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Trade impacts of external border measures under the European Union's plant health legislation

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Abstract

Background: This article assesses whether the European Union's (EU's) plant health regulations have had an impact on imports. A dynamic modelling approach was applied, using a two-step generalized method of moments estimator for panel data, and covering an 8-year period (2013–2020). The estimated equation includes volumes of trade, economic drivers, the trading partner, and variables capturing categories of import requirements (phytosanitary certificates, exemptions, restrictions) with regards to external border measures for enhanced biosecurity.

Results: From the analysis we can conclude that the import regime and its recent changes have had a limited impact, if any, on trade flows of the affected products. The most significant impact is found for products classified as high-risk plants, while the extension of the phytosanitary certificate requirement to new products seems to have had negligible effects on trade.

Conclusion: Therefore, the plant protection regime for extra-EU trade seems to be not trade distorting while supplying a framework to enhance plant health in the EU.

Keywords: dynamic modelling; European Union; non-tariff measures; plant health legislation; trade

1 INTRODUCTION

National Plant Protection Organizations (NPPOs) assume responsibility for preventing new plant pests from entering a country. To safeguard national biosecurity, they combine regulatory and technical approaches.[1] Given the major increase in the volumes of trade in live plants for planting and shifts in the origins of the plants, the task of protecting countries against harmful pests has become more challenging. Internationally, these policies are coordinated by the International Plant Protection Convention (IPPC), a legally binding agreement to facilitate the international movement and trade of plants and plant products, while minimizing the risk of spreading plant pests.[2]

Since the harmonization of the legislation in 1993, plant health regulations (PHR) in the European Union (EU) have based phytosanitary measures on pest risk analysis (PRA). PRA is used to assess whether an organism has a negative impact on plants and whether it should be regulated. While maintaining a risk-based approach and assuring openness to imports, the EU approach to plant health legislation has been evolving to increase border protection and to enhance preparedness for crisis management. This article focuses on changes in PHR that introduced trade restrictions and applied import requirements to live plants and plant products.

The aim of this study is to assess whether plant health legislation has had a significant impact on EU imports of live plants and plant products, as new import requirements could add some further costs or, complementary, could provide further confidence on exchanges. We do so through an econometric analysis of trade flows, which is presented as a practical methodology to monitor the application of PHR to different types of live plants and plant products, and changes in PHR.

First, we identify databases that we can access to explore data on relevant trade flows and non-tariff measures (NTMs) for the products that have been affected by regulations. Then we assess the short-term impacts of recent changes in PHR in terms of potential reductions in imports due to substitutions with EU produce.

Given the complex classification of plants and plant products according to their potential risk and requirements, in this research we attempt to match individual trade codes with their corresponding category of product import treatment (e.g., request for certificate, import restriction, exemptions, etc.). The EU's PHR make it possible to classify affected products in separate groups,

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distinguishing between those that are and those that are not exempt from meeting documentary requirements such as the phytosanitary certificate (PC). We distinguish between plants and plant products originating in EU countries (plus Switzerland and the United Kingdom) and those originating in third countries. We also assess the short-term impacts of recent changes in PHR, following the entry into force of Regulation 2016/2031, which in December 2019 introduced the prohibition on declared high-risk plants (HRP) and extended the list of products for which a PC is required.

While the impact of regulations depends on the country and commodity pathway for each type of product, our aim is the evaluate if the framework for PHR in the EU have had a horizontal effect, positive or negative, on trade flows. To assess such research question, trade flows are defined as specific or detailed level, if possible, at eight-digit combined nomenclature (CN) codes and matching those codes with the type of regulation applied to the corresponding products.

2 LITERATURE REVIEW

2.1 Plant health and trade

Global trade hubs for live plants for planting may be particularly exposed to pests because of the large volume and diverse origins of imports of these products. In an effort to limit the spread of pests, phytosanitary practices and regulations in these countries establish stricter standards. The study by Eschen *et al.*[3] illustrates that, despite international standards sharing a common basis, there are significant differences in how countries regulate imports of live plants for planting, with a variety of procedures including import prohibitions, documentary requirements, such as the PC, and import inspections.

In the field of plant health, there is little evidence on how effective individual measures are in reducing risk and their trade impacts. While the level of risk will never reach zero, the stringency of regulations must strike a balance between hampering trade and the likelihood or impact of a new plant pest being introduced and then spreading in the importing country.[4–6] A common requirement for live plants is the PC, with which the NPPO of the exporting country certifies that the plants have been inspected prior to export and met the requirements of the importing country.[7] Plants and plant products imported into the EU are required to have a PC issued by the exporting country. Following this initial inspection, once the plants and plant products have entered EU territory, the PC is replaced by a 'plant passport' allowing the plants to move freely within the EU.[8] Articles 72 and 73 of the PHR, in connection with Article 5 of the official controls regulation[9] and Annex XI of the Commission Implementing Regulation (CIR) 2019/2072[10] extended the list of products for which a PC is required. This Annex has three parts, which are used to categorize imports: Part A lists the products for which a PC was already required before the EU-PHR; Part B lists the products that did not previously require a PC or have to pass official controls, but do now following the implementation of the EU-PHR; Part C lists the products that were and remain exempt from the PC requirement. The entry into force of this classification provides us with a pseudo-natural experiment to identify the impact of PC requirements. While our main interest lies in exploring the impact on EU imports of plants and plant products due to the required PC, we also focus on another recent change in the EU's PHR. Specifically, Articles 40 and 42 of Regulation 2016/2031 introduced the prohibition on the introduction of certain plants and plant products which are declared HRP until a risk assessment is carried out. In 2018, the Commission established the list of HRP to which this prohibition would apply[11] which are also included in Annex VI of CIR 2019/2072.

2.2 Assessing trade impacts

The literature on the trade effects of NTMs is the closest area of research to our own. Part of this literature focuses on a specific measure or sector,[12–14] while other studies have a wider coverage.[15–18] Regarding the direction and magnitude of the trade effects, most of the literature identifies a trade-limiting effect of NTMs,[19–25] with the magnitude of the effect varying widely depending on the specific countries, products, and standards.[26–32] However, there are some studies reporting non-significant effects.[33] Notwithstanding, the literature that analyses NTMs in the aggregate concludes that many of these measures have a trade-limiting effect on agricultural products. However, some studies point out that certain NTMs have the potential to foster trade due to the expansion in demand and capacity building in the exporter countries.[34,35]

The present research uses the quantity impact method, which is based on the assessment of trade flows that are directly affected by NTMs. To this end, a gravity-type equation is used to estimate the volume traded, an approach supported by solid theoretical foundations.[36–40] Within the quantity impact framework, NTM effects are measured by the sign and coefficient of the NTM variable included with the rest of variables that can influence trade flows. NTMs can be included as dummy variables (presence/absence).

3 METHODS AND MATERIALS

3.1 Methods: dynamic modelling

Our dynamic model uses the two-step generalized method of moments (GMM) approach for panel data.[41,42] This estimator allows endogenous variables to be instrumented through equations with variables in levels and differences. Time-lagged independent variables are used as instruments as they are uncorrelated with the fixed effects. This estimation method is used in some papers on international trade in agriculture-related products.[43–45] Roodman[42] suggested that in panel data samples of only a few years, and therefore with a small number of instruments, it is more appropriate to apply the two-step GMM. This extension uses the heteroscedastic weight matrix and the instruments in levels in the estimation, which reduces the loss of information but introduces the risk of overidentification. We used the two-step GMM estimator as it offers certain advantages over the one-step GMM. For example, if the data are unbalanced, the one-step estimator suffers from a loss of observations that could affect the estimation coefficients, while the two-step estimator provides consistent figures regardless of the balance of the panel data.[46] In addition, the two-step estimator is better at dealing with autocorrelation and heteroskedasticity.[47]

The equation that is estimated is as follows:

$$\begin{aligned}\ln\left(M_{i,j,t}\right) = {} & \beta_0 + \beta_1 \ln\left(M_{i,j,t-1}\right) + \beta_2 \ln(\mathrm{GDP}_t) \\ & + \beta_3(\mathrm{GDP}_t{}^{*}D_{2020}) + \beta_4 \mathrm{non}_{\mathrm{EU}} + \beta_5 \mathrm{Part}_{\mathrm{A}} \\ & + \beta_6 \mathrm{Part}_{\mathrm{B}} + \beta_7 \mathrm{Part}_{\mathrm{C}} + \beta_8 \mathrm{HRP} + \beta_9 \mathrm{AnnexVI} + v_i \\ & + \mu_t + \varepsilon_{i,t},\end{aligned} \tag{1}$$

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Subscripts	
i	Country of origin of the imports
j	Product (combined nomenclature sub-heading)
t	Year
Variables	
M	Imports (Quantity_in_100kg)
GDP	Gross domestic product in real terms
D_{extra}	Value ONE if trade is between an EU country and a non-EU one and ZERO otherwise (trade between two EU countries). The United Kingdom and Switzerland are treated as EU countries.
D_{2020}	Value ONE for data for 2020 and ZERO for the rest of the period.
$Part_A$	Value ONE if product already required PC prior to 2020.
$Part_B$	Value ONE if product required PC in 2020. Value ZERO for the rest of the period.
$Part_C$	Value ONE if product does not require PC.
HRP	Value ONE if product is considered HRP.
AnnexVI	Value ONE if product is included in Annex VI of CIR 2019/2072
Parameters	
v	Unobserved product specific effects
μ	Unobserved period specific effects
ε	Error term
β	Coefficients

Equation (1) thus includes volumes of trade, economic drivers, type of country with which trade takes place and five variables capturing PHR and changes to those regulations. The terms $Part_A$ and $Part_C$ refer to products which were and were not, respectively, subject to a PC requirement during the entire analysed period (2013–2020). Annex VI refers to agricultural products subject to import prohibitions for health and safety reasons, and $Part_B$ and HRP refer to categories which underwent changes in 2020. Specifically, for those classifications, a negative sign for the coefficient would indicate a negative effect on trade. To check the impact of the pandemic in 2020 on income elasticities, a specific dummy variable for gross domestic product (GDP) was added for this year. Espitia *et al.*[48] and Marti *et al.*[49] suggest that trade in agricultural products was affected by the drop in GDP during the hardest months of the COVID-19 lockdowns. This slowdown in trade can also be seen in Table A1 of the Appendix where negative variations between 2019 and 2020 can be seen for CN chapters 07 and 44 in intra-trade and 06, 07, 10 and 44 in extra-trade.

3.2 Materials

Data on international trade were obtained from Eurostat for the period 2013–2020. The dynamic model was estimated for a panel of data on different cross-sections depending on the CN chapter. We focus on eight-digit CN codes for products in the eight trade chapters which include the products that could be affected by the EU-PHR and changes to those regulations.

The CIR 2018/2019, which guides the implementation of the EU-PHR, lists the corresponding four-digit or eight-digit CN codes to which the restriction applies, with the ban on trade in these products taking effect on 14 December 2019. A matching exercise between the different databases was carried out since there are differences between them in the reporting codes. This allowed us to identify which CN codes can be considered to include products from the categories of interest: the three parts included in Annex XI of CIR 2019/2072, the HRP included in CIR 2018/2019, and the list of plants and plant products that were already barred entry into the EU before the HRP regulation (Annex VI of CIR 2019/2072) came into effect.

The products for the panel are those referring to trade between the EU 27 (as reporter) and extra-EU (as partner) minus Switzerland and United Kingdom, as well as EU 27 (as reporter) and intra-EU (as partner) in the period 2013–2020. The products for which Eurostat provided information at the eight-digit level in the period studied have been included (65 products in chapter 06, 110 in chapter 07, 124 in chapter 08, 57 in chapter 10, 74 in chapter 12 and 164 in chapter 44). A single CN sub-heading can include multiple species or genera, but a specific species or genus can also be in multiple CN sub-headings. For example, *Ullucus tuberosus* plants can be reported in up to three different CN sub-headings. However, it is possible to identify whether a specific CN sub-heading contains at least one commodity listed in one of the parts of Annex XI of CIR 2019/2072 or classified as HRP under CIR 2018/2019. As the lack of one-to-one correspondence could bias the size of the measured impacts, in practice reported values need to be taken as upper bounds of the actual impacts.[1] Additionally, data on real GDP required for the estimations were taken from Eurostat for 2013–2019, while for 2020 the latest projections available from the European Central Bank were used.

Table 1 maps the 638 CN sub-headings included in the trade chapters of interest, with the various categories in Annex XI of CIR 2019/2072 and CIR 2018/2019.

More than 50% of the products in these trade chapters are included in some of the categories of interest, with the largest number of products being mentioned in Part A of Annex XI of CIR 2019/2072 and the fewest in Part C of this Annex and in the list of HRP. As a benchmark to compare the impact of PHR, we take the agricultural and processed products not included in any of the classifications, to which PHR do not apply, together with products included in sections that have not undergone any change in their treatment following the modifications to the legislation (Part A and Part C of Annex XI of CIR 2019/2072).

To support the discussion, we use data on consignments of plants and plant products imported into the EU or traded within it that were intercepted for plant health reasons, sourcing these data from EUROPHYT[2] and TRACES.[3] Interceptions focus on non-conformities other than the detection of harmful organisms. Data from EUROPHYT and TRACES databases can be easily matched with the definition of commodities in the relevant plant health legislation, which also allows the products to be classified in broad categories (plants for planting, seeds, cuttings, cut flowers, fruits and vegetables, and wood).

[1]When a particular sub-heading contains products from different categories, the sub-heading has been classified in the one that has an impact. For example, if one sub-heading contains a product from Part A and a product from Part B, the whole sub-heading is classified as Part B, that is, where the legislative change could have had an effect.

[2]EUROPHYT is the notification and rapid alert system dealing with interceptions for plant health reasons of consignments of plants and plant products imported into the EU or being traded within the EU itself.

[3]TRACES is the European Commission's online platform for sanitary and phytosanitary certification required for the importation of animals, animal products, food and feed of non-animal origin and plants into the EU, and the intra-EU trade and EU exports of animals and certain animal products.

Table 1. Number of combined nomenclature (CN) trade products under each category

Trade chapter	Part A	Part B	Part C	HRP	Rest	Total
06 Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage	13	15		17	20	65
07 Edible vegetables and certain roots and tubers	26	37		2	45	110
08 Edible fruit and nuts; peel of citrus fruit or melons	39	17	8		60	124
09 Coffee, tea, mate and spices	4	7			38	49
10 Cereals	14	10			33	57
12 Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants; straw and fodder	6	19			49	74
14 Vegetable planting materials; vegetable products not elsewhere specified or included		2			3	5
44 Wood and articles of wood; wood charcoal	77				87	164
Total	179	107	8	19	335	648

Note: Part A, phytosanitary certificate (PC) required; Part B, PC required in 2020; Part C, Exempt from PC; HRP, high-risk plants.

4 RESULTS AND DISCUSSION

To assesses whether the PHR implemented in the EU have had an impact on imports, a dynamic modelling approach was applied using the GMM estimator (Table 2).

The use of this model specification is supported by the absence of second-order autocorrelation, AR (2), and exogeneity of instruments. As expected, first-order autocorrelation, AR (1), is present in the data (all *P*-values < 0.05 except chapter 10). The absence of AR (2) in the data is confirmed (*P*-value >0.05), as required a consistent GMM estimator. The Sargan test does not reject the overidentifying restrictions (exogeneity of instruments) at conventional levels of significance (*P*-value >0.05), indicating that the instruments are valid.

Except for trade in vegetables and cereals (chapters 07 and 10, respectively), the results of the estimation show a significant lagged dependent variable. Its magnitude reveals that import levels depend on past values. This result justifies the use of a dynamic specification and the GMM approach. The GDP variable acts as a trade facilitator in some products (vegetables, fruit, cereals, oil, and wood) where it has a positive and significant coefficient; therefore, the higher the GDP of the EU Member States, the larger the volume of imports of the products analysed. The income elasticity of imports ranges between 0.35 in wood (chapter 44) and 1.19 in vegetables (chapter 07). After adding the dummy variable for GDP (GDP*D_{2020}), results are significant for all products except oil and wood, but small. This result suggests that the pandemic did not significantly affect import behaviour with respect to the income change.

However, the dummy variable 'extra-EU' has a negative and significant coefficient in all cases (except for coffee, tea, mate and spices). It shows the disadvantage faced by countries outside the EU compared to those belonging to the EU, with a relatively better position for non-EU sources in fresh fruits (chapter 08) and wood and wood products (chapter 44). However, this effect is more likely to relate to the general behaviour of the demand for imports rather than the new PHR.

In general, Part A products (PC required for the whole period) perform better than the rest of the non-EU products in live trees, fruits, oil and wood, which suggests that the PC requirement has not constrained trade (the corresponding dummy is significant and has a positive sign). The dummy representing Part C products in chapter 08 (fruits) is also significant and positive.

We tested the effects of regulations applied in 2020 by introducing dummy variables for this year corresponding to Part B, HRP, and Annex VI products. The dummy corresponding to Part B products is not significant; therefore, the results do not support the hypothesis that the new PC requirement had an overall impact on trade flows. It is only in the chapter live trees (chapter 06) that the dummy variables for HRP and Annex VI are significant and negative, suggesting that Article 42 (CIR 2018/2019) and Annex VI (CIR 2019/2072) could place constraints on certain products coming from outside the EU.

In short, import levels are affected by historical trends ($\ln(M_{t-1})$ is significant with a positive sign) and show a positive income elasticity (ln(GDP) is significant with a positive sign). The impact of the pandemic on income elasticity is negligible (the coefficient for ln(GDP)*D_{2020} is small in magnitude) and as expected the single market makes trade easier between EU countries than with outside partners (the coefficient for D_{extra} is significant with a negative sign). Products for which a PC was required even before the legislative change do not seem to be performing any worse than those that are exempt (significant and positive coefficient for Part A). However, in fruits (chapter 08) with sub-headings listed in Part A, Part B and Part C, we find that products exempt from the PC requirement before or after 2020 are also performing better than the rest (significant and positive coefficient for Part C). Therefore, it cannot be concluded that products requiring a PC are traded in greater volumes than those not.

Focusing on the products affected by a change in legislation in 2020, the inclusion of the PC requirement does not have a limiting effect on trade (Part B is not significant). We detect a potential negative impact of the most trade restrictive measures (prohibition of imports of HRP and products listed in Annex VI of CIR 2019/2072).

A quick comparison of changes in trade within the EU and changes in imports from third countries into the EU reveals that there are no substantial differences between them from 2019 to 2020. Most of the CN sub-headings experienced a decrease in trade within the EU and with the rest of the world (52% and 50%, respectively). Focusing on the sub-headings which are affected by the EU-PHR, for example, those listed in the three parts of Annex XI of the CIR 2019/2072 and in CIR 2018/2019, only HRP showed a significantly higher share of tariff lines that registered a drop in trade from the rest of the world (63%). In summary,

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Table 2. Generalized method of moments (GMM) estimation of dynamic panel

	Chapter 06 Live trees	Chapter 07 Vegetables	Chapter 08 Fruits	Chapter 09 Coffee	Chapter 10 Cereals	Chapter 12 Oil seeds	Chapter 44 Vegetable planting materials
$Ln(M_{t-1})$	0.520***	0.215	0.550***	0.870***	−0.142	0.431***	0.455***
Ln(GDP)	0.139	1.196***	0.528***	−0.022	0.943*	0.673***	0.351**
D_{extra}	−2.235***	−1.730***	−1.008***	0.069	−2.063**	−1.404***	−0.918***
$Part_A$	0.862**	0.376	0.961***	−0.064	−1.303	2.266***	0.461**
$Part_B$	−0.007	−0.173	0.207	−0.090	0.632	−0.196***	
$Part_C$			1.009*				
HRP	**−0.768****	0.400					
AnnexVI	**−4.472*****	−0.272					
$Ln(GDP)*D_{2020}$	0.005*	0.054***	0.003*	0.006***	0.011***	0.002	−0.001
AR (1) Test (*P*-value)	−2.92 (0.003)	−2.60 (0.009)	−3.90 (0.000)	−2.68 (0.007)	−0.72 (0.470)	−3.66 (0.000)	−5.01 (0.000)
AR (2) Test (*P*-value)	−1.81 (0.070)	1.65 (0.099)	1.44 (0.151)	1.20 (0.231)	−0.47 (0.641)	−1.42 (0.155)	−0.89 (0.375)
Test Sargan (*P*-value)	3.89 (0.692)	9.29 (0.158)	4.55 (0.603)	33.17 (0.000)	4.40 (0.623)	9.15 (0.165)	8.34 (0.214)
Test Hansen (*P*-value)	6.33 (0.388)	5.89 (0.436)	6.05 (0.417)	15.21 (0.019)	13.55 (0.035)	4.79 (0.571)	5.97 (0.427)
Observations	644	1540	1736	700	812	1036	2296
Groups	92	220	248	100	116	148	328

Note: ***, ** and *: denote significance at 1%, 5% and 10%, respectively. Bold typeface indicate potential impact of the change in legislation.
GDP, gross domestic product; HRP, high-risk plants.

the figures show that the introduction of a PC requirement for products in Part B of Annex XI of CIR 2019/2072 does not seem to have had an impact on trade flows when compared with products that did not experience such a change (Part A). However, the implementation of trade prohibition for HRP seems to have had an impact in some sub-headings.

As an additional check we focus on interceptions of plants and plant products for reasons other than the detection of harmful organisms which are recorded in TRACES and EUROPHYT. The total number of interceptions was 6100 in 2018, 4027 in 2019, and 6491 in 2020. Consequently, the total number of interceptions does not seem to be related to the change in legislation. It is more informative to look at the distribution of these interceptions by product groups and origins. A significant increase in the diversity of species or genera (+16%) and countries of origins (+85) for the intercepted shipment is found in the categories 'Seeds for planting' and 'living plants of fruits and vegetables', which are now subject to the PC requirement. However, the absolute numbers are small.

Focusing on the most intercepted species, there is no change in 2020 from previous years. The top five most intercepted species are seeds for planting: *Capsicum annuum*, *Solanum Lycopersicon*, *Solanum melongena*, *Mangifera indica* and *Zea mays*. Two species, traded in the form of wood, appear among the top ten most intercepted species (*Pinus sylvestris* and *Picea abies*).

Most species registering an increase in interceptions correspond to products for which a PC was already required before the new CIR 2019/2072 entered into force (Part A of Annex XI). Therefore, the implementation of new regulations has only led to an increase in interceptions for a limited set of species.

To gain an understanding of the relevance of the affected products in terms of their share of total trade we used the database from Eschen *et al.*[50] together with the list of genera and species established as HRP in CIR 2018/2019. We can see that the HRP genera represent only 0.16% of the total imports of plants for planting. Moreover, there were relatively few interceptions of these genera observed in 2019 and 2020 (26 and 49, respectively), and they were concentrated in a small group of countries (four countries – the United States, China, Serbia, and Albania – accounted for over 50% of all interceptions in 2020). Given the small number of interceptions and the brief time since the CIR 2018/2019 was introduced, we cannot confirm that the new regulation has had a clear influence on the number of interceptions in these products.

5 CONCLUSIONS

In this article, we estimate the impacts of phytosanitary legislation aimed at ensuring the biosecurity of EU imports. We have focused on the explicit trade restriction implemented via the identification of HRP and on the increased stringency of phytosanitary requirements for other plant products. The imports that were subject to a PC requirement during the whole period were not significantly affected. Changes in the import regime derived from CIR 2018/2019 and CIR 2019/2072 have had a limited impact, if any, on trade flows. The extension of the PC requirement to new products seems to have resulted in a negligible change in trade, and a limited impact has been detected for only a few products classified as HRP in CIR 2018/2019.

Two conclusions emerge from the analysis. The first is that while PHR affect specific products (including HRP and those regulated or intercepted due to the detection of risks), the plant health legislation does not appear to have a significant impact on overall

trade of plants and plant products. The second conclusion is that the potential biosecurity gains predicted by stakeholders in the domestic agricultural sector, due to lowered plant health HRP threats,[51] seem to have come at a very minor cost in terms of a reduction in imports.

Three caveats apply to the reported results. Firstly, based on this analysis, it is not possible to conclude whether the lack of short-term impacts detected will be a long-term feature of the new import regime. Accordingly, the analysis should be repeated once the system has been in place for several years to confirm or qualify the findings. This article proposes a methodology for updating the results in future monitoring exercises. Secondly, while all the appropriate methodological steps have been taken to isolate the impact of the legislative change from all other potential drivers, we cannot rule out the possibility that part of the impact is due to causes other than these changes. A more detailed analysis, using more granular trade data, would yield more precise estimates. More specific data would also allow to identify, on a case-by-case basis, trade impacts on specific commodities and countries where certain risks are detected. Thirdly, the recent changes in legislation trade changes coincided with the COVID pandemic, though income effects on trade seem to be limited.

CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interests to disclose.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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APPENDIX

Table A1. European Union (EU) 27 imports by combined nomenclature (CN) chapter

	2013	2014	2015	2016	2017	2018	2019	2020
Intra-EU trade (€ million)								
CN 06	5434.9	5637.4	5924.4	6190.7	6444.2	6696.7	6832.7	6866.2
CN 07	12 157.4	11 468.8	12 414.3	13 293.4	14 294.1	13 815.2	15 481.7	15 242.3
CN 08	13 778.0	13 525.7	15 586.4	16 714.0	17 720.4	18 260.1	18 019.1	19 869.0
CN 09	3597.1	3995.0	4751.7	4874.4	5272.4	5203.5	5313.5	5497.6
CN 10	9462.0	8598.5	9126.1	8904.7	9416.6	9373.6	9694.9	10 140.0
CN 12	6406.4	6244.4	6517.0	6962.1	6991.2	7467.9	7348.3	8176.4
CN 44	17 701.8	18 976.7	19 102.8	20 134.4	21 459.6	23 386.1	23 499.8	22 041.5
Extra-EU trade (€ million)								
CN 06	1043.0	1073.1	1152.5	1152.3	1197.8	1209.7	1265.0	1179.4
CN 07	2340.4	2334.4	2520.6	2752.9	2990.8	2835.5	3111.4	3107.9
CN 08	9536.2	9922.7	11 984.4	12 329.9	12 887.3	13 579.3	13 574.4	15 114.0
CN 09	5434.5	5331.2	6652.4	5968.7	6569.4	5791.1	5684.5	5694.5
CN 10	3115.5	3653.3	3229.6	3239.3	3581.9	3974.1	4720.4	4017.5
CN 12	7694.3	7117.2	6946.2	7293.4	7805.5	7411.9	7681.1	8361.9
CN 44	5389.3	5825.4	6336.7	6585.3	6879.9	7634.6	7934.9	7338.0

Source: Eurostat.