

Did the COVID-19 pandemic disturb intra-EU trade in agri-food products? Evidence from a counterfactual forecasting approach

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Electronic supplementary material

Supplementary Figures S1–S3

Supplementary Tables S1–S3

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Country	III 2020	IV 2020	V 2020	VI 2020	VII 2020	VIII 2020	IX 2020	X 2020	XI 2020	XII 2020	I 2021	II 2021	III 2021	IV 2021	V 2021	VI 2021	VII 2021	VIII 2021	IX 2021	X 2021	XI 2021	XII 2021	I 2022	II 2022	Country Average
Austria	53	79	61	50	39	38	37	51	78	76	82	78	74	78	70	58	49	51	51	50	49	49	53	50	59
Belgium	49	81	77	57	53	60	53	51	65	60	61	63	64	69	52	51	51	47	43	32	34	36	32	30	53
Bulgaria	49	72	61	43	42	39	37	38	49	54	54	54	56	52	48	59	48	23	43	50	49	46	46	44	48
Cyprus	46	94	87	64	48	48	53	55	71	71	81	81	73	65	67	53	49	53	52	47	46	48	50	47	60
Czech Rep.	58	67	52	38	36	36	38	54	72	67	75	80	81	69	59	50	42	40	40	43	43	42	38	37	52
Germany	49	77	64	61	57	58	50	55	62	75	84	83	77	75	75	68	68	55	39	32	41	48	46	43	60
Denmark	53	70	66	58	57	54	51	47	47	50	68	66	63	65	59	51	43	39	23	20	26	32	33	14	48
Spain	52	85	79	54	59	63	61	65	71	73	73	70	69	69	65	52	49	48	45	42	41	43	39	38	59
Estonia	34	77	59	38	35	32	34	35	39	51	47	39	54	61	44	36	24	23	27	29	36	38	46	46	41
Finland	47	70	63	40	37	34	32	36	41	51	52	52	52	52	52	48	44	38	33	24	25	36	32	33	43
France	66	88	80	66	48	47	48	50	78	69	64	62	67	74	61	51	41	43	43	42	41	44	47	38	57
Greece	55	84	71	52	57	56	61	56	76	84	82	81	88	85	68	58	58	63	69	71	71	73	74	67	69
Croatia	51	95	73	53	45	35	30	29	35	58	53	47	44	51	48	40	34	32	32	37	34	38	32	32	44
Hungary	48	77	65	53	49	49	44	41	66	72	72	72	78	71	59	50	28	29	30	30	31	30	29	28	50
Ireland	40	90	87	69	44	60	62	64	81	75	86	88	84	82	63	51	41	40	43	42	42	43	32	18	59
Italy	80	91	74	68	67	67	66	68	82	81	77	76	79	79	71	71	61	54	57	52	50	51	53	49	68
Lithuania	51	82	74	49	37	42	40	52	63	73	78	73	71	58	47	39	30	28	33	36	35	35	27	19	49
Luxembourg	50	76	58	41	30	42	47	50	57	61	55	55	55	48	47	43	40	38	38	43	46	46	55	47	49
Latvia	39	61	58	52	50	45	34	37	52	56	58	56	56	56	56	46	42	42	38	47	50	44	43	41	48
Malta	48	87	86	52	32	40	43	47	53	53	53	53	67	72	60	53	46	44	44	44	44	44	45	45	52
Netherlands	47	79	74	61	45	48	51	62	62	71	80	80	75	74	68	61	37	42	42	37	43	58	58	41	58
Poland	41	84	82	58	43	40	30	43	74	75	74	71	72	74	64	52	42	36	35	33	39	47	45	42	54
Portugal	51	83	70	60	63	61	60	62	67	67	72	82	78	70	65	64	65	55	50	36	31	41	38	27	59
Romania	53	87	79	48	42	43	44	48	69	77	77	73	68	64	54	40	37	49	53	65	71	60	53	47	58
Sweden	35	65	65	61	59	57	56	56	59	68	69	69	70	65	65	53	42	34	33	16	16	23	40	22	50
Slovakia	52	77	72	45	39	36	31	56	71	63	70	72	72	71	58	51	46	39	33	30	37	58	48	42	53
Slovenia	46	88	58	40	44	50	50	58	81	84	80	68	69	72	50	42	43	42	43	43	50	54	50	38	56
EU-average	50	80	70	53	47	47	46	51	64	67	70	68	69	67	59	52	44	42	41	40	41	45	44	38	-

Figure S1. Heat map of Covid intervention variable stringency index (SI) from Jan 2020 to Feb 2022

Average intervention is calculated for the 'COVID period' (March 2020 – February 2022). The scale of the heat map is from blue (lowest, 0) to red (highest, 1).

Source: Own calculations based on OxCGRT (2024) and Eurostat-Comext (2024) data

<https://doi.org/10.17221/264/2023-AGRICECON>

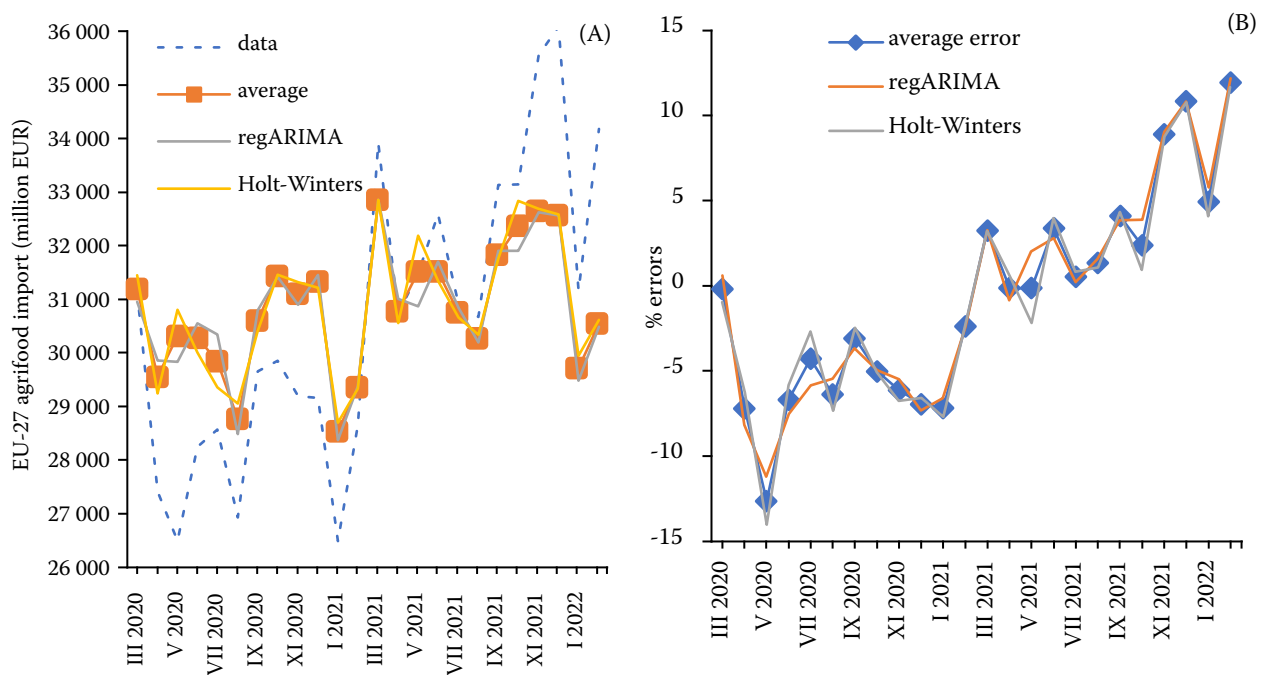


Figure S2. Example of ex-post of forecasting and errors calculation; (A) Intra EU-27 agri-food import forecasts vs. actual data (million EUR); (B) differences (forecast errors) between actual and predicted series of intra-EU-27 aggregate agri-food imports (%)

regARIMA – linear regression model with autoregressive integrated moving average errors

Source: Own calculations based on Eurostat-Comext (2024) data

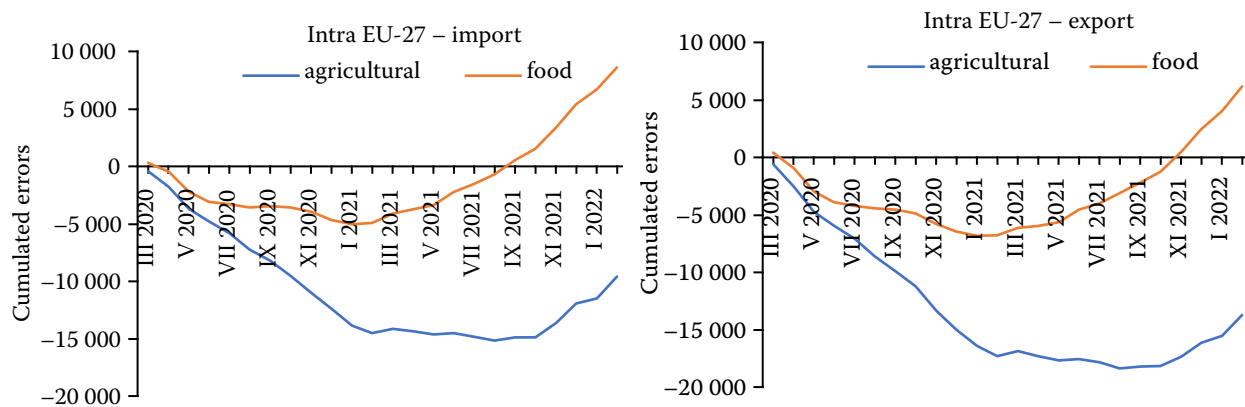


Figure S3. Cumulated average error (million EUR)

Source: Own calculations based on Eurostat-Commext (2024)

<https://doi.org/10.17221/264/2023-AGRICECON>

Table S1. Differences between COVID and no-COVID scenarios (forecast errors) for intra-EU agricultural trade

Trade	Intra-EU import of agricultural products							Intra-EU export of agricultural products						
	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021
Austria	-10.23	-6.53	-14.66	-12.01	-4.16	-4.26	0.98	-11.80	-5.50	-10.62	-5.76	-8.11	-4.10	-3.85
Belgium	-0.65	-0.65	-0.18	6.95	11.90	10.22	16.25	-13.35	-10.68	-10.96	-8.41	-3.20	-3.67	0.76
Bulgaria	-38.73	-23.53	-17.73	-14.82	-26.51	-18.14	2.24	6.78	-47.34	-20.27	-6.27	31.99	-18.81	3.16
Cyprus	-27.54	-21.09	-4.84	-9.75	4.98	2.55	19.07	-10.74	9.88	-5.49	-4.18	-13.17	-2.22	-6.47
Czechia	-16.02	-11.42	-20.44	-12.38	-7.66	-8.78	-8.51	-5.44	-3.62	0.00	3.87	2.11	5.75	17.45
Germany	-4.72	-6.68	-5.18	-1.50	-0.16	-4.55	3.90	-18.30	-11.59	-13.25	-8.56	-9.13	-7.72	0.44
Denmark	-4.72	-4.21	-4.90	-2.28	2.73	3.02	6.59	-23.07	-22.23	-30.72	-20.49	-18.48	-20.5	-14.64
Estonia	-11.34	-8.22	-12.16	-10.05	-0.08	-0.85	0.83	-14.80	-2.10	-13.84	-8.61	-6.30	4.95	-3.81
Spain	-20.29	-19.9	-13.31	-8.26	-1.83	-4.76	7.72	-8.33	-5.65	-9.14	-4.71	0.11	2.16	0.78
Finland	-9.80	-8.23	-10.88	-13.41	-7.26	-4.54	-1.85	-11.9	-19.15	-10.80	-26.52	-24.18	-17.2	-9.30
France	-8.12	-1.21	-9.09	-5.56	1.78	5.40	5.50	-13.75	-12.24	-13.19	-5.50	-1.13	-0.67	8.14
Greece	-29.64	-21.81	-13.34	-7.86	-8.85	-0.88	7.02	-0.10	0.00	-0.98	13.51	8.85	2.36	8.57
Croatia	-40.12	-28.88	-29.97	-15.22	-22.38	-8.23	-5.54	-8.92	10.95	12.46	9.54	1.70	10.25	23.40
Hungary	-35.86	-30.38	-36.22	-28.2	-34.63	-20.33	-9.62	-11.07	-17.16	-17.75	4.42	-4.04	-8.22	-4.10
Ireland	-5.33	10.07	-2.29	5.15	7.72	3.68	6.82	-1.44	-0.63	-6.29	-3.55	5.98	10.62	18.55
Italy	-20.93	-14.17	-17.7	-11.28	-6.54	-3.77	1.70	-8.36	-2.11	-3.51	4.62	9.96	7.57	5.65
Lithuania	-19.36	-8.78	-6.96	-7.44	-4.66	2.72	14.47	-31.24	-9.15	-14.13	-28.31	-24.16	-9.24	0.77
Luxembourg	-9.91	-2.37	-7.74	-1.33	-0.49	0.25	6.53	-5.54	-2.59	-7.45	1.21	1.20	0.95	18.41
Latvia	-17.22	0.30	-4.59	1.71	-6.72	6.27	1.46	-8.09	12.23	-4.26	6.31	12.14	16.11	21.29
Netherlands	-5.69	-3.01	-5.66	-2.35	4.23	6.66	9.79	-10.99	-5.65	-9.03	-1.42	1.34	1.84	4.57
Poland	-15.97	-15.45	-18.84	-10.68	-7.15	-8.40	-2.90	-11.91	-6.81	-7.56	-2.75	0.04	1.41	8.93
Portugal	-14.84	-9.58	-6.84	-2.29	-0.96	-3.11	11.12	-13.84	1.12	-12.51	-6.59	1.30	6.17	9.75
Romania	-24.52	-26.49	-7.81	2.07	-11.67	-15.04	-6.03	-47.2	-61.31	-46.08	-13.2	3.03	-11.62	4.86
Sweden	-6.64	-1.73	-5.40	-3.31	1.58	5.84	10.98	-17.03	-10.7	-10.96	-4.94	-8.89	1.09	8.35
Slovenia	-17.02	-12.49	-21.95	-13.31	-10.32	-4.87	-1.13	-3.62	-10.62	-9.21	0.96	12.67	7.05	17.88
Slovakia	-11.00	-14.29	-18.22	-12.61	-4.42	-8.25	-3.99	-12.96	-6.32	-7.05	7.87	-10.83	1.00	8.95

The colour scale ranges from red (lowest) to green (highest)

Source: Own calculations based on Eurostat-Comext (2024) data

<https://doi.org/10.17221/264/2023-AGRICECON>

Table S2. Differences between COVID and no-COVID scenarios (forecast errors) for intra-EU food trade

Trade	Intra-EU import of food products							Intra-EU export of food products						
Period	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021
Austria	-11.54	0.59	-8.34	-1.23	4.38	9.65	7.16	-10.75	-1.75	-5.07	-0.65	1.31	5.05	5.88
Belgium	1.66	4.46	2.92	9.49	14.29	15.86	20.03	-14.84	-1.22	-8.53	-3.83	-0.36	0.51	3.30
Bulgaria	-15.37	-4.02	-2.24	-2.14	0.14	6.75	9.09	-3.28	0.73	5.32	11.55	20.94	9.32	16.13
Cyprus	-18.46	-17.42	-11.72	9.16	7.88	0.07	10.66	-14.16	-7.83	-21.20	-18.41	-5.71	4.80	-4.37
Czechia	-19.30	-10.30	-16.09	-10.45	-4.70	-3.52	1.45	-12.80	-2.16	-7.84	-1.32	-5.68	-9.61	-2.70
Germany	-6.99	-3.94	-1.99	2.03	0.85	0.78	8.31	-13.00	-3.04	-3.68	4.01	3.28	4.14	9.27
Denmark	-8.47	1.69	-1.06	1.86	3.37	6.54	11.59	-24.58	-7.38	-11.81	-4.13	-0.62	5.84	7.98
Estonia	-25.54	1.37	-14.22	-7.33	-7.61	-5.07	-0.25	-22.38	-9.03	-18.02	-14.07	-11.21	-7.34	0.60
Spain	-21.60	-11.44	-11.42	-4.04	3.16	0.19	8.84	-6.71	1.80	3.59	8.74	10.94	15.15	17.09
Finland	-0.91	-0.06	1.72	0.03	-7.12	9.88	5.27	-21.78	3.89	0.90	-22.40	-12.33	-3.25	0.61
France	-5.16	3.13	-1.46	-0.68	5.38	6.92	7.39	-13.94	-2.88	-5.38	-0.14	7.51	7.21	12.91
Greece	-17.04	-8.29	-4.56	4.72	6.77	10.38	16.15	-15.03	-1.08	-2.56	0.95	19.54	11.41	4.22
Croatia	-33.14	-18.98	-4.77	-5.35	-11.65	-6.42	1.04	-9.99	-2.63	-7.04	4.88	6.53	5.97	6.59
Hungary	-15.74	-3.89	-5.09	1.66	1.37	5.94	7.43	-11.96	-3.93	-3.62	-0.42	4.45	6.24	8.92
Ireland	10.35	3.03	5.84	-0.04	5.18	6.87	12.60	-17.93	-11.87	-3.43	-66.05	-47.74	-22.93	-13.46
Italy	-15.66	0.40	-0.92	6.47	9.47	8.01	13.64	-13.48	-1.86	-4.33	-0.73	2.42	5.73	8.76
Lithuania	-18.19	-2.27	-4.08	-4.93	-1.11	-5.88	-3.93	-4.86	5.47	-22.08	-14.98	-17.89	-17.91	-17.70
Luxembourg	-21.86	9.96	-2.59	-1.92	1.68	3.68	1.61	-10.34	12.93	14.10	12.49	7.91	10.71	11.24
Latvia	-22.25	-7.24	0.27	-8.00	-7.25	-0.38	-0.82	-11.66	-7.62	-14.35	-9.47	-7.21	-7.51	-5.02
Netherlands	-6.36	1.31	-4.22	-1.18	4.05	8.24	8.92	-11.75	-2.73	-4.87	1.33	6.07	8.06	13.95
Poland	-4.78	2.11	-0.64	3.08	8.04	6.38	11.58	-4.01	0.82	-3.53	-1.28	0.27	1.75	4.44
Portugal	-16.35	-10.37	-4.17	1.71	3.46	1.27	8.45	-2.83	0.53	1.09	10.75	0.45	11.77	18.30
Romania	-27.49	-8.12	-10.33	-6.32	-5.23	-3.00	-2.49	-15.17	-13.83	-23.44	-27.14	-3.01	-12.63	8.30
Sweden	-7.13	-1.68	-2.79	-3.67	-0.42	7.35	10.63	-18.06	-1.33	-5.82	-7.83	-4.91	4.19	11.62
Slovenia	-20.41	-2.26	-11.64	-2.54	-2.25	1.29	4.26	-11.80	5.70	4.90	12.39	15.55	26.62	23.88
Slovakia	-11.09	0.59	-4.13	3.93	9.50	9.32	8.08	-6.54	3.60	-2.61	8.94	8.89	9.50	15.22

The colour scale ranges from red (lowest) to green (highest)

Source: Own calculations based on Eurostat-Comext (2024) data

Table S3. A period when the EU countries made up for the COVID-induced trade declines by product categories

Country	Food products		Agricultural products	
	export	import	export	import
EU-27	Nov-21	Sep-21	–	–
Austria	Jan-22	Sep-21	–	–
Belgium	–	Mar-20	–	Feb-21
Bulgaria	Jun-20	Nov-21	–	–
Cyprus	–	–	–	–
Czechia	–	–	Aug-21	–
Germany	Nov-21	Dec-21	–	–
Denmark	–	Jun-21	–	Jan-22
Estonia	–	–	–	–
Spain	Dec-20	–	–	–
Finland	–	May-20	–	–
France	Oct-21	Jun-21	–	–
Greece	May-21	Oct-21	Jul-20	–
Croatia	Aug-21	–	Sep-20	–
Hungary	Nov-21	Dec-21	–	–
Ireland	–	Mar-20	Jun-21	Mar-20
Italy	Dec-21	Jun-21	Jun-21	–
Lithuania	Jul-20	–	–	–
Luxembourg	Sep-20	–	Nov-21	–
Latvia	–	–	Aug-20	–
Netherlands	Sep-21	Sep-21	–	Nov-21
Poland	Dec-21	Feb-21	–	–
Portugal	Mar-20	Feb-22	–	–
Romania	–	–	–	–
Sweden	–	Nov-21	–	Dec-21
Slovenia	Nov-20	–	Sep-21	–
Slovakia	Feb-21	Jun-21	Feb-22	–

The darker green shadowed cells, the faster way back to the pre-pandemic trade level; – shows the countries that did not make up for trade declines

Source: Own calculations based on Eurostat-Comext (2024) data