

Global Economic Effects of War-Induced Agricultural Export Declines from Ukraine

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Outline

- Introduction
- Research Objectives
- Background for Study
- Methods and Data
- Results
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Introduction

- Russia's invasion of Ukraine disrupted domestic agricultural trade and production
- Uncertainty about the future of trade in the region
 - Termination of the Black Sea Grain Initiative
- Growing research on economic impacts of the war
- Build on studies of economywide effects of the war
- Investigate economywide effects of war-related changes in Ukraine's agricultural exports
 - Consider dissolution of the Black Sea Grain Initiative

Objectives

- Simulate war-related changes in Ukraine's exports of agricultural products without the Black Sea Grain Initiative
- Investigate economywide effects of restricted agricultural exports from Ukraine through the Black Sea with Two Scenarios
 - Scenario 1: Weak European Solidarity Lanes
 - Scenario 2: Strong European Solidarity Lanes
- Determine changes in output, GDP and welfare

Invasion and Situation as of June 2023

Russian Invasion of Ukraine



30% of Ukraine's territory occupied:

- ≈5 million ha of arable land
- Nationwide conscripts' mobilization reduced labor force
- Blockage of the main trade corridors (Black Sea Ports of Big Odesa, Kherson (liberated) and Mykolaiv, Azov ports of Mariupol (occupied) and Berdiansk (occupied))

Black Sea Grain Initiative and European Solidarity Lanes (ESL)

Black Sea Grain Initiative (BSGI)

- Launched July 22, 2022
- Agreement between Ukraine, UN and Turkey
- Allowed ag transport through 3 main ports
- Similar agreement with Russia, UN and Turkey
- ESL: action to facilitate Ukraine ag exports through EU countries by roads, railways, and Danube ports
- ESL routes are complex
 - Costs, different width of railroads, limited storage and transportation capacity in Danube ports in Ukraine and Romania

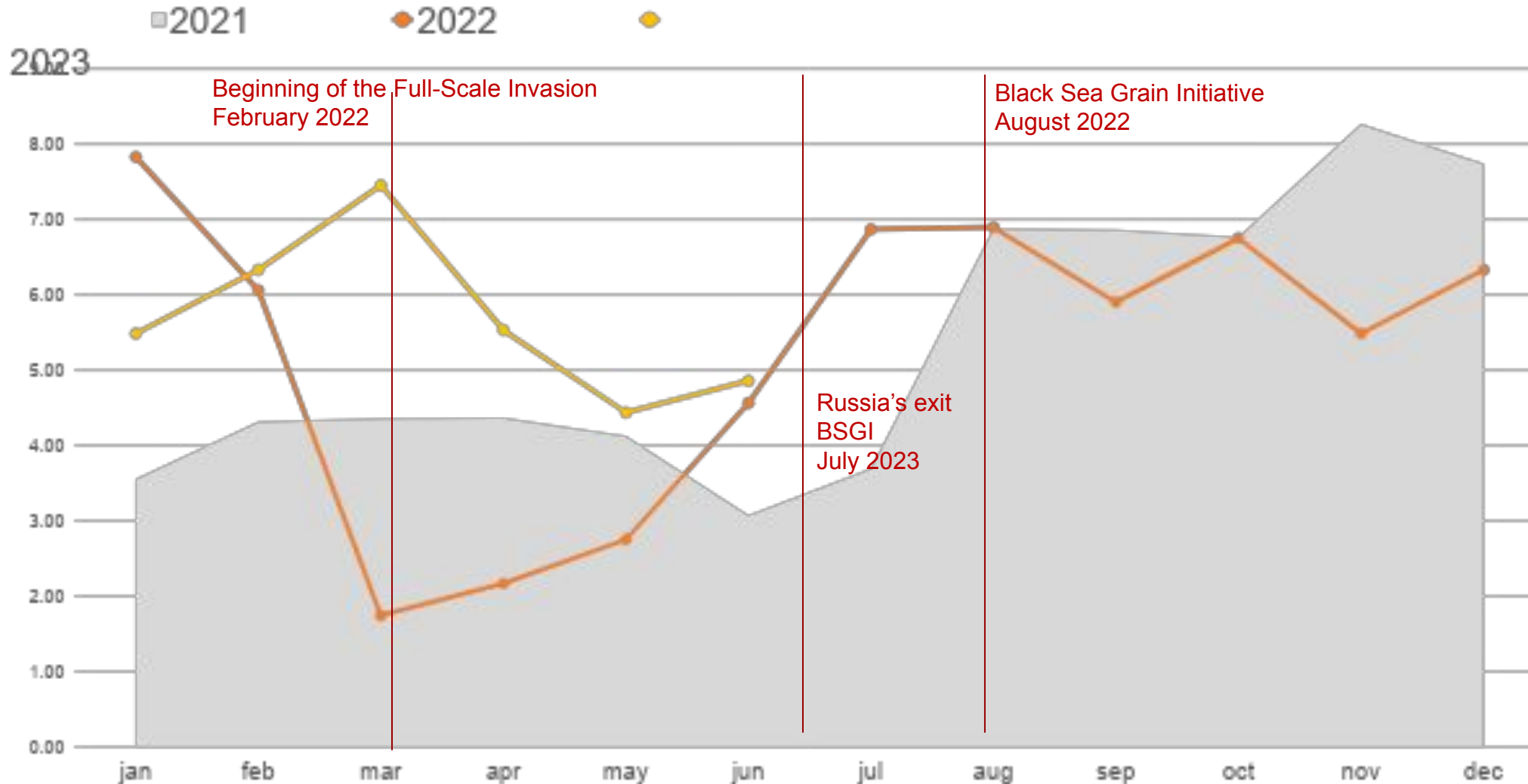


Invasion and Situation as of July 2023

Exports Volumes, million tons

Commodities HS codes: 1001, 1003, 1005, 1201, 1205, 1206, 1507, 1512, 2306

Wheat, barley, corn, soybeans, rapeseed, sunflower seeds, soybean oil, sunflower oil, oilcake



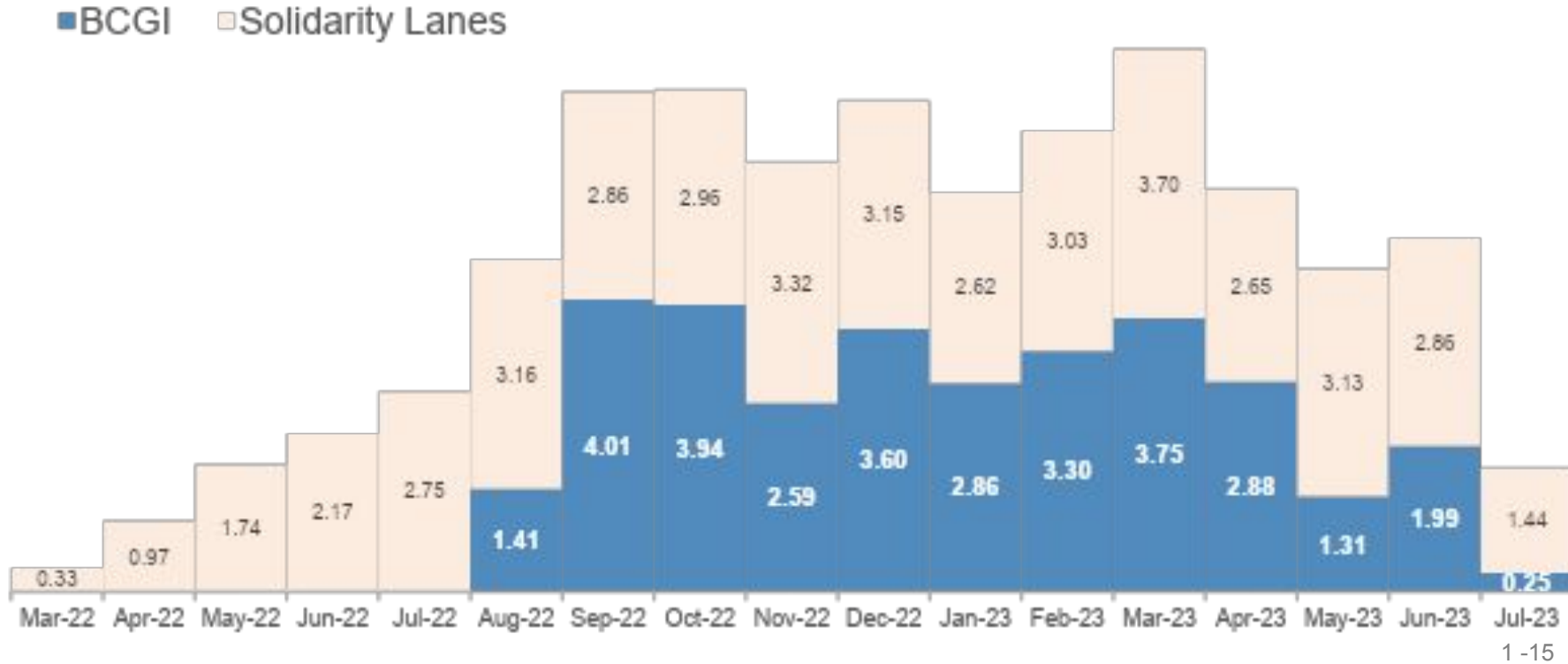
Exports of main ag products substantially decreased after invasion and improved with BSGI

Exports from Ukraine through BSGI and ESL

Logistics Breakdown, million tons

Commodities HS codes: 1001, 1003, 1005, 1201, 1205, 1206, 1507, 1512, 2306

Wheat, barley, corn, soybeans, rapeseed, sunflower seeds, soybean oil, sunflower oil, oilcake



-Pre-invasion: 80-85% of agricultural exports were shipped from Black Sea and Azov seaports

-BSGI intended to solve transportation problems after invasion (inability to ship through seaports, large transportation costs)

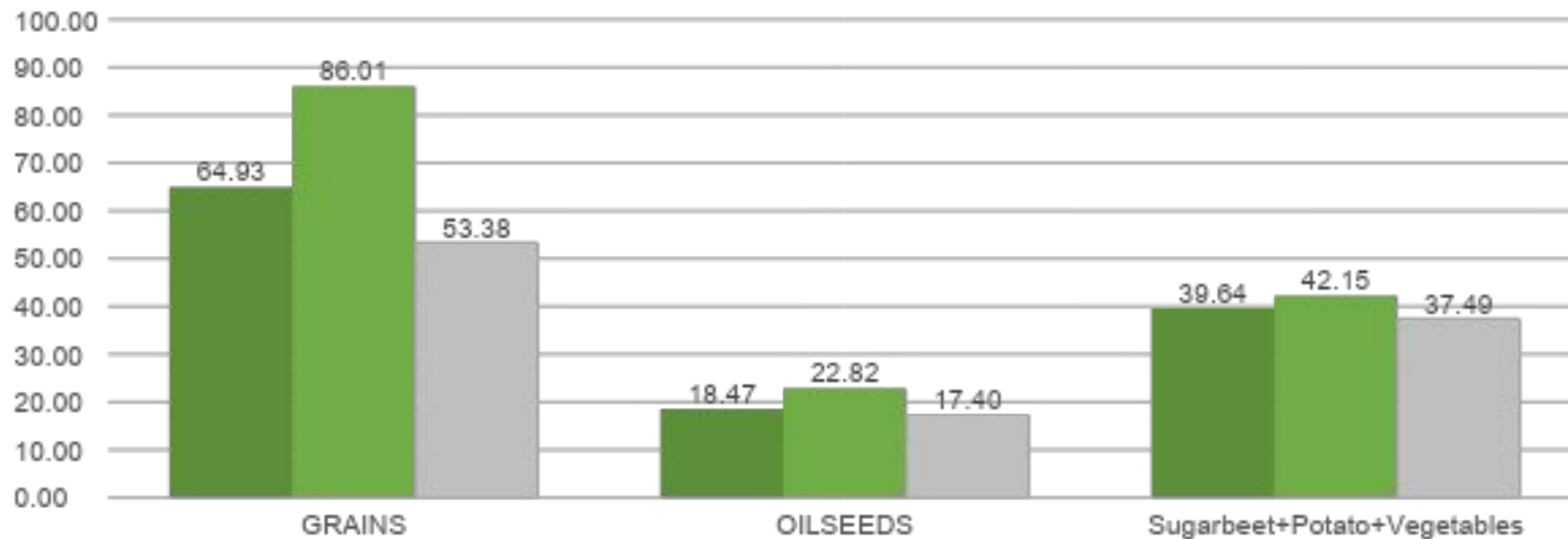
-Renewed 3 times
-Termination announced July 17, 2023

-Attack on port of Odesa
-Attacks on grain facilities

Agricultural Production in Ukraine

Agricultural Production of commodities, million tons

■ 2020 ■ 2021 ■ 2022



Economic Modeling Framework

- Economics Research: Agriculture, Food Security, Energy, International Trade
- Computable General Equilibrium Model (GTAP) with Bilateral Trade
- GTAP v11 database 2017 updated to 2021
 - Observed changes in population, real GDP, and capital
- 12 Regions
 - Ukraine, Russia & Belarus, Former Soviet Union, Europe, MENA, Central & Southern Africa, China & Hong Kong, SE Asia, South Asia, Rest of Asia, North America, Central & South America
- 13 Sectors
 - Primary Agriculture: Grains, Wheat, Other Crops, Oilseeds, Livestock & Meat
 - Processed Agriculture: Vegetable Oil, Processed Food
 - Extraction, Textiles, Manufacturing, Utilities, Transport, Other Services
- Model Scenarios: 2021 Baseline compared to war-related changes in exports with restricted access to the Black Sea
 - S1: Weak European Solidarity Lanes
 - S2: Strong European Solidarity Lanes

Scenario 1: Changes in Agricultural Exports (%)

Restricted Black Sea Routes, Weak EU Solidarity Lanes

% Change Quantity	Grains	Other Crops	Wheat	Oilseeds	Livestock & Meat	Vegetable Oil	Processed Food
Russia & Belarus	-90.63	-90.90	0	-93.58	-82.23	-99.62	-91.64
Former Soviet Union	11.15	-42.81	-56.09	122.98	-19.97	-63.61	-38.07
Europe	-56.34	-74.52	-59.57	48.14	35.34	-74.31	22.75
Middle East & North Africa	-86.80	-56.07	-97.91	108.50	1.50	-68.45	-42.94
Central & South Africa	-96.50	-91.43	-98.73	-11.24	-61.65	-86.51	-83.52
China & Hong Kong	-90.25	-69.21	-97.31	-47.61	-55.73	-92.46	-73.09
Southeast Asia	-86.91	-70.57	-99.50	40.99	220.77	-74.27	4.58
South Asia	-95.07	-86.64	-98.95	-85.42	-1.81	-91.15	-69.08
Rest of Asia	-98.88	-79.28	-97.67	-77.67	-66.92	-92.70	-81.27
North America	-99.55	-89.97	-99.99	-53.98	4.96	-80.41	-24.74
Central & South America	-98.26	-96.92	-99.95	-99.95	343.63	-94.74	-72.97

Source: Authors' calculations based on MAPF 2023 data

Scenario 2: Changes in Agricultural Exports (%)

Restricted Black Sea Routes, Strong EU Solidarity Lanes

% Change Quantity	Grains	Other Crops	Wheat	Oilseeds	Livestock & Meat	Vegetable Oil	Processed Food
Russia & Belarus	-90.63	-90.90	0	-93.58	-82.23	-99.62	-91.64
Former Soviet Union	383.28	-42.81	997.80	259.65	-19.97	65.40	-38.07
Europe	45.49	-74.52	573.82	93.31	35.34	7.48	22.75
Middle East & North Africa	-69.94	-56.07	-68.50	178.56	1.50	7.77	-42.94
Central & South Africa	-84.76	-91.43	-95.78	43.17	-61.65	-47.33	-83.52
China & Hong Kong	-72.82	-69.21	-32.87	-15.50	-55.73	-83.10	-73.09
Southeast Asia	-43.09	-70.57	-99.54	127.40	220.77	16.94	4.58
South Asia	-78.58	-86.64	-89.12	-88.97	-1.81	-82.54	-69.08
Rest of Asia	-100	-79.28	-96.77	-63.98	-66.92	-66.80	-81.27
North America	-98.04	-89.97	-99.82	-25.78	4.96	-10.94	-24.74
Central & South America	-92.45	-96.92	-100.00	-100.00	343.63	-76.09	-72.97

Source: Authors' calculations based on MAPF 2023 data

Results: Percentage Changes in Ukraine Aggregate Exports and Output

	Aggregate Exports (%)		Output (%)	
	S1: Weak ESL	S2: Strong ESL	S1: Weak ESL	S2: Strong ESL
Grains	-76.99	-35.34	-72.83	-33.42
Other Crops	-75.28	-75.29	-9.68	-7.28
Wheat	-94.81	-30.42	-94.78	-30.41
Oilseeds	55.05	104.76	-14.79	30.63
Livestock & Meat	3.84	3.83	-20.93	-5.11
Vegetable Oil	-81.67	-34.57	-75.79	-32.1
Processed Food	-39.81	-39.81	-15.61	-11.99

Source: Authors' simulations

Results S2-S1: Difference in Aggregate Exports Changes from other Regions

Sectors	Russia & Belarus	Former Soviet Union	Europe	Middle East & North Africa	Central & Southern Africa	China & Hong Kong	Southeast Asia	South Asia	Rest of Asia & Oceania	North America	Central & South America
Grains	-5.35	-9.2	-17.5	-6.07	-0.94	1.76	-1.18	-2.11	-2.33	-0.13	-3.43
Other Crops	1.36	0.36	0.4	-0.22	-0.1	-0.33	0.01	-0.19	-0.08	-0.07	0.14
Wheat	-3.62	-6.47	-10.52	-9.15	-2.13	-3.73	-0.29	-3.43	-1.26	-2.18	-0.59
Oilseeds	-6.97	-5.73	-3.77	-4.98	-3.84	-7.46	-0.41	-2.88	-4.57	-1.49	-0.95
Livestock & Meat	-0.46	0.23	0.37	-0.25	-0.38	-0.45	-0.24	-0.44	-0.38	-0.2	0.29
Vegetable Oil	-6.36	-4.48	-2.48	-0.27	-1.55	-1.79	-1.35	-2.25	-3.04	-1.25	-2.55
Processed Food	-0.1	0.29	0.21	0.06	0	-0.08	0.01	-0.14	-0.23	-0.09	0.18

Results: Changes in GDP and Welfare

	GDP (%)		Welfare (EV, \$million)	
	S1: Weak ESL	S2: Strong ESL	S1: Weak ESL	S2: Strong ESL
Ukraine	-10.06	-1.99	-17613.86	-4,599.08
Russia & Belarus	-0.02	-0.01	134.50	-9.59
Former Soviet Union	-0.08	-0.04	36.90	-51.06
Europe	-0.01	0.01	-520.25	1,905.76
Middle East & North Africa	-0.07	-0.03	-1886.69	-1,095.57
Central & South Africa	-0.01	-0.01	22.00	-163.24
China & Hong Kong	-0.01	-0.01	-798.67	-642.52
Southeast Asia	-0.01	-0.01	193.72	77.60
South Asia	-0.03	-0.03	-707.93	-680.40
Rest of Asia	0	0.00	3.39	-206.57
North America	0	0.00	349.15	144.26
Central & South America	0	0.00	1027.11	272.29

Source: Authors' simulations

Conclusion

- Dissolution of Black Sea Grain Initiative stifles ag exports from Ukraine
- Scenario 1: Weak Solidarity Lanes
 - Simulated decreased exports from 40-90% for grains, other crops, wheat, and vegetable oil except +11% grain exports to FSU
 - Simulated increased oilseed exports to FSU (123%), MENA (109%), and Southeast Asia (41%) to compensate for lost vegetable oil exports
 - Negative global effects lessened in S2 with stronger ESL with Europe helped most
- Substantial decreased output in Ukraine for all ag in S1 and S2
- Decreased ag prices in Ukraine, and minor world price decreases <1%
- GDP in Ukraine decreases by 10% in S1 and 2% in S2
- Welfare S1 vs S2: Ukraine -\$17.6 vs -4.6 bn, MENA -\$1.9 vs -1.1 bn
- Middle East and North Africa are the worst-off outside Ukraine

Continued Work

- Improve assumptions for changes in trade
 - Account for increased bilateral transport costs
 - Consider global export restrictions
- Account for increased domestic transport costs
 - Tripled for most agricultural products after the invasion
- Simulate prolonged war: potential for worsened domestic production and effects on trade
- Continued uncertainty and importance of Ukraine in agricultural markets

Thank You!

Questions?

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