The Covid-19 Pandemic and European Trade Patterns: A Sectoral Analysis

Guglielmo Maria Caporale, Anamaria Diana Sova, Robert Sova

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Abstract

This paper examines how the Covid-19 pandemic affected European trade patterns. Specifically, dynamic panel data models are estimated to assess the effects on exports and imports of various sectors and products (selected on the basis of their trading volume or strategic importance) of the restrictions and of other policy measures adopted by national governments during the crisis. The results suggest that the impact of the Covid-19 pandemic was heterogeneous across sectors and product types, both the initial drop and the subsequent rebound being different depending on sectoral characteristics and the degree of resilience. In particular, trade flows of durable products were more significantly affected by the pandemic compared to those of non-durable ones.

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1. Introduction

The Covid-19 pandemic has been a major shock hitting world output and trade, even though the 8.9% fall recorded in the latter in 2020 was smaller than during the global financial crisis (GFC) and than initially forecast by the WTO (2020); moreover, during 2021 trade recovered sharply and was already expected to have returned to pre-pandemic levels by the first quarter of 2022 (OECD, 2022). However, it should be noted that the impact of the pandemic on trade was different across goods, services and trade partners, which resulted in more pronounced pressures on specific sectors and supply chains (OECD, 2022). In particular, the value of exports of services in OECD countries declined in 2020 by twice as much as that of imports (-16.7% and -8.2%. respectively). Some supply chains (e.g. for personal protective equipment) experienced significant difficulties owing to a huge increase in demand whilst others (e.g. for parts and components for automobiles and for semiconductors) were more resilient.

The epidemic originated in China, which is a key supplier of essential inputs to most economies, whose manufacturing sectors are at the heart of various international supply chains. A supply shock is likely to lead to 'supply chain contagion" through trade in intermediate goods. In fact, supply chains appear to have shifted geographically as a result of transport issues, with China acquiring a bigger role and seeing an increase in demand for its exports (OECD, 2022). Such changes are likely to affect both efficiency and risks for global value chains (Arriola et al., 2020). Demand shocks also disrupted them (Del Rio-Chanona et al., 2020).

Since China is one of Europe's largest partners for trade in goods (Eurostat, 2022) shocks affecting its economy also have a direct impact on European trade. In fact, the Covid-19 pandemic represented a serious challenge for the European countries as well. To stop the spread of the virus their governments introduced restrictions on movement and social distancing which affected the labour supply and transport and resulted in some businesses being partially or completely closed. As for trade, the restrictive measures caused supply chain disruptions (Kohlscheen et al., 2020) and both European exports and imports dropped sharply at the beginning of 2020 relative to the previous year; this was inevitable given the fact that the European countries have a relatively open

trade regime, and thus are deeply integrated into global markets and have developed trade relationships with a wide range of partners. [1]

However, the Covid-19 pandemic had heterogeneous effects owing to differences in the industrial structure of the European economies. The product structure of trade changed during the pandemic period, with trade in some goods and services plummeting whilst increasing in the case of others. Some sectors where remote work was possible because of a high degree of digitalization were less affected by the restrictive measures (Caporale et al., 2022). Trade flows of home office equipment such as Wi-Fi routers, laptops, portable storage etc.) rose significantly in the second quarter of 2020 (UNCTAD, 2021).

In the light of the above discussion, this paper aims to explore more thoroughly the impact of the Covid-19 pandemic on trade patterns applying dynamic panel techniques to monthly sectoral level data for Europe, which is one of the most important players in global trade. [2] More precisely, first it analyses the effects on the main sectors of the economy and the most traded goods of a wide set of government policies adopted in response to the Covid-19 pandemic in order to investigate whether such effects vary across sectors and types of goods. Second, it examines specifically the impact on total trade of the restrictive measures introduced by national governments through their interaction with sectoral trade flows. The estimated model also includes a world pandemic uncertainty index (WPUI) developed by Ahir et al. (2022) which, to our knowledge, has not been used before in studies in this area of the literature.

The findings of this paper have implications for the design of appropriate trade policies aimed at reducing pandemic-related trade risks and facilitating trade logistics; in particular, policy coordination could be useful to achieve a faster recovery (WTO, 2020). They are also relevant for firms, which might need to reconsider the resilience and reliability of their supply chains given the changes in trade patterns which have occurred during the pandemic and the fact that some of them

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[1] The EU's main partners for trade in goods are the US, China, and Switzerland; since April 2020, China has overtaken the US as the largest partner of the EU for both exports and imports (Eurostat 2021).

[2] EU is the second largest exporter and the third largest importer of goods in the world, with extra-EU trade accounting for 16.9 % of global exports and 15.1 % of global imports in 2020 (Eurostat 2021).

could be long-lived. The layout of the paper is as follows: Section 2 briefly reviews the relevant literature; Section 3 outlines the methodology; Section 4 describes the data and discusses the empirical findings; Section 5 offers some concluding remarks.

2. Literature Review

The literature on changes in trade patterns during the Covid-19 pandemic comprises two types of studies, which focus on global value chains (GVC) and within product analysis respectively.

The first category includes, for instance, the paper by Bonadio et al. (2020), who modelled lockdowns as a labour supply shock which is transmitted across countries through GVCs. Eppinger et al. (2021) examined instead whether decoupling from GVCs can increase a country's welfare by reducing its exposure to foreign supply shocks; specifically, they carried out simulations using a quantitative trade model and found that welfare losses from decoupling outweigh any benefits from lower shock exposure. Using a Ricardian model with sectoral linkages, trade in intermediate goods and sectoral heterogeneity in production, Sforza and Steininger (2020) were able to show that global production linkages have an important role in magnifying the effects of the production shock, and also that such effects are heterogeneous across sectors, regions and countries. Hayakawa and Mukunoki (2021a) investigated the impact of Covid-19 cases and deaths on demand, output and value chains by focusing on finished machinery products and found that supply chain effects were the most significant. Finally, Kejzar and Velic (2020) estimated a gravity model using monthly bilateral trade data for EU member states over the period from June 2015 to May 2020 and provided evidence that supply chains disruptions played an important role in the transmission of Covid-19 demand shocks.

The second category explores the sources of heterogeneity using within product data. For instance, in a comprehensive study Liu et al. (2021) estimated a gravity model applying panel methods with fixed effects to Chinese monthly export data at the HS 8-digit level over the period January 2019-December 2020. More specifically, they split the sample between medical goods (MG) and non-MGs and distinguished between durable and non-durable consumer goods (since the trade collapse resulting from the GFC had affected the former more significantly, as shown by Bems et al. (2013);

in addition, they used the work-from-home shares from Dingel and Neiman (2020) and Bonadio et al. (2020) as activities that can be performed from home are affected differently by lockdowns from those requiring physical presence; finally they took into account the level of contract intensity by measuring the share of intermediate inputs that require relationship-specific investment as in Nunn (2007), and also the position of products along GVCs by distinguishing between capital goods, intermediate goods, and final goods for consumption. Their findings confirm the presence of considerable heterogeneity; in particular, it appears that MGs were not affected by the pandemic, and products with a high "work-from-home" share or a high contract intensity as well as capital goods to a lesser extent in comparison to other goods.

Hayakawa and Mukunoki (2021b) also used a panel approach with fixed effects to examine the impact of the Covid-19 pandemic on monthly exports of 34 countries to 173 countries over the period from January to August in 2019 and 2020, and found again heterogeneous trade effects across industries. Specifically, in the case of imports the pandemic decreased demand for mineral products, leather products, and transport equipment (all non-essential goods whose purchase can be postponed), whilst it increased it for chemical products, textiles, and precious metals (the former two including medical products, such as masks or protective equipment for medical use). As for exports, labour-intensive industries such as textiles, leather products and footwear appear to have suffered from the negative effects of lockdowns and other containment measures; a negative impact of the pandemic was also estimated in the case of transport equipment, which was affected by both a supply and a demand shock.

The present paper belongs the second category, which focuses on sectoral and within product analysis, but unlike previous related contributions focuses on the specific case of the European countries.

3. Econometric Methodology and Data Description

The empirical framework chosen to analyse the impact of the Covid-19 pandemic on trade is a dynamic panel model with a set of explanatory variables including a Covid-19 index. Its general form is the following:

$$TRD_{i,t}^m = \alpha_{i,0} + \delta_{I,1} TRD_{i,t-1}^m + \sum_{k=1}^{K} \lambda_{i,k} X_{i,t}^k + \sum_{j=1}^{J} \beta_{i,j}\, COVID_{i,t}^j + \mu_t + \eta_i + \varepsilon_{i,t} \qquad (1)$$

where the dependent variable $TRD_{i,t}^m$ is an international trade indicator (for exports and imports in turn); as for the regressors:

- ✓ $X_{i,t}^k$ denotes a set of control variables affecting international trade
- ✓ $COVID_{i,t}^j$ is the main variable of interest and stands for stringency and a wider index of the governmental responses to the pandemic in turn
- ✓ μ_t and η_i stand for time-specific and country-specific effects respectively, ε_{it} is a white noise error with zero mean, where i=1,2…,and N and t=1,2,…,T denote the country and time period respectively, and α_i is the country-specific intercept that can vary across countries.

Various specifications are estimated. In particular, first we focus on the direct impact of the governmental policy responses to the pandemic on both exports and imports of various sectors, and also on goods at the HS 2-digit level; second, we examine their indirect impact on total trade using an interaction term (STR x TRDS), where STR stands for a stringency index and TRDS for sectoral trade (EXPS and IMPS for exports and imports in turn).

Our empirical approach is based on a sector-level trade model, which leads to estimating the following export and import equations:

$$EXPS_{i,t}^{s} = \alpha_i + \beta_{i,0}EXPS_{i,t-!}^{s} + \beta_{i,1}IPI_{i,t} + \beta_{i,2}WPUI_{i,t} + \beta_{i,3}STR_{i,t} + \beta_{i,4}EC\_SUP_{i,t} +$$
$$\beta_{i,5}CPI_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \tag{2}$$

$$IMPS_{i,t}^{s} = \alpha_i + \beta_{i,0}IMPS_{i,t-1}^{s} + \beta_{i,1}IPI_{i,t} + \beta_{i,2}WPUI_{i,t} + \beta_{i,3}STR + \beta_{i,4}EC\_SUP_{i,t} +$$
$$\beta_{i,5}CPI_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \tag{3}$$

where: $EXPS_{i,t}^{s}$/ $IMPS_{i,t}^{s}$= sectoral exports and imports, IPI= industrial production index; WPUI= World Pandemic Uncertainty Index, STR = stringency index (STR); EC_SUP = economic support, CPI= consumer price index.

To check for the robustness of the results we also use a wider measure of the response to the Covid-19 pandemic, namely the governmental response index (GOV_RESP), which includes both the restrictions and other policies adopted during the pandemic; thus the estimated equations become the following:

$$EXPS_{i,t}^{s} = \alpha_i + \beta_{i,0}EXPS_{i,t-!}^{s} + \beta_{i,1}IPI_{i,t} + \beta_{i,2}WPUI_{i,t} + \beta_{i,3}GOV\_RESP_{i,t} + \beta_{i,4}CPI_{i,t} +$$
$$+\mu_t + \eta_i + \varepsilon_{i,t} \tag{4}$$

$$IMPS_{i,t}^{s} = \alpha_i + \beta_{i,0}IMPS_{i,t-1}^{s} + \beta_{i,1}IPI_{i,t} + \beta_{i,2}WPUI_{i,t} + \beta_{i,3}GOV\_RESP + \beta_{i,4}CPI_{i,t} +$$
$$+\mu_t + \eta_i + \varepsilon_{i,t} \tag{5}$$

The model specification for product analysis is instead the following:

$$EXPP_{i,t}^{p} = \alpha_i + \beta_{i,0}EXPP_{i,t-!}^{p} + \beta_{i,1}IPI_{i,t} + \beta_{i,2}WPUI_{i,t} + \beta_{i,3}STRING_{i,t} + \beta_{i,4}EC\_SUP_{i,t} +$$
$$\beta_{i,5}CPI_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \tag{6}$$

$$IMPP_{i,t}^{p} = \alpha_i + \beta_{i,0}IMPP_{i,t-1}^{p} + \beta_{i,1}IPI_{i,t} + \beta_{i,2}WPUI_{i,t} + \beta_{i,3}STRING_{i,t} + \beta_{i,4}EC\_SUP_{i,t} +$$
$$\beta_{i,5}CPI_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \tag{7}$$

where $EXPP_{i,t}^{p}$ = product (good) export value, $IMPP_{i,t}^{p}$ = product (good) import value, p=1......99 = HS2-code

To analyse how the policy responses affected the contribution of the main sectors to international trade, again we include an interaction term (STR x TRDS) and re-specify the equations as follows:

$$EXPT_{i,t} = \alpha_i + \beta_{i,0}EXPT_{i,t-!} + \beta_{i,1}EXPS_{i,t}^{s} + \beta_{i,2}IPI_{i,t} + \beta_{i,3}WPUI_{i,t} + \beta_{i,4}STR\_EXPS_{i,t} +$$
$$\beta_{i,5}EC\_SUP_{i,t} + \beta_{i,6}CPI_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \qquad (8)$$

$$IMPT_{i,t} = \alpha_i + \beta_{i,0}IMPT_{i,t-!} + \beta_{i,1}IMPS_{i,t}^{s} + \beta_{i,2}IPI_{i,t} + \beta_{i,3}WPUI_{i,t} + \beta_{i,4}STR\_IMPS_{i,t} +$$
$$\beta_{i,5}EC\_SUP_{i,t} + \beta_{i,6}CPI_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \qquad (9)$$

where: $EXPT_{i,t}^{S}$/ $IMPT_{i,t}^{S}$= international trade (total value of export and total values of imports). $STR\_EXP_{i,t} = STR_{i,t} \times EXPS_{i,t}^{s}$ and $STR\_IMP_{i,t} = STR_{i,t} \times IMPS_{i,t}^{s}$

Each specification includes various control variables that are selected on the basis of the theoretical and empirical literature discussed in Section 2. Unlike previous studies, we analyse both the impact of the policy responses to and of the uncertainty generated by the pandemic (measured by WPUI).

The dataset comprises monthly data over the period 2019M1–2021M12 for 28 European countries (the EU27 as well as the UK). As already mentioned, $(COVID_{i,t}^{j})$ is the main variable of interest: we use a stringency index (STR)[3] and an overall government response index (GOV_RESP)[4] in turn to measure the impact on trade of the policies adopted by national governments to handle the pandemic. The former is based only on restrictive measures such as social distancing, workplace closures, and travel bans, whilst the latter includes both closure policies and health system and economic policies to support households and businesses during the crisis period. Both have been

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[3] The stringency index is calculated using 9 indicators, namely: school and workplace closing, cancel public events, close public transport, stay-at-home requirements, restrictions on gathering size, on internal movement, on international travel and public information campaign (source: OXCGRT).
[4] The government response index includes testing policy, contact tracing and facial coverings in addition to the policies already included in the stringency and economic support variables. (source: OXCGRT).

obtained from the Oxford Covid-19 Government Response Tracker (OXCGRT) and range between 0 and 100, with higher values indicating tighter restrictions/stronger policy responses, and both peaked during the first wave of Covid-19 in the first two quarters of 2020.

The model also includes the World Pandemic Uncertainty Index (WPUI) developed by Ahir et al. (2022), which counts "the number of times uncertainty is mentioned within a proximity to a word related to pandemics in the Economist Intelligence Unit (EIU) country reports".[5] It captures uncertainty directly related to the pandemic and it is therefore more appropriate for our purposes than a general uncertainty index based on economic and political uncertainty. This series has been obtained from https://worlduncertaintyindex.com.

The industrial production index (IPI) measures output in industries such as manufacturing, mining, electric, and gas industries relative to a base year. It is a standard proxy for GDP (for which monthly data are not available) since the value added of industrial production normally represents a significant share of GDP and thus can be used to assess its current state and short-term outlook (see Mitchell et al., 2005). The source is the Eurostat database.

Economic support (EC-SUP) captures the economic policies adopted by governments to support households and business during the lockdown measures. This index is created using two indicators, namely income support and debt and contract relief for households, and it is also extracted from the Oxford Covid-19 Government Response Tracker (OXCGRT).

$EXPT_{i,t}^s$/ $IMPT_{i,t}^s$ and $EXPP_{i,t}^p$/ $IMPP_{i,t}^p$ stand for exports and imports at sector and product level (the HS 2-digit level) respectively. Specifically, we select the main sectors producing durable and non-durable goods such as agriculture, food and drink, mineral products, chemical products, plastics, base metals, instruments and apparatus, textiles and footwear and machinery and vehicles. These are chosen on the basis of their share of total trade but also of their importance for the economy. For instance, the agriculture and food sectors are included because they are normally considered by governments a national priority (Beckman and Countryman, 2021). For a better

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[5] More precisely, it is "the percent of the word "uncertain", and its variants, that appear near the pandemic terms in EIU country reports, multiplied by 1,000" (Ahir et al., 2022).

understanding of the impact of the pandemic on trade, we also extend the analysis to the goods level. The goods considered are those whose trade volume was above 60 billion dollars in 2021, more precisely cereals (10), mineral fuels (27), organic chemical (29), pharmaceutical products (30), iron and steel (72), articles of iron and steel (73); machinery and mechanical appliances (84); electric machinery and equipment (85); vehicles other than railway (87); aircraft, spacecraft and parts (88); optical, photographic, cinema (90). This type of investigation is particularly interesting since it allows to establish whether the effects of governmental policy responses differed for durable and non-durable goods. All trade data are taken from the UN-COMTRADE database.

Finally, $CPI_{i,t}$ is the consumer price index which is used to measure inflation; the source is the EUROSTAT database.

The estimated dynamic panel models include lagged values of the explanatory endogenous variables as instruments, thus controlling for endogeneity and measurement errors. The system GMM estimator developed by Arellano and Bover (1995) is employed. Sargan tests of the over-identifying restrictions are carried out to check the validity of the chosen instruments, and serial correlation tests (AR (1), AR (2)) are also performed. Before proceeding to the estimation, Harris and Tzavalis (1999), Breitung (2000) and Levine et al. (2002) unit root tests are conducted. [6] All series are found to be stationary and therefore no co-integration analysis is necessary and the GMM estimation can be done directly. [7]

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[6] The test results are not included but are available upon request.

[7] For the estimation we use the STATA xtabond2 routine developed by Roodman (2009) extended to include Windmeijer's (2005) finite sample correction to the standard errors reported in the two-step estimation, (without which standard errors tend to be heavily biased downwards); the automatic Sargan/Hansen difference tests for the validity of the instrument subsets; the forward orthogonal gap transformation, which preserves the sample size in panels with gaps; the appropriate autocorrelation tests for linear GMM panel regressions, especially important when lags are used as instruments.

4. Empirical Results

The estimation results are reported in Tables 1-10. First, we focus on the direct effects of the Covid-19 policy responses on trade patterns in the European countries by estimating separate equations for the exports and imports of each sector considered.

Insert Table 1 and 2

It can be seen from Table 1 (exports) and Table 2 (imports) that the impact of the restrictive measures on trade varied across sectors. In particular, agriculture, chemicals and food and drinks appear to be the least affected in terms of both exports and imports. By contrast, there is evidence of sizable negative effects in the case of machinery and vehicles, mineral products, plastics, base metals, textiles and footwear and instruments and apparatus. The reason for the greater resilience of some sectors is that during the pandemic those producing essentials, such as agri-food or chemical products, were allowed to continue to work or were even exempted from implementing lockdown measures and workplace closures.

The agriculture and agro-food sector is considered strategic by the European countries. Initially concerns arose owing to labour shortages caused by border closures and movement restrictions. An example is the fruit and vegetable subsector where such measures significantly reduced the availability of seasonal workers during periods of peak labour demand or labour-intensive production in the European Union (Beckman and Countryman, 2021). Besides, consumer panic buying, especially during the first wave of the pandemic, had an impact on the food supply. However, various measures adopted by the European countries such as classifying the agri-food workforce as essential and introducing green lanes helped to mitigate the negative impact of the pandemic and made this sector more resilient (see Figure 1a).

Europe is the second-largest chemicals producer in the world and accounts for 16.9% of total global sales (Eurostat, 2021). The chemical industry plays a crucial role for almost all value chains and it is an essential part of the European economies, since most industries rely on chemicals.

Some of its products or subsectors were classified as essential during the pandemic given their strategic role in producing the necessary health care materials and equipment. Again, despite a sharp drop in trade during the first two months of the pandemic, the overall impact of the health crisis was not as pronounced as in the case of other sectors (see Figure 1b). The two factors explaining this finding are the priority given to this industry by national governments in order to ensure the availability of essential chemicals during the pandemic, and the increase in demand for some chemical products such as disinfectants during this period.

The sector most affected by the pandemic appears to have been the machinery and vehicles one, these being durable products (see column 9 in Tables 1 and 2). Specifically, there was a large drop in both exports and imports at the beginning of 2020, during the first wave of the pandemic, which was followed by a quick recovery starting in the third quarter of 2020 (see Figure 1c). The initial decline can be explained by short-term input supply shortages resulting from the closures of factories in Europe and elsewhere, but also by changes in consumer behaviour. In particular, durable non-essential goods were more affected in the presence of the greater uncertainty associated with the health crisis. Note that in comparison to the Global Financial Crisis (GFC), the impact of the pandemic on both exports and imports was smaller and the recovery quicker (see Figure 2). This reflects some key differences between the two crises: in the case of the GFC liquidity and solvency problems in the banking and financial sector were the main challenges, and both monetary and fiscal policy were required to tackle them and support businesses and households; by contrast, in the case of the recent crisis restrictions aimed at limiting the spread of the virus affected mobility and the labour supply. Concerning the other sectors, the lockdown measures (captured by the stringency variable) also had negative effects. These restrictions disrupted the supply of inputs and the transport of goods, and caused labour shortages as well. As a result, both exports and imports declined, especially during the first period of the pandemic.

As expected, the world pandemic uncertainty index is generally found to have had a negative impact. Uncertainty related to the pandemic peaked during the first wave (see Figure 3), especially in the case of the European countries with a higher number of Covid-19 cases. This affected the food and drink sector through panic buying, and also the durable sectors. As for economic support, its impact is generally found to be positive but its size depends on sectoral characteristics.

Concerning the other variables, the effects of the industrial production index are positive and significant in most cases. Similar conclusions are reached in all cases when the wider measure for the policy responses (i.e., the government response index) is used, which confirms the robustness of our results (see Tables 3 and 4).

Insert Table 3 and 4

Next we repeat the analysis at a higher level of disaggregation by estimating equations (5) and (6) for 11 goods at the HS2 digit level. As already mentioned, their selection is based on their trade volumes, these being the most traded products, with their exports and imports exceeding 60 billion dollars in 2021.

Insert Table 5 and 6

These results confirm that the effects of pandemic varied by product type. In particular, there was a negative impact of the restrictions on trade in the case of durable goods such as machinery and mechanical appliances (84); electric machinery and equipment (85); vehicles other than railway (87); aircraft, spacecraft and parts (88). The most affected were the latter two (87, 88), which had not yet fully recovered by the end of 2021. In general demand for non-essential goods initially dropped but then gradually picked up again, especially in the case of products (such as computers) required for remote work. The recovery in spending on durable goods was caused by a shift in consumer demand from services towards them and by the higher disposable income resulting from the fiscal stimulus (Tauber and Van Zandweghe, 2021). By contrast, the impact of the restrictions was not significant in the case of pharmaceutical and organic products, demand increasing in the first semester of 2020 for the former and also in some cases (e.g., disinfectants) for the latter. As already mentioned, pharmaceutical products were given priority during the pandemic, even in the presence of lockdown measures and border closures, which explains this finding.

On the whole, there is clear evidence of heterogeneity in the impact of the pandemic and also in the extent of the rebound in the case of both exports and imports, at both the sector and the product level, depending on sectoral characteristics (such as the level of digitalization) and the degree of

resilience. Almost all industries (the exception being pharmaceutical products) were significantly affected in early 2020, during the first wave, when uncertainty was higher and restrictions tighter (see Tables 7 and 8) and industrial production as a whole fell sharply, before starting to recover in the following months (see Figure 1). The production of durable consumer goods and capital goods was most affected (Eurostat, 2022). European industries then tried to adapt to the pandemic and therefore the next waves had a milder impact on trade.

Insert Table 7 and 8

In the final part of the analysis we examine further the impact of the pandemic on trade using an interaction term (STR x TRDS) between the restrictive measures and sectoral trade flows; this captures changes in the contribution of the main sectors to total trade resulting from the restrictions. These results are displayed in Tables 9 and 10

Insert Table 9 and 10

It can be seen that the interaction term has a negative impact on both exports and imports in the case of machinery and vehicles, mineral products, and base metals, whilst there is no significant effect in the case of agriculture, food and drinks and chemicals. It is clear, therefore, that the restrictions affected the contribution of the various sectors to international trade. More precisely, their impact was more pronounced in the case of manufacturing sectors such as machinery and vehicles than in the agri-food one. These findings are consistent with the previous ones concerning the direct effects of the pandemic on sectoral trade through the adopted policy measures.

4. **Conclusions**

This paper provides new evidence on the effects of the Covid-19 pandemic on European trade patterns by estimating dynamic panel models at both the sector and the product level. The findings indicate that the lockdown restrictions and the other policies adopted by national governments to contain the spread of the virus had a heterogeneous impact across sectors and types of products

depending on their characteristics and degree of resilience. Specifically, agriculture, chemicals and food and drinks were less affected than machinery and vehicles and other manufacturing industries. As in the case of the GFC, trade of durable products dropped more sharply since consumers reduced their spending on this category of goods in response to the higher uncertainty generated by the pandemic. Pharmaceuticals were the least affected category and their production and trade flows even increased during the health crisis. These findings are consistent with previous ones also carrying out within product analysis (e.g., Liu et al., 2021, and Hayakawa and Mukunoki, 2021b), but shed new light on the specific case of the European countries using a dynamic modelling framework.

It is noteworthy that the recovery was also different across sectors and products depending on the degree of digitalization, but in all cases trade had fully recovered or even exceeded pre-Covid levels by the end of 2021. This is because European industries adapted to the pandemic by introducing remote work and resorting to e-commerce whenever possible and thus restrictions had a milder impact (Caporale et al., 2022, and Espitia et al., 2021), with trade actually increasing in the case of laptops, logiciels, wifi, and internet connection. National governments also adopted other measures to provide financial support and facilitate access to credit in order to mitigate the effects of the crisis (Caporale et al., 2021).

On the whole, the Covid-19 pandemic revealed weaknesses and vulnerabilities, with many businesses experiencing difficulties and being initially unable to cope with supply shortages caused by border and manufacturing site closures. There are clearly lessons to be learned for the future. The heterogeneous impact of the pandemic on trade flows and thus on patterns resulted in high uncertainty and adjustment costs, which provided incentives to firms and governments to adopt appropriate risk mitigation strategies. In particular, European industries should invest in digitalization and innovation to increase their competitiveness, and the resilience of value chains should be enhanced through the diversification of suppliers, thus reducing dependency on individual ones and the risks related to partners in third countries.

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Table 1: The direct effects of the Covid-19 pandemic (STR-stringency measure) on exports of the main sectors in the case of the European countries

Sectors / Variables	(1) Agriculture	(2) Food & Drinks	(3) Mineral Products	(4) Chemical Products	(5) Plastics, Rubber	(6) Base Metals	(7) Instruments, Apparatus	(8) Textiles Footwear	(9) Machinery & Vehicles
	EXPS	EXPS	EXPS	EXPS	EXPS	EXPS	EXPS	EXPS	EXPS
L.	0.964	0.952	0.722	0.961	0.879	0.882	0.675	0.698	0.730
	(8.60)***	(5.45)***	(8.68)***	(3.81)***	(3.73)***	(4.22)***	(7.77)***	(5.99)***	(8.75)***
IPI	0.0021	0.0023	0.0024	0.0023	0.0027	0.0034	0.0060	0.0064	0.0039
	(3.92)***	(7.26)***	(3.56)***	(6.13)***	(4.30)***	(6.66)***	(5.69)***	(10.56)***	(3.80)***
WPUI	-0.0000	-0.0002	-0.0005	0.0000	-0.0000	-0.0003	-0.0004	-0.0002	-0.0005
	(0.29)	(3.24)***	(1.81)*	(0.12)	(0.11)	(2.12)**	(1.77)*	(1.48)	(1.72)*
STR	-0.0003	-0.0002	-0.0005	-0.0004	-0.0009	-0.0006	-0.0012	-0.0010	-0.0016
	(0.96)	(0.40)	(1.67)*	(0.94)	(5.03)***	(1.70)*	(2.41)**	(5.18)***	(2.72)***
EC-SUP	-0.0043	0.0156	-0.0777	0.0665	0.0521	0.0390	0.0080	-0.0011	0.0525
	(0.29)	(1.19)	(1.51)	(4.01)***	(4.12)***	(1.73)*	(2.94)***	(0.04)	(1.52)
CPI	-0.0035	-0.0061	-0.0236	-0.0406	0.0264	0.0716	-0.0314	-0.0985	0.0290
	(0.17)	(0.41)	(0.44)	(1.42)	(4.48)***	(2.12)**	(1.20)	(3.90)***	(0.71)
Constant	0.2684	0.4093	2.1820	0.3292	0.9750	0.8415	2.2750	1.9769	2.1320
	(1.23)	(1.53)	(3.50)***	(1.58)	(3.29)***	(3.33)***	(3.79)***	(6.90)***	(3.31)***
Observations	13720	8820	2940	10780	1960	10780	980	18620	8820
AR(1)	-3.26	-4.35	-3.97	-5.11	-4.93	-3.99	-5.33	-3.80	-4.77
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	0.42	0.46	1.07	1.25	-1.35	-1.51	-0.42	0.29	0.87
	(0.673)	(0.279)	(0.283)	(0.212)	(0.177)	(0.131)	(0.675)	(0.774)	(0.384)
Sargan test	6.71	8.06	3.84	1.03	10.05	7.04	11.82	2.28	3.89
	(0.459)	(0.327)	(0.799)	(0.794)	(0.186)	(0.425)	(0.107)	(0.32)	(0.793)
Absolute value of t statistics in parentheses									
* significant at 10%; ** significant at 5%; *** significant at 1%									

Notes: Column (1) is live Animals, Animal products and Vegetable products; Column (2) is Food & Drinks; Column (3) is Mineral products; Column (4) is Chemical products; Column (5) is Plastics , Rubber and articles thereof; Column (6) is Base metals and articles of base metal; Column (7) is Instruments, Apparatus; Column (8) is Textile and Footwear and Column (9) is Machinery and Vehicles.

Table 2: The direct effects of the Covid-19 pandemic (STR-stringency measure) on imports of the main sectors in the case of the European countries

Sectors / Variables	(1) Agriculture	(2) Food & Drinks	(3) Mineral Products	(4) Chemical Products	(5) Plastics, Rubber	(6) Base Metals	(7) Instruments, Apparatus	(10) Textiles Footwear	(11) Machinery & Vehicles
	IMPS	IMPS	IMPS	IMPS	IMPS	IMPS	IMPS	IMPS	IMPS
L.	1.045	0.917	0.850	0.993	0.917	0.828	0.934	0.798	0.773
	(4.17)***	(7.08)***	(11.00)***	(4.73)***	(3.25)***	(4.34)***	(2.62)***	(2.96)***	(9.25)***
IPI	0.0014	0.0012	0.0018	0.0022	0.0024	0.0027	0.0053	0.0033	0.0056
	(6.01)***	(7.16)***	(2.17)**	(6.05)***	(5.63)***	(7.69)***	(5.79)***	(10.02)***	(7.05)***
WPUI	-0.0001	-0.0001	-0.0006	-0.0002	-0.0002	-0.0004	-0.0005	-0.0006	-0.0008
	(1.57)	(3.25)***	(3.07)***	(2.17)**	(2.16)**	(4.54)***	(3.98)***	(9.43)***	(1.93)**
STR	-0.0002	0.0004	-0.0005	0.0003	-0.0004	-0.0003	-0.0002	-0.0004	-0.0006
	(1.16)	(0.71)	(1.79)*	(1.24)	(1.81)*	(1.73)*	(0.80)	(0.26)	(2.01)**
EC-SUP	0.0497	0.0241	-0.0426	0.0714	0.0168	- 0.0061	0.0021	0.0272	-0.0658
	(1.71)*	(1.65)*	(1.24)	(5.03)***	(1.24)	(0.41)	(0.09)	(1.89)*	(1.93)*
CPI	-0.0525	-0.0121	-0.0454	-0.0523	0.0133	0.0530	0.0097	0.0374	-0.0166
	(3.75)***	(1.25)	(1.48)	(2.86)***	(0.82)	(2.92)***	(0.40)	(3.03)***	(0.44)
Constant	-0.2634	0.6795	1.3433	0.1305	0.7080	1.2774	0.5528	1.4394	1.9265
	(1.57)	(4.66)***	(2.19)**	(0.62)	(3.59)***	(5.11)***	(1.77)*	(5.93)***	(2.86)***
Observations	13720	8820	2940	10780	1960	10780	980	18620	8820
AR(1)	-4.15	-6.58	-5.57	-5.48	-4.11	-3.26	-5.01	-5.23	-4.95
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	0.35	-0.39	0.44	-0.51	-0.36	0.42	1.51	1.56	-1.25
	(0.725)	(0.697z0	(0.663)	(0.608)	(0.718)	(0.673)	(0.132)	(0.118)	(0.212)
Sargan test	2.73	2.71	7.53	1.95	10.74	1.61	2.86	1.43	1.03
	(0.144)	(2.58)	(0.376)	(0.162)	(0.150)	(0.447)	(0.239)	(0.490)	(0.794)
Absolute value of t statistics in parentheses									
* significant at 10%; ** significant at 5%; *** significant at 1%									

Notes: Column (1) is live Animals, Animal products and Vegetable products; Column (2) is Food & Drinks; Column (3) is Mineral products; Column (4) is Chemical products; Column (5) is Plastics, Rubber and articles thereof; Column (6) is Base metals and articles of base metal; Column (7) is Instruments, Apparatus; Column (8) is Textile and Footwear and Column (9) is Machinery and Vehicles.

Table 3: The direct effects of the Covid-19 pandemic (GOV-RESP) on exports of the main sectors in the case of the European countries

Sectors \\ Variables	(1) Agriculture	(2) Food & Drinks	(3) Mineral Products	(4) Chemical Products	(5) Plastics, Rubber	(6) Base Metals	(7) Instruments, Apparatus	(8) Textiles Footwear	(9) Machinery & Vehicles
	EXPS	EXPS	EXPS	EXPS	EXPS	EXPS	EXPS	EXPS	EXPS
L.	0.214	0.153	0.210	0.307	0.748	0.038	0.225	0.173	0.824
	(9.97)***	(11.04)***	(19.15)***	(13.03)***	(17.67)***	(1.89)*	(14.30)***	(7.62)***	(8.48)***
IPI	0.0016	0.0001	0.0043	-0.0002	0.0008	0.0017	0.0014	0.0034	0.0043
	(3.37)***	(0.69)	(32.71)***	(0.75)	(19.22)***	(5.07)***	(1.55)	(9.50)***	(2.11)**
WPUI	-0.0002	-0.0001	-0.0000	-0.0000	-0.0001	-0.0001	-0.0006	0.0001	-0.0004
	(2.09)**	(2.11)**	(0.73)	(0.76)	(2.03)**	(1.65)	(3.97)***	(1.41)	(2.18)**
GOV-RESP	-0.0003	-0.0004	-0.0012	0.0005	-0.0002	-0.0008	-0.0006	-0.0004	-0.0013
	(1.55)	(1.13)	(2.49)**	(1.82)*	(2.00)**	(1.79)*	(2.59)***	(2.23)**	(2.36)**
CPI	- 0.0123	0.0076	0.0145	-0.0004	-0.0020	0.0012	0.0549	0.0041	0.0042
	(4.95)***	(6.59)***	(11.26)***	(0.22)	(4.35)***	(0.55)	(4.11)***	(1.86)*	(1.78)*
Constant	5.4652	6.2122	5.8193	5.0842	2.0155	6.7412	4.7936	5.4543	1.3443
	(6.67)***	(6.79)***	(7.80)***	(9.93)***	(5.91)***	(7.36)***	(9.03)***	(6.54)***	(5.88)***
Observations	13720	8820	2940	10780	1960	10780	980	18620	8820
AR(1)	-4.48	-4.20	-4.13	-4.52	-4.37	-5.22	-5.73	-6.93	-3.56
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	-1.48	0.79	1.30	1.05	1.25	-0.69	1.58	-0.18	1.47
	(0.140)	(0.424)	(0.193)	(0.293)	(0.211)	(0.490)	(0.113)	(0.854)	(0.142)
Sargan test	8.13	12.45	79.19	4.46	74.83	5.40	6.56	13.13	8.41
	(0.616)	(0.256)	(0.166)	(0.924)	(0.266)	(0.863)	(0.767)	(0.217)	(0.589)
Absolute value of t statistics in parentheses									
* significant at 10%; ** significant at 5%; *** significant at 1%									

Notes: Column (1) is live Animals, Animal products and Vegetable products; Column (2) is Food & Drinks; Column (3) is Mineral products; Column (4) is Chemical products; Column (5) is Plastics, Rubber and articles thereof; Column (6) is Base metals and articles of base metal; Column (7) is Instruments, Apparatus; Column (8) is Textile and Footwear and Column (9) is Machinery and Vehicles.

Table 4: The direct effects of the Covid-19 pandemic (GOV-RESP) on imports of the main sectors in the case of the European countries

Sectors / Variables	(1) Agriculture	(2) Food & Drinks	(3) Mineral Products	(4) Chemical Products	(5) Plastics, Rubber	(6) Base Metals	(7) Instruments, Apparatus	(8) Textiles Footwear	(9) Machinery & Vehicles
	IMPS	IMPS	IMPS	IMPS	IMPS	IMPS	IMPS	IMPS	IMPS
L.	0.111	0.084	0.389	0.452	0.747	0.395	0.254	0.200	0.428
	(5.07)***	(6.61)***	(8.37)***	(6.53)***	(9.29)***	(3.93)***	(6.92)***	(11.46)***	(4.73)***
IPI	0.0008	0.0002	0.0036	0.0009	0.0005	0.0030	0.0033	0.0027	0.0054
	(3.79)***	(1.32)	(6.12)***	(5.38)***	(7.65)***	(11.99)***	(2.02)*	(10.09)***	(6.74)***
WPUI	0.0000	-0.0000	-0.0001	-0.0000	-0.0001	0.0000	-0.0005	0.0000	-0.0002
	(0.11)	(1.01)	(4.28)***	(0.34)	(6.79)***	(0.64)	(2.35)**	(1.41)	(1.68)*
GOV-RESP	0.0008	0.0002	-0.0009	0.0004	-0.0001	-0.0005	-0.0007	-0.0003	-0.0010
	(1.35)	(0.43)	(7.35)***	(2.47)**	(2.88)***	(3.98)***	(4.63)***	(2.21)**	(1.74)*
CPI	0.0021	0.0000	-0.0025	0.0022	-0.0068	-0.0028	0.0139	-0.0061	0.0019
	(1.30)	(0.05)	(1.57)	(1.58)	(3.03)***	(1.66)*	(1.30)	(3.70)***	(0.66)
Constant	6.4084	6.9250	4.7750	4.1249	2.0567	4.4026	4.7617	5.5088	4.4620
	(4.54)***	(7.78)***	(6.57)***	(4.27)***	(7.72)***	(3.00)***	(6.74)***	(4.73)***	(3.24)***
Observations	13720	8820	2940	10780	1960	10780	980	18620	8820
AR(1)	-4.44	-3.13	-3.45	-4.16	-3.89	-4.49	-3.97	-5.38	-4.74
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	0.87	1.01	-0.44	1.04	1.48	0.14	1.24	-1.44	-0.27
	(0.382)	(0.314)	(0.658)	(0.297)	(0.140)	(0.888)	(0.215)	(0.149)	(0.789)
Sargan test	10.11	12.01	7.49	13.82	72.90	4.80	55.64	5.82	80.90
	(0.606)	(0.445)	(0.824)	(0.312)	(0.854)	(0.964)	(0.858)	(0.925)	(0.136)
Absolute value of t statistics in parentheses									
* significant at 10%; ** significant at 5%; *** significant at 1%									

Notes: Column (1) is live Animals, Animal products and Vegetable products; Column (2) is Food & Drinks; Column (3) is Mineral products; Column (4) is Chemical products; Column (5) is Plastics, Rubber and articles thereof; Column (6) is Base metals and articles of base metal; Column (7) is Instruments, Apparatus; Column (8) is Textile and Footwear and Column (9) is Machinery and Vehicles.

Table 5: The direct effects of the Covid-19 pandemic on exports of the most traded goods in the case of the European countries, 2019-2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
HS 2 digit	(10)	(27)	(29)	(30)	(72)	(73)	(84)	(85)	(87)	(88)	(90)
Variabless	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP
L.	0.955	0.969	0.878	0.927	1.001	0.833	0.940	1.012	0.590	0.951	0.938
	(18.83)***	(11.98)***	(11.58)***	(16.13)***	(13.14)***	(14.86)***	(17.86)***	(21.38)***	(4.03)***	(22.45)***	(20.08)***
IPI	0.0013	0.0021	-0.0005	0.0017	0.0038	0.0032	0.0053	0.0041	0.0052	0.0086	0.0061
	(1.55)	(3.33)***	(0.38)	(3.17)***	(4.19)***	(3.53)***	(4.82)***	(4.71)***	(1.79)*	(10.80)***	(5.95)***
WPUI	-0.0003	-0.0007	-0.0004	-0.0006	-0.0032	-0.0030	-0.0028	-0.0008	-0.0060	-0.0008	-0.0012
	(0.36)	(0.99)	(0.48)	(1.42)	(4.86)***	(2.42)**	(2.35)**	(0.88)	(2.50)**	(1.64)*	(1.82)*
STR	-0.0015	-0.0042	0.0012	0.0010	-0.0014	-0.0003	-0.0016	-0.0007	-0.0027	-0.0068	-0.0008
	(1.13)	(3.43)***	(1.46)	(1.78)*	(2.09)**	(0.17)	(4.50)***	(1.80)*	(2.47)**	(6.23)***	(1.66)*
EC_SUP	0.1127	0.4414	0.4328	0.0135	0.3930	-0.0571	0.1939	0.6473	0.0064	0.0354	-0.0421
	(0.71)	(3.04)***	(1.19)	(0.09)	(1.68)*	(0.17)	(0.70)	(4.14)***	(0.01)	(1.06)	(0.98)
CPI	0.0591	0.0811	0.1610	0.1136	0.0944	0.1906	0.1169	0.0112	0.1563	-0.0278	-0.0310
	(1.67)*	(2.61)***	(2.49)**	(4.16)***	(3.32)***	(3.14)***	(2.07)**	(0.35)	(1.26)	(0.76)	(0.64)
Constant	0.3205	0.2391	0.9372	0.5603	0.0723	1.1592	0.4809	-0.0996	3.2948	0.4075	0.5686
	(1.54)	(1.12)	(1.71)*	(3.05)***	(0.39)	(3.03)***	(1.32)	(0.36)	(3.05)***	(1.54)	(1.65)
Observations	1960	1260	420	1540	280	1540	420	280	560	5796	3976
AR(1)	-4.35	-3.97	-3.37	-4.12	-5.13	-4.43	-4.19	-4.20	-5.13	-4.65	-4.40
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	1.03	0.46	-1.05	0.79	1.05	-0.51	0.12	-1.25	0.79	1.13	-0.69
	(0.305)	(0.279)	(0.292)	(0.428)	(0.293)	(0.611)	(0.908)	(0.212)	(0.430)	(0.259)	(0.490)
Sargan test	9.47	15.49	8.13	15.99	1.36	4.46	5.40	6.56	8.62	(7.95)	8.41
	(0.488)	(0.115)	(0.616)	(0.100)	(0.998)	(0.924)	(0.863)	(0.767)	(0.569)	(0.634)	(0.589)
Absolute value of t statistics in parentheses											
* significant at 10%; ** significant at 5%; *** significant at 1%											

Notes: Column 1 is cereals (10); Column 2 Mineral fuels (27); Column 3 Organic chemical (29); Column 4 is pharmaceutical products (30); column 5 is Iron and steel (72); column 6 is Articles of Iron and steel(73); column 7 is Machinery and mechanical appliances (84); column 8 is Electric machinery and Equipment (85); column 9 is Vehicles other than railway (87); column 10 is Aircraft, spacecraft and parts 88); column 11 is Optical, photographic. Cinema (90)

Table 6: The direct effects of the Covid-19 pandemic on imports of the most traded goods in the case of the European countries, 2019-2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Hs2 code	**10**	**27**	**29**	**30**	**72**	**73**	**84**	**85**	**87**	**88**	**90**
Variables	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP
L.	1.017	0.899	1.036	0.776	0.387	0.722	0.935	0.834	0.432	0.316	0.930
	(7.89)***	(19.59)***	(13.04)***	(14.49)***	(5.20)***	(17.55)***	(36.50)***	(24.56)***	(8.77)***	(2.32)**	(25.73)***
IPI	0.0004	0.0024	0.0026	0.0019	-0.0005	0.0031	0.0023	0.0025	0.0042	0.0009	0.0025
	(0.66)	(3.60)***	(4.42)***	(5.88)***	(1.52)	(9.57)***	(7.01)***	(4.76)***	(6.34)***	(0.62)	(5.47)***
WPUI	0.0004	-0.0033	-0.0004	0.0003	-0.0021	-0.0016	-0.0009	-0.0016	-0.0045	-0.0049	-0.0013
	(0.46)	(5.68)***	(1.31)	(2.21)**	(3.36)***	(6.90)***	(4.09)***	(5.10)***	(7.69)***	(3.23)***	(5.17)***
STR	-0.0005	-0.0017	-0.0002	0.0010	-0.0008	-0.0004	-0.0005	-0.0003	-0.0009	-0.0037	-0.0002
	(0.60)	(6.08)***	(1.65) *	(2.23)**	(1.83)*	(2.43)**	(1.84)*	(0.80)	(3.65)***	(6.65)***	(1.73)*
EC-SUP	0.2149	-0.0644	0.0345	0.1075	-0.1146	-0.0261	0.0020	-0.0499	-0.0901	-0.2491	-0.0322
	(4.19)***	(1.66)	(2.38)**	(4.50)***	(3.51)***	(2.49)**	(0.25)	(3.06)***	(4.11)***	(2.90)***	(1.85)*
CPI	-0.1295	0.0578	-0.0387	-0.0464	0.1281	0.0269	0.0089	-0.0098	-0.0239	-0.0419	-0.0312
	(3.37)***	(3.17)***	(3.77)***	(3.28)***	(6.95)***	(2.85)***	(1.12)	(1.11)	(1.35)	(0.51)	(3.34)***
Constant	-0.0564	0.9820	-0.2526	1.9135	5.1021	2.2834	0.5865	1.5131	5.2176	5.3511	0.6211
	(0.06)	(2.35)**	(1.03)	(4.16)***	(8.30)***	(6.73)***	(2.57)**	(4.92)***	(11.80)***	(5.43)***	(2.09)**
Observations	980	980	980	980	980	980	980	980	980	980	980
AR(1)	-3.57	-3.94	-3.45	-3.76	-4.16	-3.53	-3.62	-4.37	-3.58	-3.88	-4.27
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	0.88	0.23	0.92	-0.70	1.54	1.34	1.41	1.33	0.59	0.42	-1.14
	(0.381)	(9.816)	(0.355)	(0.484)	(0.124)	(0.181)	(0.159)	(0.184)	(0.556)	(0.673)	(0.255)
Sargan test	15.52	11.82	4.48	13.70	5.10	4.52	2.34	2.60	6.97	11.97	4.15
	(0.114)	(0.297)	(0.923)	(0.187)	(0.885)	(0.921)	(0.993)	(0.989)	(0.729)	(0.287)	(0.940)
Absolute value of t statistics in parentheses											
* significant at 10%; ** significant at 5%; *** significant at 1%											

Notes: Column 1 is cereals (10); Column 2 Mineral fuels (27); Column 3 Organic chemical (29); Column 4 is pharmaceutical products (30); Column 5 is Iron and steel (72); Column 6 is Articles of Iron and steel (73); Column 7 is Machinery and mechanical appliances (84); Column 8 is Electric machinery and Equipment (85); Column 9 is Vehicles (87); Column 10 is Aircraft, spacecraft and parts 88); Column 11 is Instruments and apparatus (90)

Table 7: The direct effects of the Covid-19 pandemic on exports of the most traded goods in the case of the European countries during the first wave

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Hs2 code	10	27	29	30	72	73	84	85	87	88	90
Variables	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP	EXPP
L.	0.265	0.724	1.016	0.811	0.907	0.832	0.998	0.926	0.706	0.563	0.980
	(1.62)	(5.52)***	(15.46)***	(13.15)***	(12.02)***	(9.44)***	(17.13)***	(14.80)***	(7.20)***	(3.00)***	(17.55)***
IPI	0.0030	-0.0010	0.0021	0.0003	0.0028	0.0073	0.0060	0.0009	0.0094	0.0074	0.0029
	(1.05)	(0.66)	(2.28)**	(0.38)	(3.53)***	(4.23)***	(9.62)***	(0.68)	(4.05)***	(2.24)**	(3.32)***
WPUI	-0.0008	-0.0042	0.0003	-0.0004	-0.0013	0.0011	0.0000	-0.0030	-0.0088	-0.0019	-0.0030
	(0.26)	(1.76)*	(0.28)	(0.54)	(1.52)	(0.98)	(0.05)	(3.00)***	(4.76)***	(0.57)	(2.11)**
STR	-0.0021	-0.0078	-0.0023	-0.0006	-0.0022	-0.0006	-0.0065	-0.0026	-0.0090	-0.0115	-0.0042
	(1.79)*	(2.34)**	(2.04)**	(0.27)	(2.38)**	(1.65)*	(2.44)**	(3.11)***	(2.89)***	(3.82)***	(2.19)**
EC_SUP	0.5750	0.8783	0.7946	-0.1283	0.1737	-0.5244	0.2693	0.8254	1.0426	-1.3993	0.3849
	(1.75)*	(1.53)	(1.79)*	(0.48)	(0.62)	(2.26)**	(1.83)*	(3.44)***	(1.96)**	(0.79)	(1.53)
CPI	0.1837	0.2749	0.0705	0.1253	0.0785	-0.0122	-0.0236	0.1057	0.1793	0.2630	0.1030
	(1.26)	(3.10)***	(1.25)	(3.78)***	(1.99)**	(0.33)	(0.76)	(2.79)***	(2.16)**	(1.83)*	(2.43)**
Constant	0.4523	0.2789	-0.1363	1.5943	0.7660	1.3089	0.0407	0.6637	0.7346	0.0783	0.2206
	(4.38)***	(2.06)**	(0.27)	(3.13)***	(1.24)	(1.82)*	(0.17)	(1.22)	(3.12)***	(2.18)**	(0.49)
Observations	168	168	168	168	168	168	168	168	168	168	168
AR(1)	-3.97	-3.73	-4.16	-3.60	-4.29	-5.45	-4.13	-3.88	-3.71	-4.24	-3.50
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	1.14	-0.84	0.93	-0.17	0.30	-1.16	0.14	0.71	-0.10	1.08	-1.32
	(0.256)	(0.403)	(0.352)	(0.869)	(0.701)	(0.246)	(0.888)	(0.479)	(0.923)	(0.282)	(0.187)
Sargan test	4.97	6.03	10.56	8.13	12.10	6.56	4.80	7.52	4.46	8.32	3.99
	(0.836)	(0.737)	(0.307)	(0.616)	(0.203)	(0.767)	(0.964)	0.583)	(0.879)	(0.503)	(0.912)
Absolute value of t statistics in parentheses											
* significant at 10%; ** significant at 5%; *** significant at 1%											

Notes: Column 1 is cereals (10); Column 2 Mineral fuels (27); Column 3 Organic chemical (29); Column 4 is pharmaceutical products (30); Column 5 is Iron and steel (72); Column 6 is Articles of Iron and steel (73); Column 7 is Machinery and mechanical appliances (84); Column 8 is Electric machinery and Equipment (85); Column 9 is Vehicles (87); Column 10 is Aircraft, spacecraft and parts 88); Column 11 is Instruments and apparatus (90)

Table 8: The direct effects of the Covid-19 pandemic on imports of the most traded goods in the case of the European countries during the first wave

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Hs2 Code	**10**	**27**	**29**	**30**	**72**	**73**	**84**	**85**	**87**	**88**	**90**
Variables	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP	IMPP
L.	1.082	0.588	0.929	0.804	0.738	0.982	0.993	1.030	0.680	0.113	1.006
	(15.78)***	(4.39)***	(17.93)***	(8.49)***	(8.00)***	(36.18)***	(20.75)***	(20.83)***	(7.01)***	(0.61)	(21.96)***
IPI	0.0006	-0.0012	0.0002	0.0004	0.0006	0.0043	0.0028	0.0027	0.0066	0.0004	0.0020
	(0.85)	(1.30)	(0.22)	(0.59)	(0.85)	(7.05)***	(5.13)***	(4.23)***	(4.54)***	(0.15)	(3.39)***
WPUI	-0.0004	-0.0024	-0.0015	-0.0009	-0.0021	-0.0033	-0.0034	-0.0024	-0.0078	-0.0075	-0.0026
	(0.35)	(2.05)**	(1.39)	(1.03)	(2.07)**	(6.84)***	(3.56)***	(3.62)***	(5.39)***	(2.12)**	(3.43)***
STR	-0.0002	-0.0040	-0.0006	-0.0012	0.0047	-0.0013	-0.0036	-0.0014	-0.0081	-0.0142	-0.0026
	(0.44)	(2.89)***	(1.69)*	(0.35)	(3.09)***	(1.78)*	(3.04)***	(2.10)**	(4.67)***	(2.87)***	(4.47)***
EC_SUP	0.8417	0.5273	0.0372	0.6289	-0.1464	0.0857	0.3913	0.7852	1.2015	-2.3490	0.7006
	(3.23)***	(1.54)	(0.15)	(3.45)***	(0.98)	(0.57)	(2.33)**	(4.80)***	(3.30)***	(2.29)**	(3.72)***
CPI	0.0123	0.2183	0.1096	0.2137	0.0896	0.0296	0.0861	0.0962	0.1733	0.5105	0.1131
	(0.30)	(4.35)***	(2.45)**	(5.84)***	(3.11)***	(1.57)	(2.47)**	(3.90)***	(2.93)***	(3.57)***	(4.36)***
Constant	-0.5394	3.6067	0.5856	1.7163	2.2322	0.2196	0.1118	-0.2818	2.9639	6.9483	-0.0096
	(1.09)	(3.06)***	(1.44)	(2.19)**	(2.99)***	(0.98)	(0.27)	(0.66)	(3.46)***	(4.98)***	(0.03)
Observations	168	168	168	168	168	168	168	168	168	168	168
AR(1)	-3.76	-3.96	-3.81	-3.89	-3.71	-4.18	-3.77	-3.83	-4.30	-4.16	-3.84
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	-0.59	1.49	-1.37	-1.33	1.10	1.37	0.45	1.47	0.59	0.62	1.37
	(0.557)	(0.135)	(0.169)	(0.184)	(0.272)	(0.172)	(0.652)	(0.142)	(0.556)	(0.537)	(0.170)
Sargan test	11.83	11.62	12.56	11.30	5.80	12.00	5.88	8.67	8.16	9.21	9.49
	(0.223)	(0.236)	(0.183)	(0.255)	(0.760)	(0.213)	(0.751)	(0.468)	(0.519)	(0.418)	(0.393)
Absolute value of t statistics in parentheses											
* significant at 10%; ** significant at 5%; *** significant at 1%											

Notes: Column 1 is cereals (10); Column 2 Mineral fuels (27); Column 3 Organic chemical (29); Column 4 is pharmaceutical products (30); Column 5 is Iron and steel (72); Column 6 is Articles of Iron and steel (73); Column 7 is Machinery and mechanical appliances (84); Column 8 is Electric machinery and Equipment (85); Column 9 is Vehicles (87); Column 10 is Aircraft, spacecraft and parts 88); Column 11 is Instruments and apparatus (90)

Table 9: The indirect effect of stringency on total exports through sectors

| Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	EXPT	EXPT	EXPT	EXPT	EXPT	EXPT	EXPT	EXPT	EXPT
L.	0.660	0.656	0.654	0.652	0.657	0.645	0.628	0.627	0.641
	(11.25)***	(8.78)***	(5.06)***	(9.93)***	(4.31)***	(9.86)***	(4.85)***	(11.97)***	(6.99)***
IPI	0.0042	0.0061	0.0078	0.0097	0.0043	0.0083	0.0037	0.0040	0.0061
	(11.36)***	(8.50)***	(5.24)***	(10.18)***	(4.42)***	(10.08)***	(4.83)***	(11.66)***	(7.19)***
WPUI	-0.0018	-0.0010	-0.0049	-0.0012	-0.0022	-0.0027	-0.0009	-0.0036	-0.0058
	(0.52)	(0.68)	(2.93)***	(0.91)	(2.47)**	(6.02)***	(1.19)	(7.97)***	(4.22)***
STR-EXPS	-0.0004	-0.0006	-0.0010	-0.0007	-0.0011	-0.0016	-0.0006	-0.0015	-0.0025
	(0.95)	(0.17)	(2.69)***	(1.05)	(2.97)***	(3.12)***	(0.56)	(3.04)***	(2.45)**
EC-SUP	0.1728	0.1963	-0.1733	0.1791	-0.1949	0.1644	0.1711	0.1683	0.1723
	(2.73)***	(2.33)**	(1.31)	(2.43)**	(1.11)	(2.26)**	(1.19)	(3.00)***	(1.75)*
CPI	0.0062	0.0059	0.0068	0.0047	0.0055	0.0033	0.0049	0.0062	0.0030
	(0.54)	(0.46)	(1.69)*	(0.41)	(0.22)	(0.44)	(1.25)	(1.73)*	(0.35)
Constant	3.1537	3.1879	3.2127	3.2297	3.1806	3.2990	3.4627	3.4777	3.3430
	(5.54)***	(4.39)***	(2.55)**	(5.07)***	(2.15)**	(5.19)***	(2.75)***	(6.84)***	(3.76)***
Observations	13720	8820	2940	10780	1960	10780	2940	18620	5880
AR(1)	-5.04	-3.99	-4.95	-4.45	-4.77	-3.89	-3.65	-5.66	-4.17
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	-0.84	-0.67	-0.40	-0.77	-1.50	-0.76	-0.40	-0.97	-0.57
	(0.400)	(0.501)	(0.687)	(0.439)	(0.134)	(0.445)	(0.687)	(0.330)	(0.572)
Sargan test	1.88	1.30	0.41	1.53	0.27	1.57	0.47	0.27	0.87
	(0.170)	(0.253)	(0.523))	(0.216)	(0601)	(0.211)	(0.492)	(0.601)	(0.350)
t statistics in parentheses									
* significant at 10%; ** significant at 5%; *** significant at 1%									

Notes: Column (1) is live Animals, Animal products and Vegetable products; Column (2) is Food & Drinks; Column (3) is Mineral products; Column (4) is Chemical products; Column (5) is Plastics, Rubber and articles thereof; Column (6) is Base metals and articles of base metal; Column (7) is Instruments, Apparatus; Column (8) is Textile and Footwear and Column (9) is Machinery and Vehicles

Table 10: The indirect effect of stringency on total imports through sectors

|	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	IMPT	IMPT	IMPT	IMPT	IMPT	IMPT	IMPT	IMPT	IMPT
L.	0.744	0.747	0.728	0.730	0.722	0.725	0.723	0.726	0.701
	(12.79)***	(10.29)***	(5.57)***	(10.97)***	(4.56)***	(10.84)***	(5.54)***	(14.05)***	(7.39)***
IPI	0.0041	0.0030	0.0034	0.0027	0.0019	0.0040	0.0013	0.0039	0.0037
	(12.04)***	(9.56)***	(5.48)***	(10.50)***	(4.28)***	(10.36)***	(5.06)***	(13.10)***	(6.74)***
WPUI	-0.0023	-0.0054	-0.0050	0.0041	-0.0052	-0.0037	-0.0024	-0.0050	-0.0062
	(0.84)	(2.08)**	(2.39)**	(1.55)*	(2.21)**	(2.26)**	(2.68)***	(6.82)***	(3.79)***
STR-IMPS	-0.0006	-0.0007	-0.0013	-0.0009	-0.0008	-0.0012	-0.0005	-0.0014	-0.0018
	(1.12)	(1.39)	(1.79)*	(1.45)	(1.86)*	(2.03)**	(3.44)	(2.48)**	(2.68)***
EC-SUP	0.1486	0.1604	-0.1561	0.1451	-0.1487	-0.1490	-0.1503	0.1468	-0.1390
	(2.63)***	(2.26)**	(1.27)	(2.26)**	(0.97)	(2.30)**	(1.19)	(3.00)***	(1.57)
CPI	-0.0036	-0.0038	-0.0021	-0.0020	-0.0008	-0.0020	-0.0023	-0.0026	0.0002
	(0.31)	(1.66)*	(0.08)	(0.15)	(0.02)	(0.15)	(0.09)	(1.76)*	(0.01)
Constant	2.3597	2.3262	2.5166	2.4940	2.5717	2.5490	2.5655	2.5364	2.7821
	(4.14)***	(3.27)***	(1.97)*	(3.83)***	(1.66)	(3.90)***	(2.01)**	(5.02)***	(3.00)***
Observations	13720	8820	2940	10780	1960	10780	2940	18620	5880
AR(1)	-5.21	-4.17	-4.52	-4.56	-5.01	-4.44	-3.97	-5.95	-4.21
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	-1.02	-0.82	-0.48	-0.91	-1.50	-0.92	-0.49	-1.20	-0.68
	(0.308)	(0.413)	(0.631)	(0.361)	(0.134)	(0.357)	(0.625)	(0.230)	(0.498)
Sargan test	1.11	0.71	0.27	0.54	0.18	0.97	027	1.71	0.61
	(0.291)	(0.401)	(0.602)	(0.333)	(0.671)	(0.325)	(0.601)	(0.191)	(0.436)
t statistics in parentheses									
* significant at 10%; ** significant at 5%; *** significant at 1%									

Notes: Column (1) is live Animals, Animal products and Vegetable products; Column (2) is Food & Drinks; Column (3) is Mineral products; Column (4) is Chemical products; Column (5) is Plastics, Rubber and articles thereof; Column (6) is Base metals and articles of base metal; Column (7) is Instruments, Apparatus; Column (8) is Textile and Footwear and Column (9) is Machinery and Vehicles

Figure 1a: Monthly European trade for the Food and Drink sector, 2019-2021 (billion dollars)
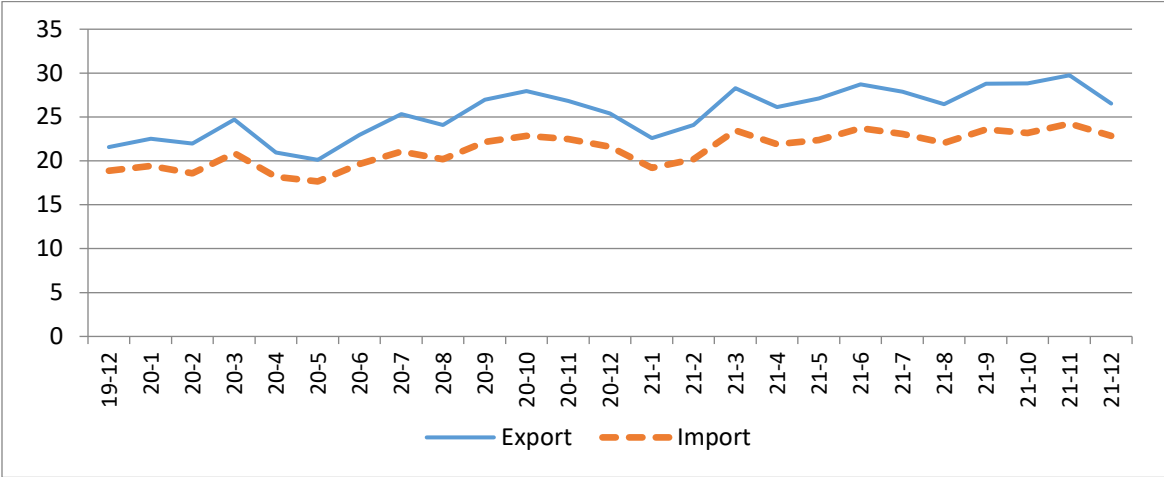
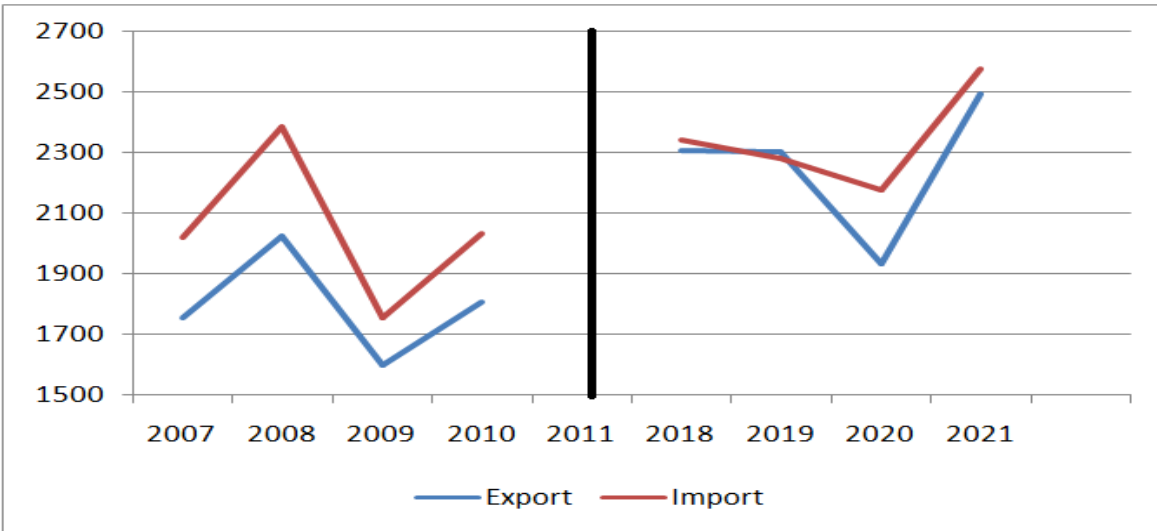**Figure 1b: Monthly European trade for the Chemicals sector, 2019-2021 (billion dollars)**
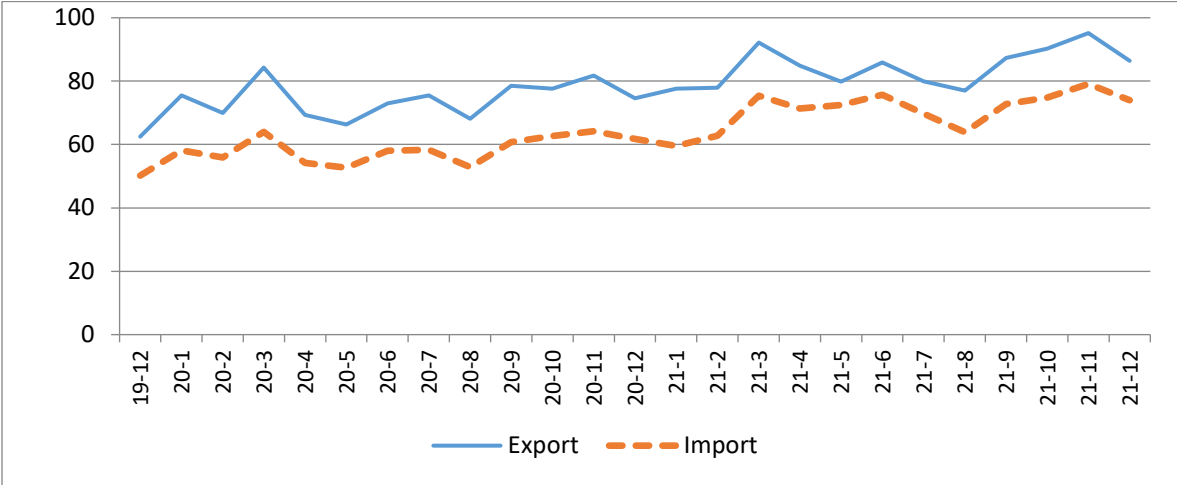
Figure 1c: Monthly European trade for Machine and Vehicles sector, 2019-2021 (billion dollars)
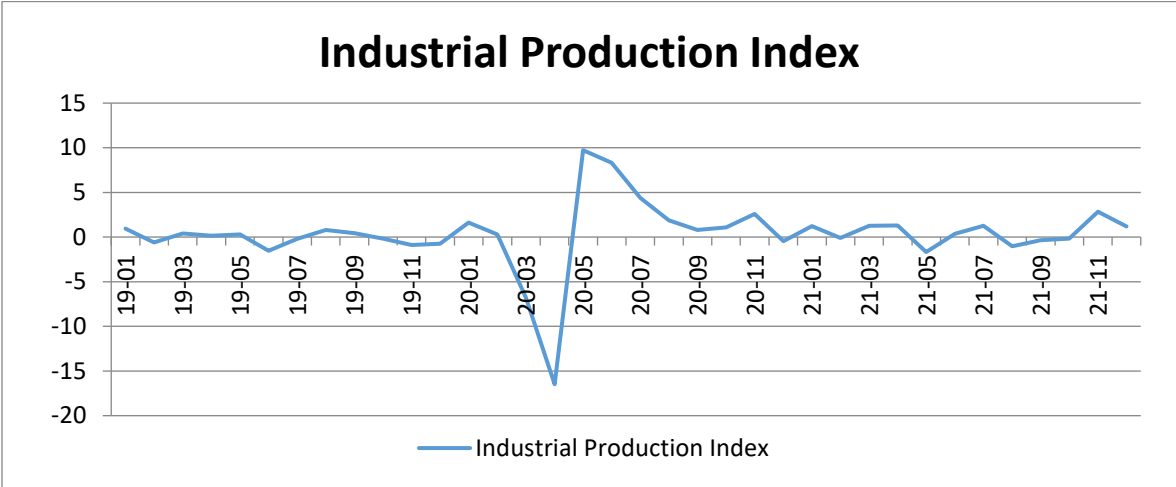

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Source: Comtrade database

Figure 2: Monthly European trade for Machine and Vehicles during the GFC and Covid-19 Pandemic (billion dollars)
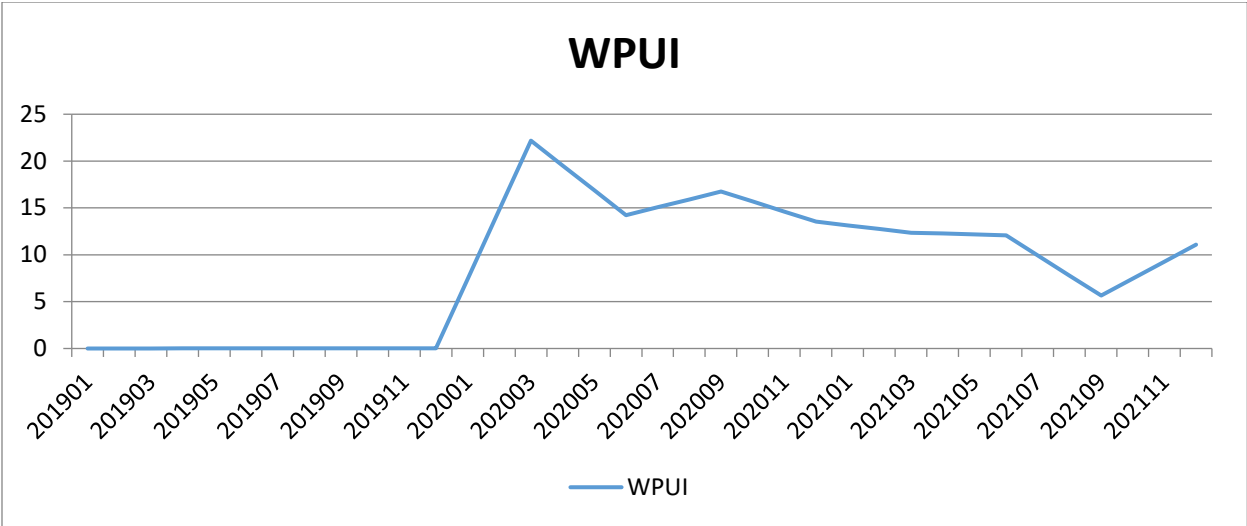

Source: Comtrade database

Figure 3: The Industrial Production Index (IPI) in the European countries, 2019-2021

Industrial Production Index

Source: Eurostat database

Figure 4: The World Pandemic Uncertainty index (WPUI) for the European countries, 2019-2021

WPUI

Source: https://worlduncertaintyindex.com