention to the discrepancy in the value of the EU-China trade in their official statistics. The reasons include transportation costs and re-exports. The EU's bilateral trade deficit with China was $90.6 billion. But after adjustment to re-exports, it turns out to be 4.4 times smaller in gross terms and 5.7 times smaller in value-added terms.

Another efficiency measure may go beyond pure economics. Laike and Chun (2010) raised the issue of the EU-China trade imbalance measured by the related CO2 emission. Trade with China helped the EU to reduce domestic CO2 emissions, but the emissions in China increased. Chinese exports to the EU exceeded bilateral imports 2.6 times, but the exported CO2 emissions embodied in these exports were 20 times larger than the emissions

embodied in the imports (Yan et al., 2011). Despite the decline in CO2 emissions in the EU from 2000–2014, the share of emissions associated with imports increased from 27% to 37%, mainly due to trade with China. The increase varied from 97% in Romania to a decrease of 35% in Greece. The share of imported emissions was larger in higher-income countries (55% in Luxemburg, unlike 20% in Poland, Estonia, and Bulgaria). However, the carbon border adjustment mechanism may affect bilateral trade as China is the largest source of CO2 emissions, especially in imports of inputs for production, unlike imports of consumer goods (Simola, 2020). Its effect was simulated by Zhu et al. (2024). The mechanism is able to decrease export prices of Chinese taxed exports and, to a certain extent, other exports to the EU, which can improve terms of trade of the EU, but it would also decrease total exports of the EU. A possible reaction by China may include implementing a differentiated carbon tax in China to avoid double taxation and establishing a carbon emission accounting system in Chinese companies.

Several factors of the EU-China trade were analyzed. Tang et al. (2024) used a gravity model to prove that the China-EU bilateral trade depends on the GDP per capita, monetary freedom, trade freedom, distance, and human development index. Mao and Xiong (2022) suggested that the bilateral trade between the EU and China is not sufficiently efficient by the value-added method and estimated the effects of several factors. The efficiency depends mostly on tangible trade infrastructures of both exporters and importers (airports, container shipping, telecommunications, etc.) and less on intangible ones (customs procedures, business environment, etc.).

As for tangible trade infrastructure, Lo (2018) used modeling premiums for the timely delivery of goods via ground transport in trade between China and the EU in comparison to slower maritime transport. The New Silk Road initiative, together with the effect of the premium, may lead to a switch to faster ground transportation. The initiative may ultimately increase the bilateral trade by 8-32%. The author recognizes the limitations of the study as the advantage of the large loading capacity of sea transport, legal, political, and institutional barriers are not considered. The NSR initiative also has effects on China's trade with third countries. Fang and Shakur (2018) indicated that in 2001–2015 trade costs for the EU-China agri-food trade were decreasing but still too high. Trade cost reduction provided about half of the bilateral trade growth. Further reduction may be achieved by the Belt and Road Initiative implementation, which may affect transportation and related costs. Jackson and Shepotylo (2021) noted that the Belt and Road Initiative substantially affects transportation costs. Under the scenario, a 15% reduction in transportation costs could lead to a 0.67% increase in welfare in high-income countries and by 0.54% in low-income countries. Signing an FTA can also provide benefits, which are equivalent to transport cost reductions by 15-20%. But further integration is not the only option. Under the reshoring and deglobalization scenario, doubling trade costs under unilateral decoupling from China can potentially reduce real income in the EU by 0.8% or by 1% if China retaliates (Felbermayr et al., 2021).

As for monetary factors, deeper integration within the EU in the form of the establishment of the euro area led to better interconnectivity between the member states and the expansion of the EU-China trade (Karkanis, 2018). Cardoso and Duarte (2015) used a vector error correction model and concluded that exchange rate manipulation helped to increase Chinese exports. Later, Cardoso and Duarte (2017) estimated that under correction of the exchange rate misalignment (requiring appreciation of renminbi by 32%), the bilateral trade deficit would be reduced by 20%. The undervalued renminbi also led to the reallocation of business of many European companies to China. Nevertheless, Jitaru and Dumitrașciuc (2019) have found no correlation between the EU trade deficit and renminbi depreciation in 2001–2017 (unlike the correlation with its components: exports 0.58 and imports 0.43). Invoice currency can be an important condition of depreciation effect. On the one hand, the depreciation of the Chinese renminbi against the euro improves China's trade balance with the EU when the EU currencies are used. But when the US dollar is used as an invoice currency depreciation of the Chinese renminbi against the dollar does not affect this balance (Bao et al., 2022; Bao et al., 2023).

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Previous research suggests that there is a moderate complementarity of the EU – China bilateral trade. Growing trade with China may substitute intra-EU trade. Various measures of trade balance showed either large or moderate trade deficit of the EU with China. The effect of the bilateral trade may go beyond pure economics and indicate the shift from domestic carbon dioxide emissions in the EU to importing products with embodied emissions from China. Value and efficiency of trade may depend on infrastructure, business regulation, trade barriers, development level, and exchange rate trends.

2. AIM AND HYPOTHESES

The paper aims to determine the structure and trends in the bilateral trade imbalances between the EU and China. The main hypothesis in this paper is

H1: There are still substantial and fairly stable trade imbalances in bilateral trade between the EU and China.

Several additional hypotheses have to be checked.

H2: There is a wide variety in the contribution of various goods and services to bilateral trade imbalances and trade dependency.

H3: There is a variety in individual trade imbalances of EU member states with China.

H4: The bilateral trade imbalance depends on business cycles and real exchange rate trends.

3. METHODOLOGY

Analysis of the Eurostat (2023) statistics was used to assess the structure and trends in the merchandise and services trade between the EU and mainland China. EU-27 (after 2020) composition was used (already excluding the United Kingdom). The trade structure is analyzed by groups of products and services and by the EU member states. The share of the EU-China bilateral trade in total extra-EU exports is calculated to measure the importance of China as a trade partner. Net export index – NEI (a relative trade balance in % of the relevant exports and imports) is calculated here as the first trade imbalance indicator like in Banterle (2005). It can be treated as a relative export competitiveness indicator (exports exceeding imports mean that there is more foreign demand for domestic goods at current prices than domestic demand for foreign goods). NEI also measures the direct efficiency of trade but fails to consider indirect effects as it disregards the fact that imported components may help to produce export products for other countries. A difference in growth rates of exports and imports (in 2016–2021) is a second trade imbalance indicator that is calculated in this study to estimate progress in competitiveness and specialization.

Correlation and regression analysis is used to assess determinants of the net export index for the EU member states with China using annual data for 2011–2021. The general formula of the tested model is:

$$NEI = b_0 + b_1 NEI_{t-1} + b_2 RER_{cpi} + b_3 RER_{ulc} + b_4 RER_{ch} + b_5 IP + b_6 IP_{ch}, \quad (1)$$

where NEI_{t-1} is added in some models to adjust for the previous values of *NEI* and assess the stability of the imbalances. The independent variables (source – International Monetary Fund (2023)) are:

- real effective exchange rate of the EU member state (*RER*) either based on the consumer price index (*cpi*) or unit labor costs (*ulc*) or the one of China based on the consumer price index (*ch*), 2010 used as a base period (100);
- industrial production growth in % in the EU member state (*IP*) or China (IP_{ch}) as an indicator of the economic cycle phase;
- b_0, b_1,…b_6 – regression coefficients estimated with OLS method.

4. RESULTS

Tables 1 and 2 show the bilateral trade trends in 2010–2021. In 2021, the total trade between the EU and China reached almost 800 billion euros

(including 88% merchandise trade and 12% services trade). It constitutes 12.5% of the total extra-EU trade (16.2% for merchandise trade and 4.9% for services trade; 8.7% for the EU exports and 16.7% for imports). This share peaked in 2020–2021, which demonstrates the increasing role of China as a trading partner for the EU as a result of the growing share of China in the global economy even in the period of the pandemic. But the role of services trade with China is disproportionately lower than merchandise trade.

As for the net export index, the EU has a large deficit in merchandise trade with China with no obvious trend. The services trade surplus in favor of the EU increased in 2015–2018, but it is far from offsetting the merchandise trade deficit (the ratio of the surplus and the deficit is 1:12).

Table 3 provides the data about the product structure of the merchandise trade. The EU exports mostly machinery, road vehicles and chemical (especially pharmaceutical) products to China and imports mostly machinery and also chemical products and apparel. China is 1.5 more important market for the EU exports of machinery and vehicles than average third countries. 30% of the EU exports of meat go to China. The EU largely depends on imports of machinery from China and also furniture, toys and apparel.

Net export index shows that the EU is more competitive than China in nonfuel minerals, food, beverages and agricultural products (especially animal products, beverages and cereals), vehicles (especially aircrafts), and pharmaceutical products. It is least competitive

Table 1. EU merchandise trade with China

Indicator	Exports	Imports	Trade balance		Exports	Imports
Units	Billion euro		% exports + imports		% total extra-EU	
2010	105	245	–140	–40	7.3	16.7
2011	127	256	–129	–34	7.8	15.4
2012	132	250	–118	–31	7.5	14.7
2013	135	239	–104	–28	7.6	14.7
2014	145	257	–111	–28	8.1	15.8
2015	146	296	–150	–34	7.8	18.0
2016	153	299	–146	–32	8.2	18.7
2017	179	323	–144	–29	9.0	18.2
2018	188	343	–155	–29	9.1	17.9
2019	198	363	–165	–29	9.3	18.7
2020	203	385	–182	–31	10.5	22.4
2021	223	474	–250	–36	10.2	22.3
2022	273	567	-294	-35	10.6	19.6

Table 2. EU services trade with China

Indicator	Exports	Imports	Trade balance		Exports	Imports
Units	Billion euro		% exports + imports		% total extra-EU	
2010	17.1	15.6	1.4	4.4	3.0	3.2
2011	19.0	16.3	2.6	7.4	3.1	3.2
2012	22.0	18.1	3.8	9.5	3.3	3.3
2013	22.5	19.3	3.2	7.7	3.2	3.4
2014	26.1	21.5	4.6	9.6	3.5	3.4
2015	37.9	26.4	11.5	17.8	4.5	3.4
2016	38.4	29.7	8.7	12.8	4.5	3.8
2017	41.4	29.6	11.8	16.7	4.4	3.6
2018	48.1	31.0	17.1	21.7	4.8	3.6
2019	53.2	33.4	19.9	22.9	5.0	3.3
2020	47.4	31.9	15.5	19.5	5.2	3.5
2021	59.1	38.6	20.5	21.0	5.5	4.1
2022	64.7	48.3	16.4	14.5	4.8	4.2

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Table 3. Structure of the EU merchandise trade with China, 2021

Indicator	Exports	Imports	Trade balance		Exports	Imports	Exports growth	Imports growth	Export growth – import growth
Units	Billion euro		% exports + imports		% total extra-EU		% growth relatively 2016		
Goods and Services	282.6	512.3	–229.8	–29	8.7	16.7	47	56	–9
Total goods	223.5	473.8	–250.3	–36	10.2	22.3	46	58	–13
Food, beverages and agricultural products	16.5	7.0	9.5	41	8.4	4.6	69	27	42
Nonfuel minerals	2.2	0.5	1.6	60	23.6	1.4	70	50	21
Mineral fuels and oils	1.5	1.0	0.4	17	1.4	0.3	-9	224	–233
Chemical products	36.5	50.3	–13.8	–16	7.3	15.7	61	117	–56
Leather and fur products	3.9	5.0	–1.2	–13	17.6	42.6	115	–12	127
Wood and paper products	6.4	5.8	0.5	4	10.6	18.5	63	49	13
Apparel, footwear and textile products	5.7	45.1	–39.4	–78	7.8	35.3	63	10	53
Cement, stone, glass, ceramic products etc.	3.1	7.7	–4.6	–43	4.0	10.1	76	39	37
Metals and metal product	11.6	28.3	–16.7	–42	9.3	19.4	29	49	–19
Machinery	73.1	243.7	–170.6	–54	13.8	46.2	50	63	–13
Vehicles	42.2	21.3	20.9	33	14.0	14.7	19	160	–141
Optical, measuring, medical instruments etc.	15.6	14.2	1.4	5	14.4	19.1	51	61	–10
Furniture etc.	1.4	21.3	–19.9	–88	5.0	65.8	13	68	–55
Toys, games and sports requisites	0.4	16.6	–16.2	–95	5.6	77.3	69	62	7
Other products	0.8	5.0	–4.2	–72	2.1	15.2	–25	23	–47

in toys, furniture, apparel, footwear, machinery (especially electrical appliances), organic chemicals, ceramic and glass products, iron, steel, and aluminum products, ships, and boats. The trade deficit in machinery constitutes ¾ of the overall trade deficit with China.

There is a growing efficiency of the EU trade with China in leather products, cereals, animal products, perfumery, wood products, apparel, precious materials, and jewelry. And there is growing competition from China in vehicles, chemical (especially pharmaceutical) products, glassware, iron and steel products, and furniture. The EU's imports of fuels from China grew a lot but their share in imports from all the countries is very low.

Table 4 provides the data about the product structure of services trade. The EU exports mostly transport (especially sea), business and computer services, and intellectual property to China and imports mostly transport and business services. China is 1.5 more important market for the EU exports of transport services and intellectual property than average third countries. 22% of imports of manufacturing services on physical inputs owned by others are from China.

The net export index reveals that the EU is more competitive than China in charges for using intellectual property, travel, sea transport, telecommunications, computer, and information services. It is least competitive in manufacturing services using physical inputs owned by others. The trade surplus in charges for intellectual property and computer services constitutes 90% of the overall services trade surplus with China.

There is a growing relative competitiveness of the EU trade with China in charges for the use of intellectual property, computer services, transport (especially rail and sea), and some business services. There are faster growing imports from China in construction, manufacturing services on physical inputs owned by others, road transport, insurance and pension services.

Table 5 provides the data about the geographical structure of merchandise and services trade between the EU and China. Germany is disproportionally the largest exporter to China

Table 4. Structure of EU services trade with China, 2021

Indicator	Exports	Imports	Trade balance		Exports	Imports	Exports growth	Imports growth	Export growth – import growth
Units	Billion euro		% exports + imports		% total extra-EU		% growth relatively 2016		
Total services	59.1	38.6	20.5	21	5.5	4.1	54	30	24
Manufacturing services on physical inputs owned by others	0.50	4.43	–3.93	–80	1.7	22.0	57	112	–55
Maintenance and repair services	0.56	1.17	–0.60	–35	3.1	8.4	55	34	21
Transport	21.66	16.51	5.15	13	10.3	9.9	173	90	83
Travel	1.67	0.30	1.38	70	2.6	0.7	–79	–87	9
Construction	0.30	0.91	–0.61	–50	3.1	15.3	10	307	–297
Insurance and pension services	0.52	1.02	–0.50	–33	1.9	4.0	31	88	–57
Financial services	0.58	0.25	0.33	40	0.7	0.3	–26	–16	–10
Charges for the use of intellectual property	11.23	0.30	10.93	95	11.4	0.2	95	–18	113
Telecommunications, computer, and information services	9.69	1.40	8.29	75	4.4	1.6	121	2	119
Other business services	11.99	12.03	-0.04	0	4.5	3.8	22	–4	26
Personal, cultural, and recreational services	0.17	0.15	0.02	7	1.1	1.6	1	71	–71
Government goods and services	0.09	0.09	0.00	–1	1.4	3.0	–16	–64	47

Table 5. EU merchandise and services trade with China by the member states, 2021

Indicator	Exports	Imports	Trade balance		Exports growth	Imports growth	Export growth – import growth
Units	Billion dollars		% exports + imports		% growth relatively 2016		
European Union	282.59	512.34	–229.75	–29	47	56	–9
Austria	5.47	8.52	–3.05	–22	40	64	–24
Belgium	9.38	25.97	–16.59	–47	19	68	–49
Bulgaria	1.15	2.16	–1.01	–30	136	99	37
Cyprus	0.10	0.51	–0.41	–67	–24	–18	–6
Czechia	3.00	20.02	–17.02	–74	43	93	–50
Germany	123.68	107.55	16.13	7	37	38	–1
Denmark	9.89	10.63	–0.74	–4	77	46	30
Estonia	0.27	1.03	–0.76	–59	31	44	–13
Spain	9.64	32.44	–22.80	–54	67	54	13
Finland	5.07	4.83	0.24	2	28	72	–44
France	35.01	45.63	–10.61	–13	49	39	11
Greece	2.38	5.37	–2.99	–39	100	77	23
Croatia	0.11	1.06	–0.95	–81	2	73	–70
Hungary	1.81	10.22	–8.41	–70	14	87	–74
Ireland	20.60	12.69	7.91	24	195	249	–54
Italy	17.44	40.00	–22.56	–39	42	37	5
Lithuania	0.28	1.76	–1.49	–73	98	144	–46
Luxembourg	1.40	0.61	0.79	39	–13	–52	40
Latvia	0.22	0.98	–0.76	–63	70	113	–43
Malta	0.09	0.33	–0.24	–57			
The Netherlands	19.45	114.35	–94.90	–71	57	52	5
Poland	3.58	32.48	–28.91	–80	87	128	–41
Portugal	0.82	4.72	–3.90	–70	–3	126	–129
Romania	1.02	6.42	–5.41	–73	53	83	–30
Sweden	8.05	12.41	–4.36	–21	21	52	–32
Slovenia	0.49	5.95	–5.47	–85	–2	344	–345
Slovakia	2.21	3.71	–1.50	–25	88	16	72

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among the EU countries (43%), much larger than other large exporters: France, Ireland, and Italy. Luxemburg (84%) and Greece (70%) export predominantly services to China. Ireland (5.6 billion euro) is the second largest exporter of services to China after Germany (9.3 billion euro).

The Netherlands and Germany (together 43%) are the largest importers from China within the EU. In Luxemburg and Ireland, almost half of imports from China are services. Germany (19.1 billion euro), France (11.0 billion euro), and Ireland (9.4 billion euro) are the largest services importers from China.

The Netherlands' trade deficit with China constitutes 41% of the EU trade deficit with this partner. The net export index shows that only Luxemburg and Ireland have a relatively large direct efficiency of trade with China. Germany and Finland have a marginally positive net export index. France and Denmark have a marginally negative value. Several countries have a large negative net export index (<–65%): Slovenia, Croatia, Poland, Czechia, Lithuania, Romania, the Netherlands, Hungary, Portugal, and Cyprus. Greece has a value –39%. Therefore, most of the member states may have reasons to support an open strategic autonomy strategy. However, other methods should also be used to assess the incentives considering the problem of estimating the indirect effects of bilateral trade.

However, 9 EU member states improved their trade balance with China in 2016–2021, especially Slovakia, Luxemburg, Bulgaria, and Denmark. And decreasing bilateral trade efficiency is a challenge mainly for Slovenia, Portugal, Hungary, Croatia, Ireland, Czechia, and Belgium.

At the next stage, the factors affecting the net export index of the EU-China bilateral trade are analyzed. According to the findings in Table 6, trade balances depend on their previous values. There was a weak relationship between merchandise and services trade efficiency and real effective exchange rate in EU member states (with different effects for goods and services) and between services trade efficiency and industrial production growth in China. The economic cycle in the EU member states and the real effective exchange rate of the renminbi had no effect. The positive correlation between the merchandise net export index and the real effective exchange rate was the highest in 2012–2017 and then became much smaller. And the negative correlation between the services net export index and the real effective exchange rate has been since 2015.

The results of the correlation analysis were used to choose the factors in regression models (see Table 7). The number of the analyzed cases is between 140 and 247.

Models with previous values of the net export index have a much better coefficient of determination, which proves the assumption about the relative stability of trade imbalances. Real effective exchange rates in the EU member states matter, at least in some models, but the consumer price-based exchange rate has a negative coefficient, and the unit labor cost-based exchange rate has positive coefficients. It is likely that domestic prices may have a negative effect on the competitiveness of European exports, and labor costs provide a positive effect. Or better trade balance may lead to real effective exchange rate appreciation and growth of wages. Thus, there is only mixed evidence in favor of the hypothesis

Table 6. Correlation between the net export index and its factors

Indicators	NEI goods	NEI services	NEI_{t-1} goods	NEI_{t-1} services	RERcpi	RERulc	IP	RERch	IPch
NEI goods	1.00								
NEI services	0.26	1.00							
NEI_{t-1} goods	0.95	0.23	1.00						
NEI_{t-1} services	0.27	0.85	0.23	1.00					
RERcpi	0.12	–0.21	0.14	–0.18	1.00				
RERulc	0.22	–0.02	0.21	0.07	0.56	1.00			
IP	0.01	0.04	0.06	0.04	–0.19	–0.18	1.00		
RERch	0.02	0.09	0.05	0.08	–0.37	–0.25	0.17	1.00	
IPch	–0.07	–0.14	–0.03	–0.17	0.33	0.22	0.22	–0.73	1.00

Table 7. Regression results for the factors of net export index in bilateral trade

NEI	R^2	b_0	$b_{NEIt-1\ goods}$	$b_{NEIt-1\ services}$	b_{RERcpi}	b_{RERulc}
Goods	0.88***	–18.3*	0.93***			0.18*
Goods	0.14***	94.8*			–2.7***	1.4***
Services	0.72***	–0.20		0.85***		
Services	0.05***	163.2***			–1.7***	

Note: *t*-test and *F*-test: *** – $p < 0.01$, ** – $p < 0.1$, * – $p < 0.1$.

of the influence of the real exchange rate. Within the regression analysis method, no evidence was found to consider business cycles as a stable factor of the bilateral trade balance at the EU member states' level.

As a result, hypothesis 1 was accepted. The EU has not overcome the problem of trade deficit with China yet and had no progress in it recently. Hypothesis 2 was accepted. There is large variance in net export index and dependency ratio for individual goods and services, which can be explained by the effects of international specialization. Hypothesis 3 is partially accepted. The EU member states' trade balances with China vary from large deficit to minor surplus, but no member state has a major trade surplus. Hypothesis 4 is not accepted because of the mixed evidence provided under different approaches applied to assess the effect of business cycles and real exchange rate trends on the net export index.

5. DISCUSSION

The main hypothesis of the paper on the large and relatively stable trade deficit of the EU with China has been proved with the net export index method and regression models with large significant coefficients for the lagged values of this variable.

In comparison to the previous studies in general, there was a downward trend in the relative trade deficit of the EU with China since a decrease to the value of 34% in exports and imports in 2012, as mentioned by Xin (2014). But in 2021, the downward trend reverted to reach a deficit of 36%. The larger dependence of the EU on China in exports and imports in 2014 in this study, compared to Bekkers et al. (2016), is explained by the method used as only extra-EU trade was considered here. The dependence also continued to grow later.

The second hypothesis on the large variety in the contribution of various goods and services to bilateral trade imbalances and trade dependency has been proved with the net export index and dependency ratios for specific products and services, which evidences in favour of existing large trade specialization.

This study has a similar conclusion on which EU products have the largest dependence on China, as in Kaaresvirta et al. (2023). In addition to the most competitive Chinese exports mentioned by Yilmaz (2020), this study also mentions organic chemicals, ceramic and glass products, iron, steel and aluminum products, ships and boats. As for the EU most competitive exports, nonfuel minerals, food, beverages and agricultural products are added to the list by Yilmaz (2020). Besides the net export index, an increase in competitiveness is also calculated here as the difference in export and import growth. The conclusion on the competitiveness of the EU food sector in 2012 by Kostadinov (2017) still remains valid a decade later. The same is relevant to the conclusion on better competitiveness of the EU services sector by Baláž et al. (2020). The list of Chinese services exports with growing competitiveness partially coincides with the findings of Ambroziak and Stefaniak (2022), but road transport, insurance, and pension services are added.

The third hypothesis on diversity in trade imbalances at the EU member states has been partially proved. Most member states have similarities with the general EU economy's trade deficit regularity, which provides reasons for supporting reshoring and near-shoring policies. However, few member states have trade surpluses and, therefore, may be more inclined towards further development of trade with China. The small list of the EU member states with a trade surplus with China remains almost the same, like in Yilmaz (2020), but changes in the indicators in 2016–2021 were mentioned here.

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The fourth hypothesis on the effects of real exchange rate and business cycle measured with industrial output has not been proved sufficiently with the regression analysis based on the member states' statistics.

This paper analyzes them as the factors of a net export index unlike most previous studies using the value of bilateral trade between the EU and China as a dependent variable. Unlike Cardoso and Duarte (2015), this analysis does not find evidence of the influence of the real effective exchange rate of the Chinese renminbi. Thus, the conclusion here based on later data remains the same as in Jitaru and Dumitrașciuc (2019). Partial effect of the bilateral exchange rate of the euro and the renminbi in Bao et al. (2022) is supported here. But unlike their view on the importance of invoice currency for explaining the variability of this effect, here the explanation is related to the definition of the real exchange rate (either based on consumer prices or on unit labor costs).

Industrial output is additionally tested as a factor here, but no significant effect is found. Nevertheless, the effect was observed at the level of the aggregate EU net export index (the COVID-19 pandemic crisis had an asymmetrical effect on the bilateral exports of the parties in favor of China). But there is no confidence that ordinary business cycles in future will have a similar effect as the pandemic crisis was an extraordinary event.

CONCLUSION

The paper aimed to determine structural components, changes, and possible factors of the bilateral trade imbalances between the EU and China. In 2021, the total trade between the EU and China reached almost 800 billion euro. The trade in services is disproportionally lower than in goods (only 12%). The role of China as a trade partner increased in the last decade. The EU has a stable negative trade balance with China with the exception of a smaller surplus in services.

Machinery is the main traded product group. China is also an important market for vehicles produced in the EU and a large source of electric appliances supply. The net export index and net growth rate exports show the high and growing competitiveness of the EU in trade with China in animal products, cereals, charges for the use of intellectual property, computer and transport services. Good competitiveness of the EU in vehicles is decreasing. China exercises and increases competitive pressure on the EU in furniture, glassware, iron and steel products, manufacturing services on physical inputs owned by others, and almost exclusively exports toys and similar items without reverse imports.

Germany and the Netherlands are the main EU trade partners for China. Luxemburg and Ireland have a large trade surplus with China. Slovakia was the most successful in decreasing its trade deficit with China. Several Central European countries and Portugal have the lowest and decreasing trade competitiveness relative to China.

Correlation and regression analysis was used to estimate the effect of several factors affecting the main bilateral trade imbalances and thus the direct efficiency of trade with China for the EU. The imbalances seem to be stable in time with some minor changes partially caused by real effective exchange rate values in the member states. However, the coefficient sign depends on the method used to calculate these rates. Therefore, there is no proof of the unidirectional effect of real exchange rates, especially in China after 2010. No significant effect of industrial output in both trading parties has been found at the level of the EU member states.

Future research may consider the effect of post-pandemic challenges on the efficiency of the EU and China trade.

AUTHOR CONTRIBUTIONS

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REFERENCES

1. Ambroziak, A. A., & Stefaniak, J. (2022). The position of China in trade in services within the European Union. *Oeconomia Copernicana, 13*(2), 335-354. https://doi.org/10.24136/oc.2022.010
2. Baláž, P., Královičová, M., & Steinhauser, D. (2020). Foreign trade as a tool to strengthen the EU's competitiveness against China (A case of the service sector). *Prague Economic Papers, 29*(2), 129-151. https://doi.org/10.18267/j.pep.731
3. Banterle, A. (2005) *Competitiveness and agri-food trade: An empirical analysis in the European Union*. 2005 International Congress. Copenhagen: European Association of Agricultural Economists. https://doi.org/10.22004/ag.econ.24692
4. Bao, H. H. G., Dinh, Th. Th. H., & Le, H. Ph. (2023). A nonlinear industry-level analysis of China's trade balances with the EU-28: Does the Utilization of the Vehicle Currency USD Matter? *Chinese Economy, 56*(5), 384-398. https://doi.org/10.1080/10971475.2023.2173398
5. Bao, H. H. G., Tran, Th. H. L., & Le, H. Ph. (2022). The roles of vehicle currency and real effective exchange rate in China's trade with the whole EU. *Cogent Economics & Finance, 10*(1), 1-16. https://doi.org/10.1080/23322039.2022.2028974
6. Bekkers, E., Francois, J., & Tomberger, P. (2016). *Tomorrow's Silk Road: Assessing an EU-China Free Trade Agreement* (World Trade Institute Paper 974). Retrieved from https://www.wti.org/media/filer_public/92/59/92591824-dce9-4077-9d3d-8a6112a9a23d/euchina_fta_final.pdf
7. Cardoso, A., & Duarte, A. P. (2017). The impact of the Chinese exchange policy on foreign trade with the European Union. *Brazilian Journal of Political Economy, 37*(4), 870-893. http://dx.doi.org/10.1590/0101-31572017v37n04a12
8. Cardoso, A., & Duarte, A. P. (2015). *The impact of the Chinese exchange policy on foreign trade with the European Union* (GEMF Working Paper 2015-09). University of Coimbra. Retrieved from https://repec.uc.pt/gmf/wpaper/wpgemf/gemf_2015-09.pdf
9. Chen, H., Luo, Ch., Renard, M.-F., & Sun, Sh. (2021). *EU-China trade and intra-EU trade: Substitute or complementary?* (Working Papers hal-03467473). Retrieved from https://uca.hal.science/hal-03467473/document
10. Eurostat. (2023). *Database*. Retrieved from https://ec.europa.eu/eurostat/web/main/data/database
11. Fang, L., & Shakur, Sh. (2018). Impact of trade cost on China-EU agri-food trade. *Journal of Chinese Economic and Business Studies, 16*(3), 259-274. https://doi.org/10.1080/14765284.2018.1482089
12. Felbermayr, G., Gans, S. Mahlkow, H., & Sandkamp, A.-N. (2021). *Decoupling Europe*. Kiel: Kiel Institute for the World Economy. Retrieved from https://www.econstor.eu/bitstream/10419/242494/1/KPB-153.pdf
13. Grübler, J. (2021). *Reshaping trade ties with China in the aftermath of COVID-19* (WIIW Policy Notes 44). The Vienna Institute for International Economic Studies. Retrieved from https://wiiw.ac.at/reshaping-trade-ties-with-china-in-the-aftermath-of-covid-19-dlp-5606.pdf
14. International Monetary Fund. (2023). *International Financial Statistics*. Retrieved from https://data.imf.org/?sk=4c514d48-b6ba-49ed-8ab9-52b0c1a0179b
15. Jackson, K., & Shepotylo, O. (2021). Belt and road: The China dream? *China Economic Review, 67*(C). https://doi.org/10.1016/j.chieco.2021.101604
16. Jiang, X., Kong, Y., Li, X., Yang, C., & Chen, X. (2019). Re-estimation of China-EU trade balance. *China Economic Review, 54*(C), 350-366. https://doi.org/10.1016/j.chieco.2019.01.008
17. Jitaru, L., & Dumitrașciuc, L. F. (2019). The influence of the depreciation of China's domestic currency on trade relations with the EU. *Ovidius University Annals, Economic Sciences Series, 19*(1),

http://dx.doi.org/10.21511/ppm.22(2).2024.12

33-38. Retrieved from https://stec.univ-ovidius.ro/html/anale/RO/wp-content/uploads/2019/08/5.pdf

18. Kaaresvirta, J., Kerola, E., & Nuutilainen, R. (2023). *Assessing the dependency of Finland and the EU on Chinese imports* (BOFIT Policy Briefs 7/2023). Bank of Finland Institute for Emerging Economies. Retrieved from https://www.econstor.eu/bitstream/10419/270849/1/1841028738.pdf
19. Karkanis, D. (2018). EU-China Trade: Geography and institutions from 2001 to 2015. *Journal of Economic Integration, 33*(1), 1158-1175. http://dx.doi.org/10.11130/jei.2018.33.1.1158
20. Kostadinov, A. (2017). *EU – China food trade perspectives*. (EconStor Conference Papers 149572). Leibniz Information Centre for Economics. Retrieved from https://www.econstor.eu/handle/10419/149572
21. Laike, Y., & Chun L. (2010). China-European Union trade and global warming. International *Journal of Social Ecology and Sustainable Development, 1*(1), 30-40. http://dx.doi.org/10.4018/jsesd.2010010104
22. Li, J., & Andreosso-O'Callaghan, B. (2020). An analysis of EU-China agricultural trade relations in the context of Brexit: The Perspective of Trade Specialization Dynamics. *Transition Studies Review, 27*(2), 109-130. Retrieved from https://transitionacademiapress.org/jtsr/article/view/327
23. Li, Y. (2008). Trade interdependence, comparative advantage and FDI between China and EU. *International Journal of Trade and Global Markets, 1*(3), 223-238. http://dx.doi.org/10.1504/IJTGM.2008.020428
24. Lo, Ch. P. (2018). China's New Silk Road and China-EU trade. *Annals of Economics and Finance, 19*(2), 683-701. Retrieved from http://down.aefweb.net/AefArticles/aef190213Lo.pdf
25. Mao, H., & Xiong, L. (2022). Is bilateral value added in trade between China and EU countries efficient? *China & World Economy, 30*(3), 210-238. http://dx.doi.org/10.1111/cwe.12424
26. Pawlak, K., Kołodziejczak, M., & Xie, Y. (2016). Changes in foreign trade in agri-food products between the EU and China. *Journal of Agribusiness and Rural Development, 4*(42), 607-618. http://dx.doi.org/10.17306/JARD.2016.87
27. Simola, H. (2020). *CO2 emissions embodied in EU-China trade and carbon border tax* (BOFIT Policy Briefs 4/2020). Bank of Finland Institute for Emerging Economies. Retrieved from https://www.econstor.eu/bitstream/10419/251691/1/bpb2004.pdf
28. Tang, C., Rosland, A., Li, J., & Yasmeen, R. (2024). The comparison of bilateral trade between China and ASEAN, China and EU: from the aspect of trade structure, trade complementarity and structural gravity model of trade. *Applied Economics, 56*(9), 1077-1089. https://doi.org/10.1080/00036846.2023.2174940
29. Xin, Ch. (2014). China-EU trade and economic relations (2003–2013). *Global Economic Observer, 2*(1), 41-55. Retrieved from http://www.globeco.ro/wp-content/uploads/vol/split/vol_2_no_1/geo_2014_vol2_no1_art_004.pdf
30. Yan, Y., Yang, L., & Priewe J. (2011). The impact of China-EU trade on climate change. *Geopolitics, History, and International Relations, 3*(2), 122-138. https://doi.org/10.1109/ICMSS.2011.5998661
31. Yilmaz, B. (2020). *China-EU trade relations: Is China an economic partner, competitor or rival?* (Koç University-TUSIAD Economic Research Forum Working Papers 2010). Retrieved from https://eaf.ku.edu.tr/wp-content/uploads/2020/04/erf_wp_2010.pdf
32. Zhu, J., Zhao, Y., & Zheng, L. (2024). The impact of the EU Carbon Border Adjustment Mechanism on China's exports to the EU. *Energies, MDPI, 17*(2), 1-18. https://doi.org/10.3390/en17020509