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War and Commodities

S2024

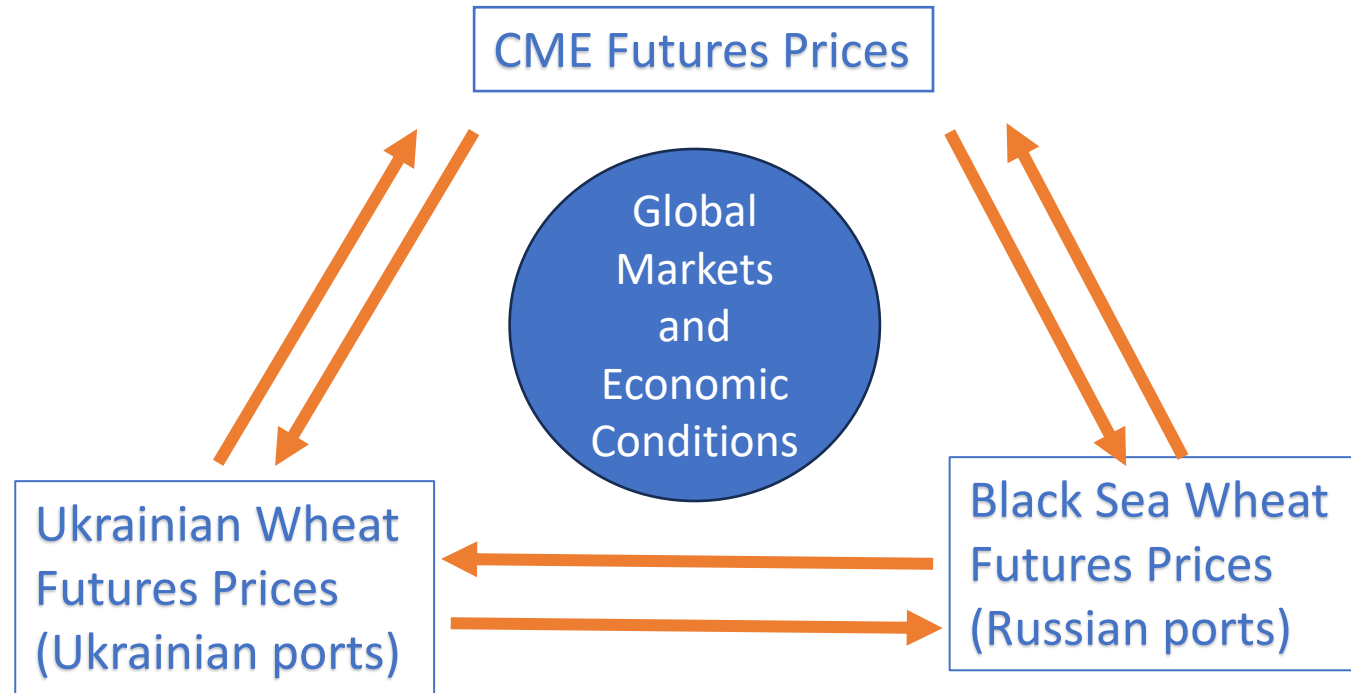
Background

- Russia's invasion of Ukraine of February 24, 2022 shocked the world and had a profound effect of commodity futures prices.
- The invasion affected global markets in many respects... economists refer to these events as 'exogenous shocks' which disrupt the normal random evolution of market prices
- The war was ambiguous and ubiquitous in the sense that on initiation traders had little information on which to assess prices
 - Long war vs short war
 - Political risks
 - Market risks
 - Trade risks
 - Financial risks
 - Currency risks
- The two largest impacts were in agricultural commodities and energy
 - Wheat from Ukraine to rest of world including Europe but more important Africa
 - Oil and natural gas from Russia to Europe
- War is disruptive, disruption is risk

How to make sense of the effects of war on commodity prices?

- Holbrook Working (1941) provides some guidance on this
 1. War should not be isolated as the sole causal factor for a price change
 2. Economic conditions prior to war (COVID, gov't spending etc) could contribute to inflationary environment
 3. Classical economic factors: as energy prices rise, fertilizer costs rise. To maintain equilibrium quantity of supply, prices must rise.
 4. Absolute-value theory
 5. Need to consider price changes in other countries and global trade conditions.
 6. Where country exports to/import from will matter
 1. How long price shocks persist will depend on how other countries can reallocate commodity and modify supply chains from other excess supply regions to meet disruption in export demand
 7. If export demand is highly inelastic then price effect of even a small disruption in trade can produce significant changes in global prices.
 1. Excess demand is likely more inelastic to North Africa than Europe because of lack of substitutes and storage capacity for basic commodity
 2. Limited and costly (uninsurable) transportation into war zone reduces freight capacity
 8. Price controls (e.g fixing energy costs), rationing of purchases, blockades and embargos

The Wheat Futures Complex



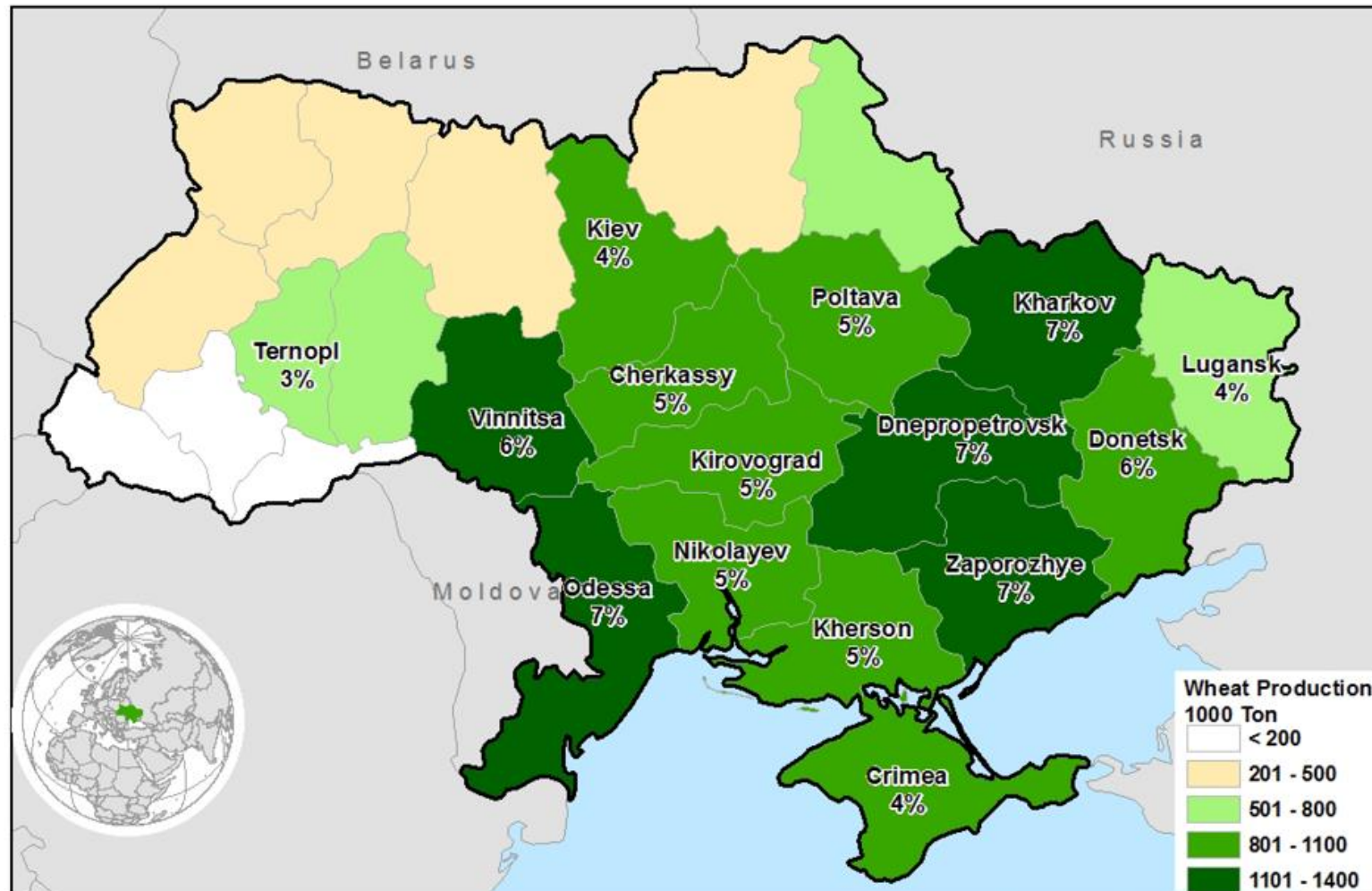
- Wheat markets are globally linked through spatial trade relationships as well as local supply and demand conditions and shipping costs
- What was the relationships and information flows between futures prices before the war?
- How were these markets cointegrated?
- What were the patterns or directional flow of influence between markets?
- ***How did these price relationships change as a result of the war?***

Ukrainian Agriculture

- Ukraine is one of the world's top agricultural producers and exporters and plays a critical role in supplying oilseeds and grains to the global market.
- More than 55 percent of Ukraine's land area is arable land. Agriculture provides employment for 14 percent of Ukraine's population.
- Agricultural products are Ukraine's most important exports.
- In 2021 they totaled \$27.8 billion, accounting for 41 percent of the country's \$68 billion in overall exports.

Ukraine Wheat Production

UKRAINE: Wheat Production by Oblast

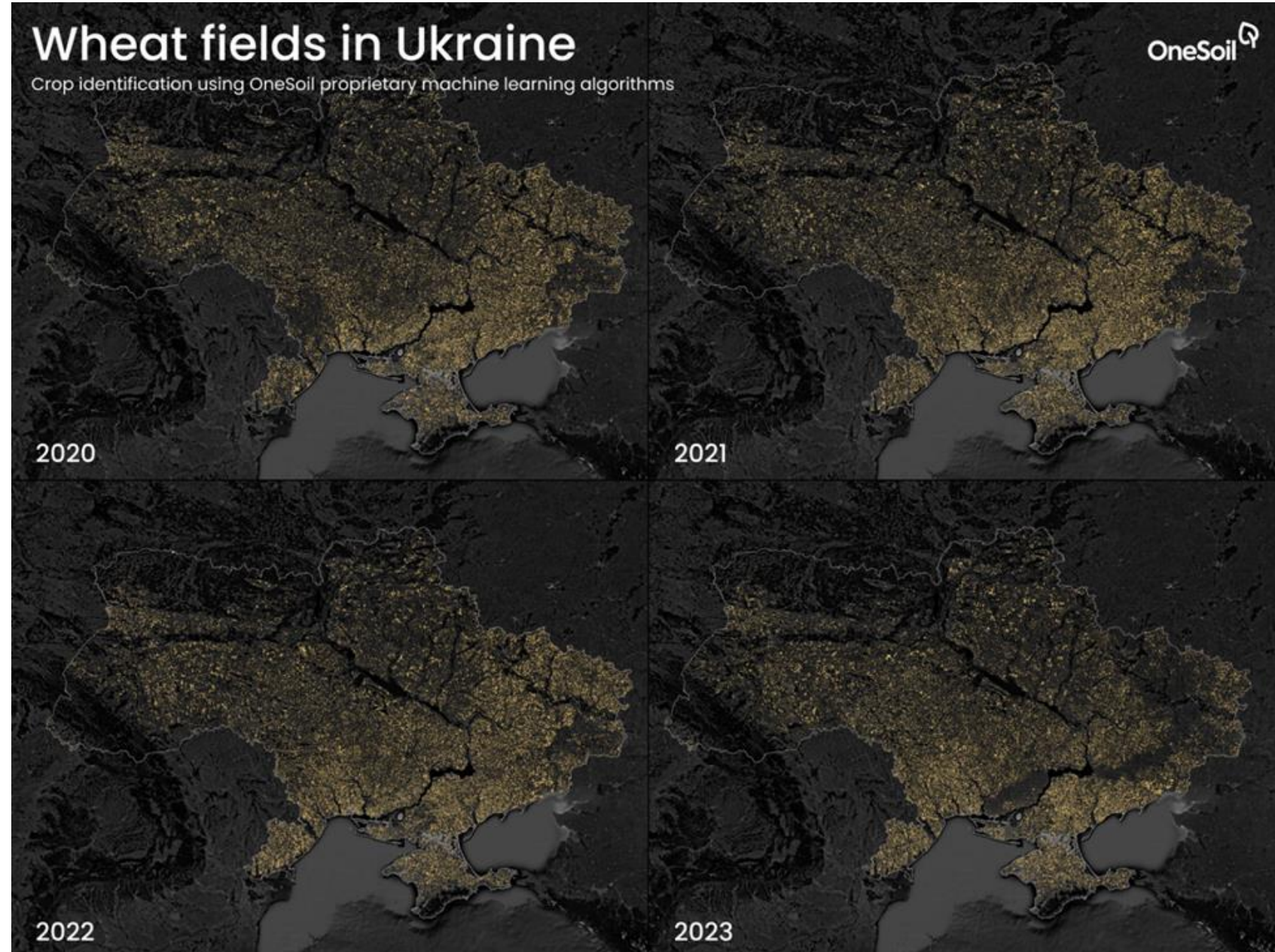


Data Source: State Statistical Committee of Ukraine
Average Production of 2011-2015

Foreign Agriculture Service
Office of Global Analysis
IPA Division



Effect of war on
Wheat
production,
2020-2023
(Source:
OneSoil)



Ukraine
agriculture
production
and
exports
(source:USDA)

Ukraine Agricultural Production and Exports (2022/23 Marketing Year)

	Production			Exports		
Product	Volume (1,000 MT)	Rank Among Global Producers	% of Global Production	Volume (1,000 MT)	Rank Among Global Exporters	% of Global Exports
Corn	25,000	#8	2.1%	9,000	#4	4.9%
Wheat	21,500	#9	2.8%	10,000	#8	4.9%
Sunflower	9,500	#3	19.3%	750	#1	20.7%
Barley	5,700	#7	3.9%	1,800	#6	5.9%
Sunflower Oil	4,085	#3	21.4%	3,600	#1 joint	34.7%
Sunflower Meal	3,924	#3	19.0%	2,700	#1	39.8%
Rapeseed	3,200	#6	4.0%	2,750	#3	16.6%

Source: USDA WASDE and PSD Database, updated July 12, 2022.

Ukraine Agricultural Exports (2021 Calendar Year)

Product	Value	Top Markets		
TOTAL	\$27.8 billion	EU \$7.7B	China \$4.2B	India \$2.0B
Sunflower Oil	\$6.4 billion	India \$1.9B	EU \$1.9B	China \$0.9B
Corn	\$5.9 billion	China \$1.9B	EU \$1.8B	Egypt \$0.5B
Wheat	\$5.2 billion	Egypt \$0.9B	Indonesia \$0.7B	Turkey \$0.4B
Rapeseed	\$1.7 billion	EU \$1.1B	Pakistan \$0.2B	UK \$0.2B
Barley	\$1.3 billion	China \$0.7B	Turkey \$0.2B	S. Arabia \$0.1B
Sunflower Oilcake	\$1.2 billion	China \$0.6B	EU \$0.3B	Belarus \$0.1B

Source: Trade Data Monitor LLC

March 7, 2022 Markets Insider

Wheat prices soar to trigger trading halt for 5th straight day, surging nearly 50% since Russia invaded the bread basket of Europe

Matthew Fox Mar 7, 2022, 2:06 PM



Farmers harvest with their combines in a wheat field near the village Tbilisskaya, Russia, July 21, 2021. AP Photo/Vitaly Timkiv, File

- Wheat futures traded limit up for the fifth day in a row on Monday, making new record highs.
- The commodity futures have surged nearly 50% since Russia invaded Ukraine, which is often called the bread basket of Europe.
- Ukraine is responsible for more than 10% of global wheat production.

June 4, 2022 Outlook

Russia's war may deprive world of three Ukrainian wheat harvests, agriculture minister says

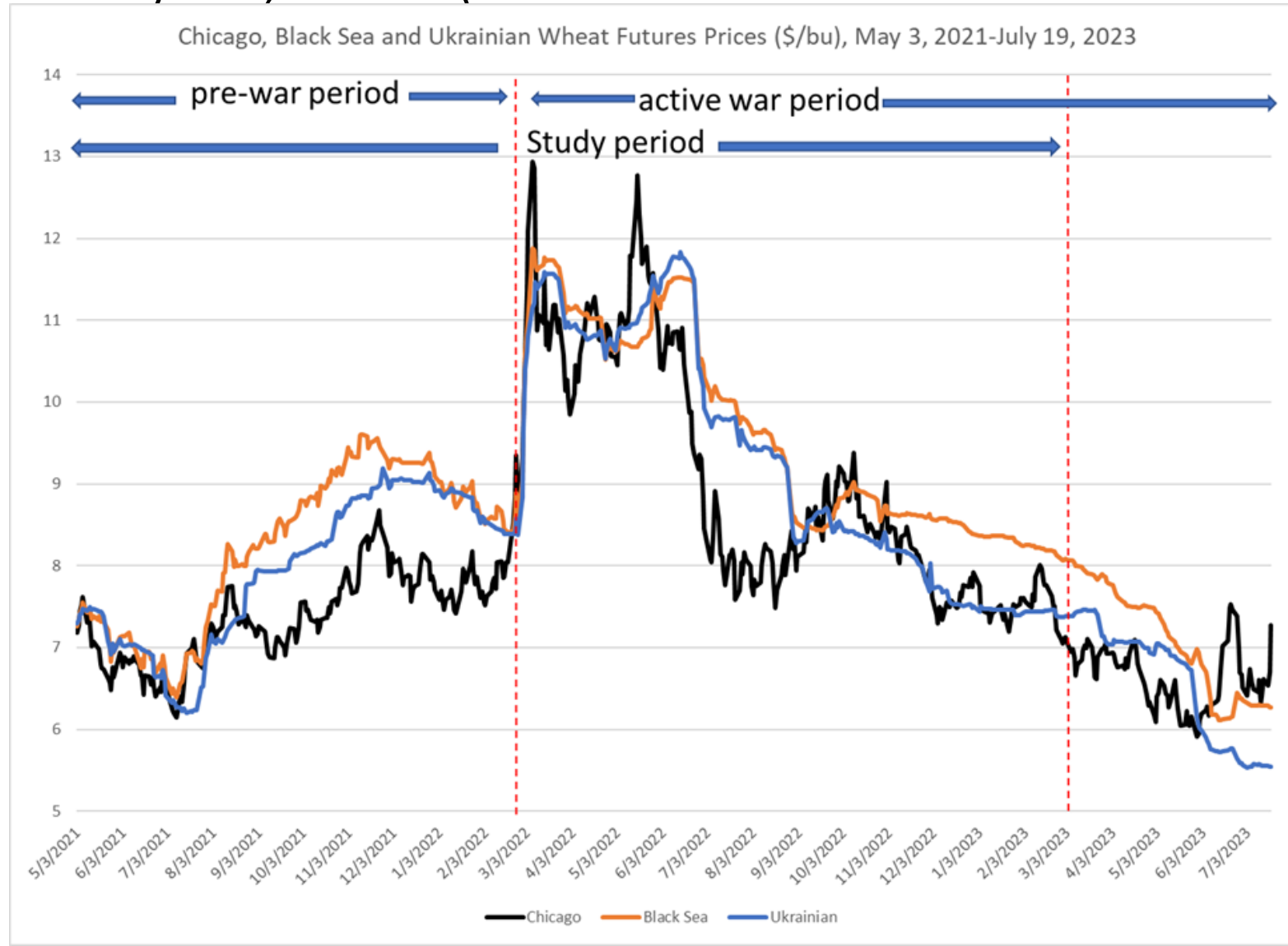
By Pavel Polityuk



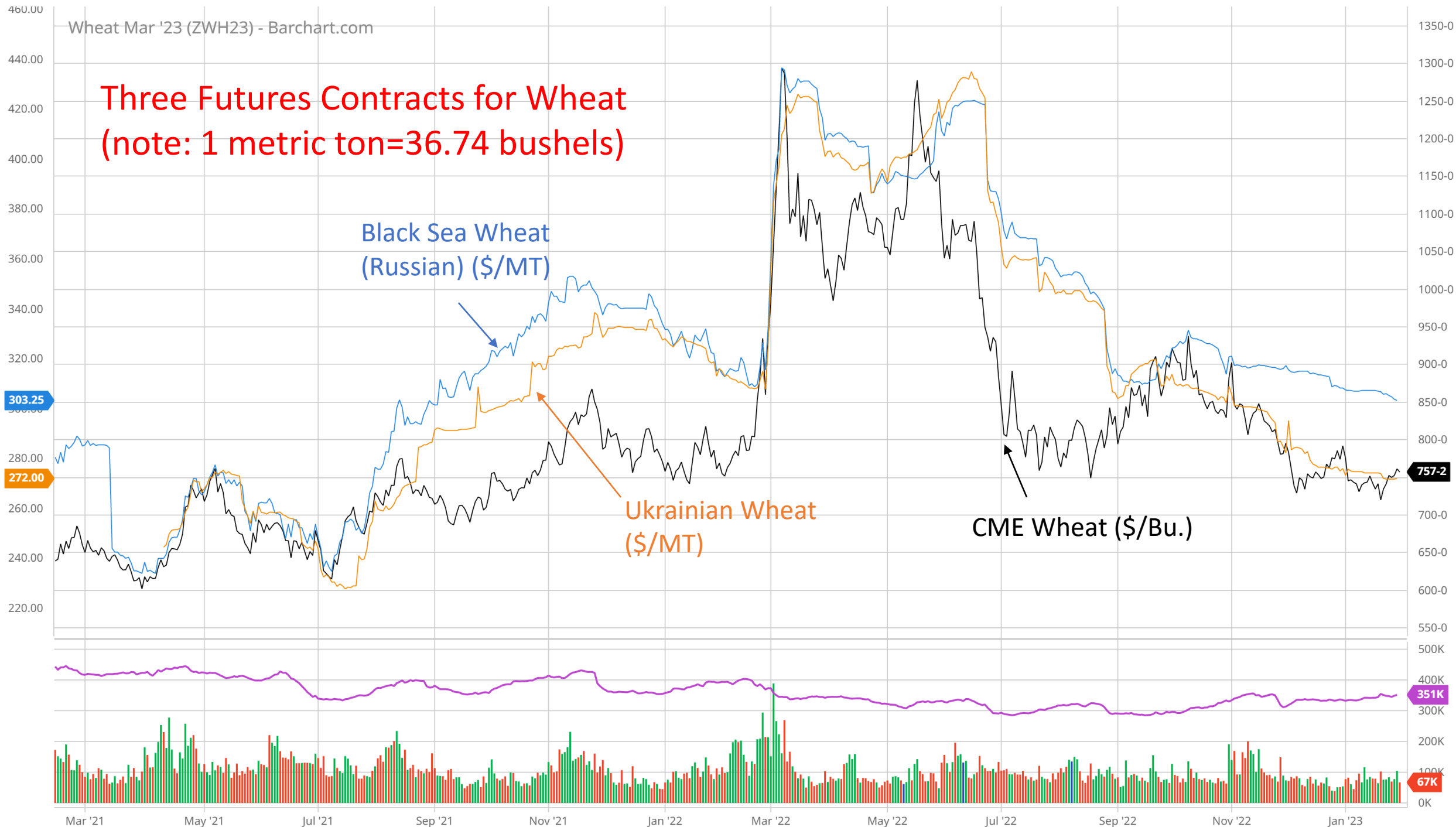
[1/3] Remains of a Russian Tochka-U ballistic missile are seen in a winter wheat field, amid Russia's invasion of Ukraine, near the town of Soledar, Donetsk region, Ukraine June 8, 2022. REUTERS Read more

- KYIV, June 14 (Reuters) - Russia's invasion of Ukraine will create a global wheat shortage for at least three seasons by keeping much of the Ukrainian crop from markets, pushing prices to record levels, Ukraine's agriculture minister told Reuters.
- Ukraine, sometimes known as Europe's bread basket, has had its maritime grain export routes blocked by Russia and faces a maelstrom of other problems, from mined wheat fields to a lack of grain storage space.

Chicago, Black Sea and Ukrainian wheat futures price, May 3, 2021-July 20, 2023 (Source Barchart.Com modified)



Three Futures Contracts for Wheat (note: 1 metric ton=36.74 bushels)



Things to note

- Black Sea futures (cash settled, \$/MT) are highly correlated with cash price of wheat from Russia
- Ukraine wheat futures (cash settled, \$/MT) are highly correlated with wheat from Ukraine
- Historic differences in prices between Russia, Ukraine and Rest of World is likely due to quality differences in wheat specialization (e.g. Russian wheat is called 12.5% wheat (for moisture?). Could also be cost of transportation to international markets.
- In June 2022 prices had fallen 20% from February/March high. USDA released its wheat report indicating ideal conditions for US crop, a bumper crop in Australia, favorable conditions in Russia, UK and elsewhere, reduced demand as importing countries sought to reduce imports and use current stocks
- Russian withdrawal from Kiev and north/northeast reduced risk of harvest lost there and in the west. Combat forces in south and east still limited harvest.
- January 2023, USDA reports that US farmers increased planting of winter wheat in response to high prices, increasing hemispheric supply. President Biden had previously indicated that farmland held in conservation reserve could be released without penalty to plant wheat to stabilize global supply.

Shipping Risk

Reuters · 23 days ago
Media & News Company

Analysis-Some ocean shipping rates collapsing, but real price relief is months away

By Lisa Baertlein

LOS ANGELES (Reuters) - Prices in the most volatile segment of ocean shipping are collapsing, but top retailers like Walmart and Home Depot should not expect relief until the spring c... (94% more)

Read for 5 pts



Reuters · 1 month ago
Media & News Company

Ship insurers to cancel war cover for Russia, Ukraine from Jan. 1

By Carolyn Cohn and Jonathan Saul

LONDON (Reuters) -Ship insurers said they are cancelling war risk cover across Russia, Ukraine and Belarus, following an exit from the region by reinsurers in the face... (93% more)

Read for 3 pts



Food security and cultivation

Seeded acres will be reduced because of war

Port elevators destroyed, Russians steal wheat supply

Rising costs of inputs such as nitrogen fertilizer will lead to lower production on cultivated acres

Migration can affect labour supply

Russian theft of agricultural equipment

Destroyed storage facility and dangerous routes to Odessa, Mariouple and Kerson ports destroyed.

Russian blockade of grain exports until July 22, 2022

Kyiv Independent: Ukraine secures food supplies for 2023, receives over \$31 billion financial support. Despite “the most difficult sowing season in the history of Ukraine”, farmers managed to harvest 60 million tons of crops ensuring food stocks for the next year, Prime Minister Denys Shmyhal said at a cabinet meeting on Dec.30.

K The Kyiv Independent

THE KYIV INDEPENDENT

News from Ukraine, Eastern Europe

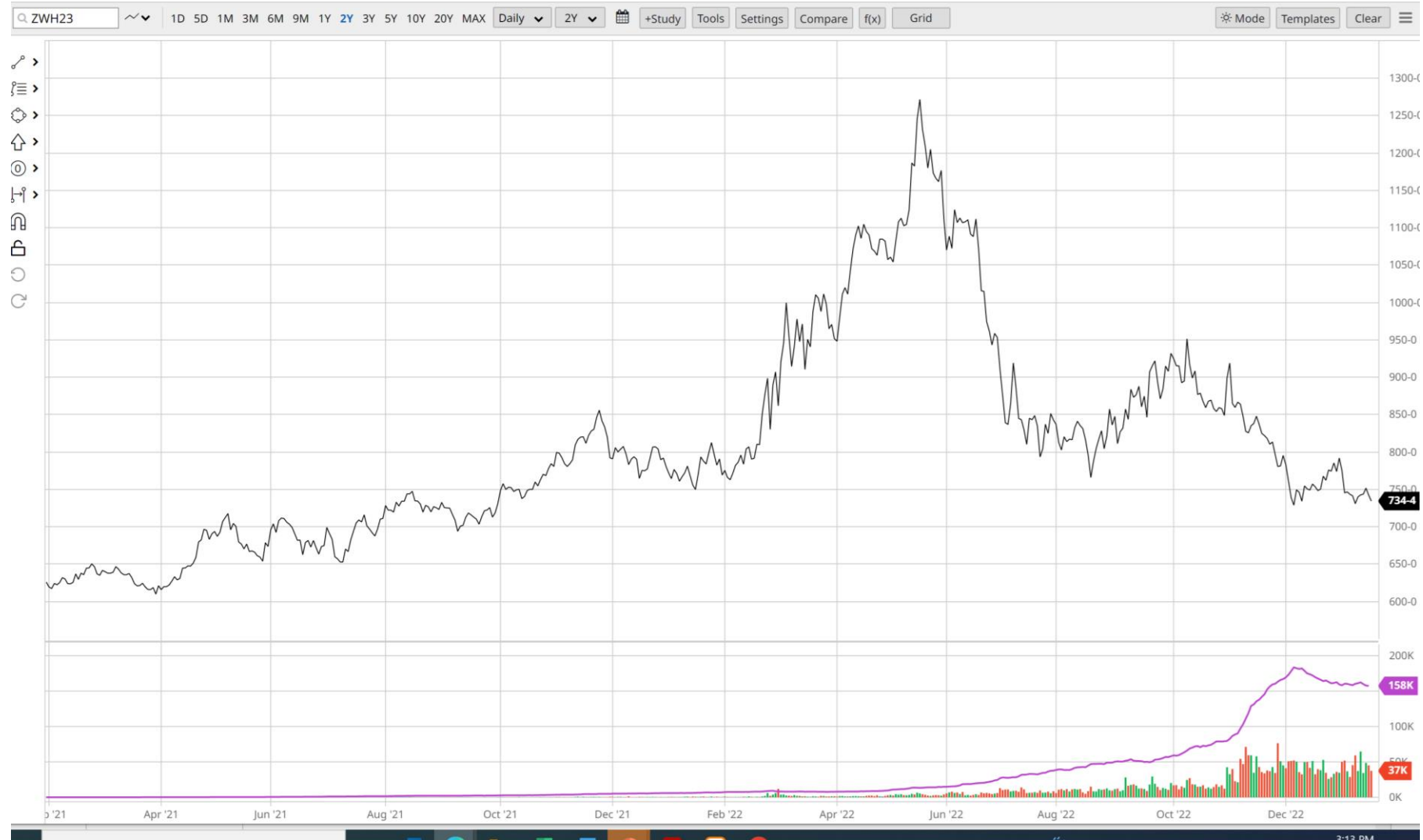
PM Shmyhal: Ukraine secures food supplies for 2023, receives over \$31 billion financial support

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[Read the article on kyivindependent.com »](https://kyivindependent.com)

March 2023 Wheat Futures

Wheat (ZWH23) 734-4s -8-0 (-1.08%) 01/19/23 [CBOT] DELAYED



February 2023 WTI Crude Oil



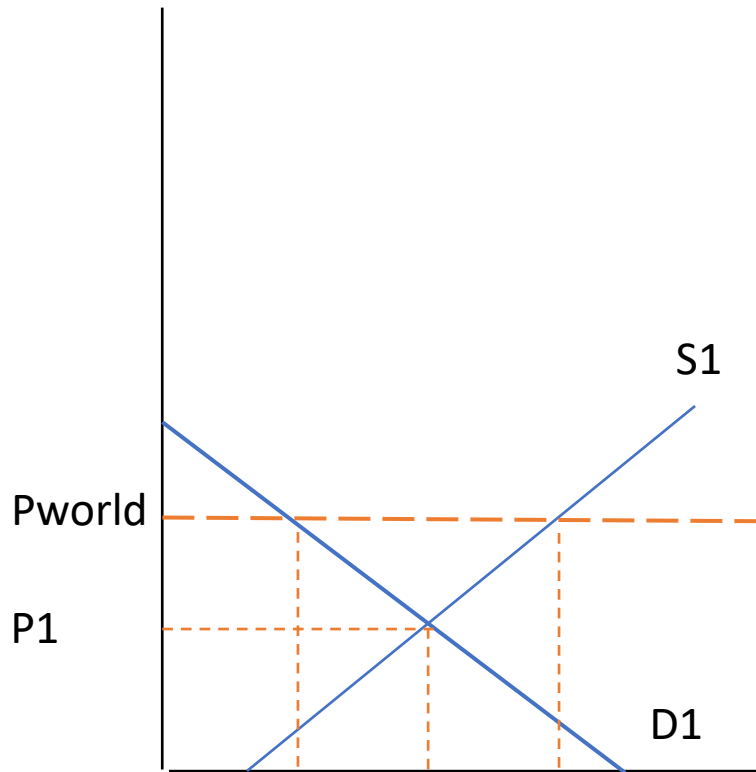
February 2023 Natural Gas futures



Economics and War

- Commodities are global, and markets tend to adjust to conflicts
- There are systemic causal impacts of war on commodity prices but ultimately trade patterns adjust to a new equilibrium
- As these markets adjust there will be substantial volatility depending on export/import price inelasticities.
- Multiple commodities can be affected by a single event. Wheat, oil, natural gas are weakly correlated, if at all, but can become locally cointegrated in response to a singular event. The degree of cointegration and localized correlation weakens as each market adjusts to its own circumstances
- The price analysts/commodity futures trader needs to consider these adjustments
- These can be examined by use of simple trade models to gain a basic understanding.
 - Changes in global supply because of blockades
 - Increased costs of transportation in conflict zones
 - Global adjustments in supply/demand response

Exporter (region 1)



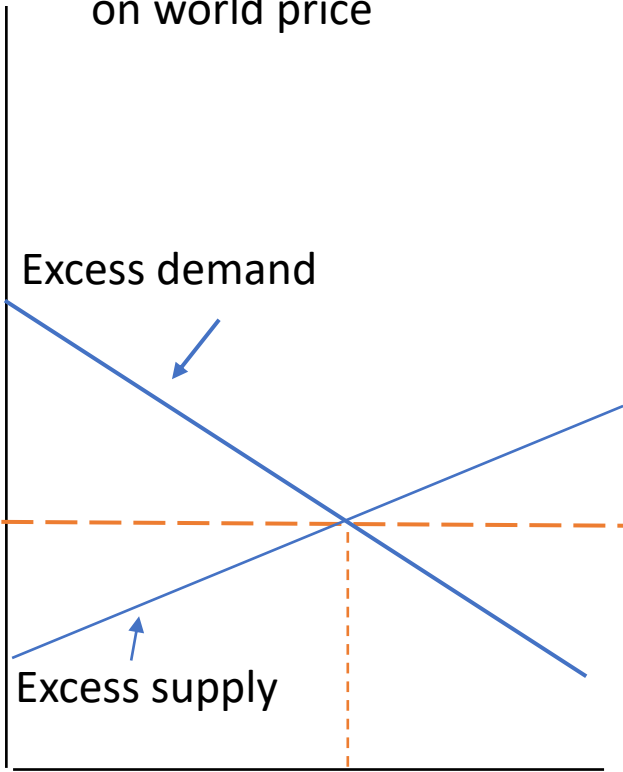
R1
consumes
less at
world
price

Y1

Exports

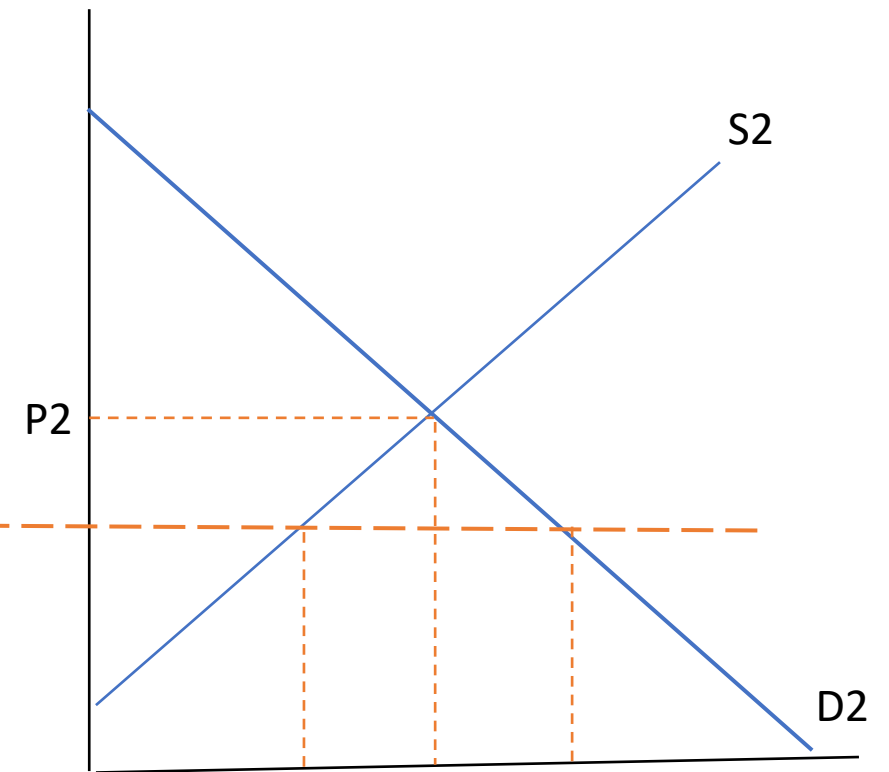
R1
produces
more at
world
price

Region 1 has comparative
advantage over region 2 in
production. Trade from
Region 1 to Region 2 based
on world price



Y1,2

Importer (region 2)



R2
produces
less at
world
price

Y2

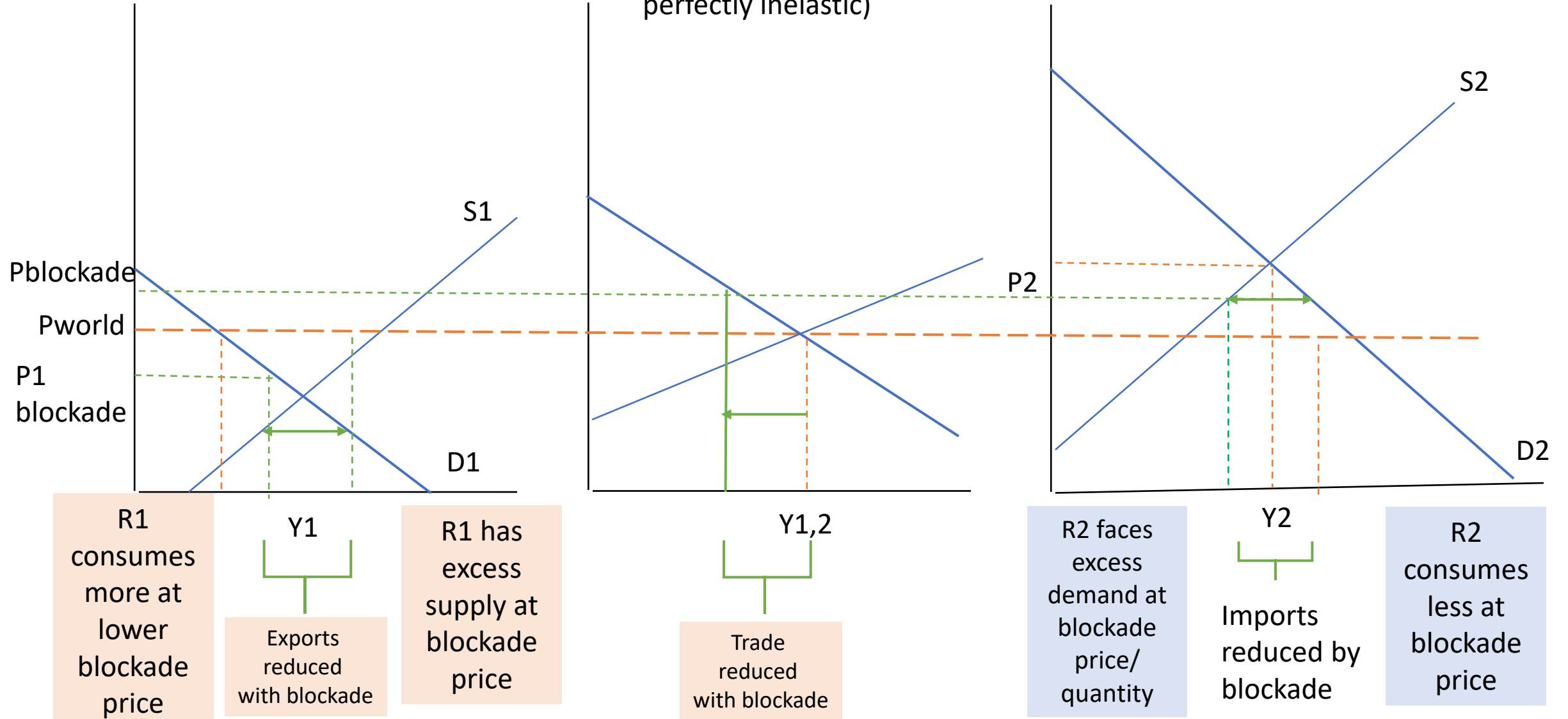
Imports

R2
consumes
more at
world
price

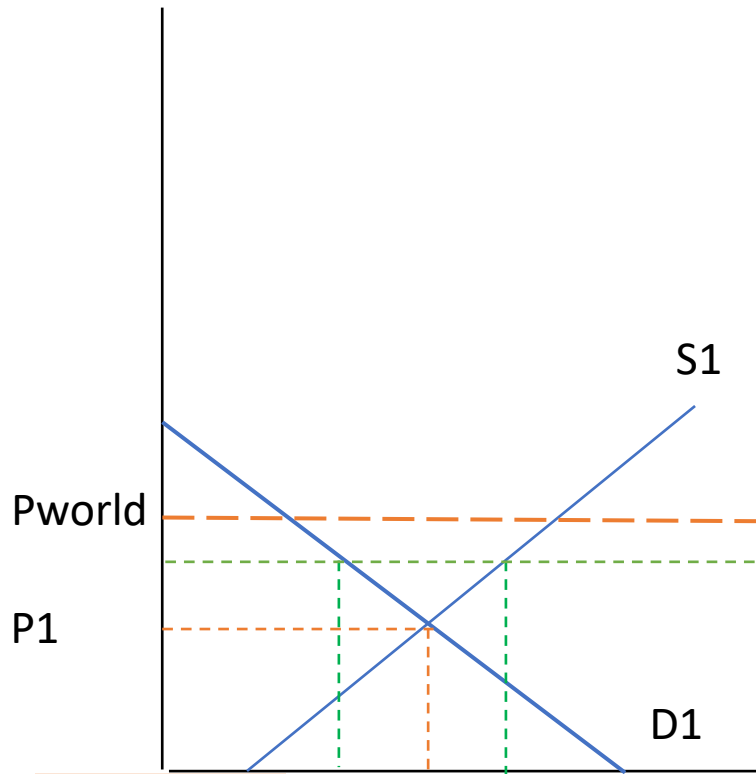
Exporter (region 1)

A 3rd country invades region 1 and imposes a blockade on supply from region 1 (short-term effects, excess supply is perfectly inelastic)

Importer (region 2)



Exporter (region 1)



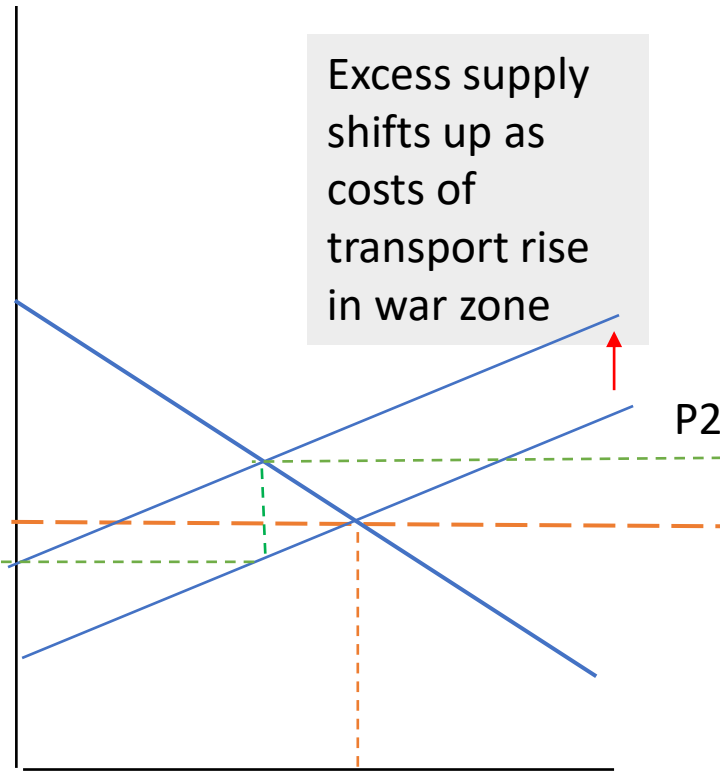
R1
consumes
less at
world
price

Y1
Exports

R1
produces
more at
world
price

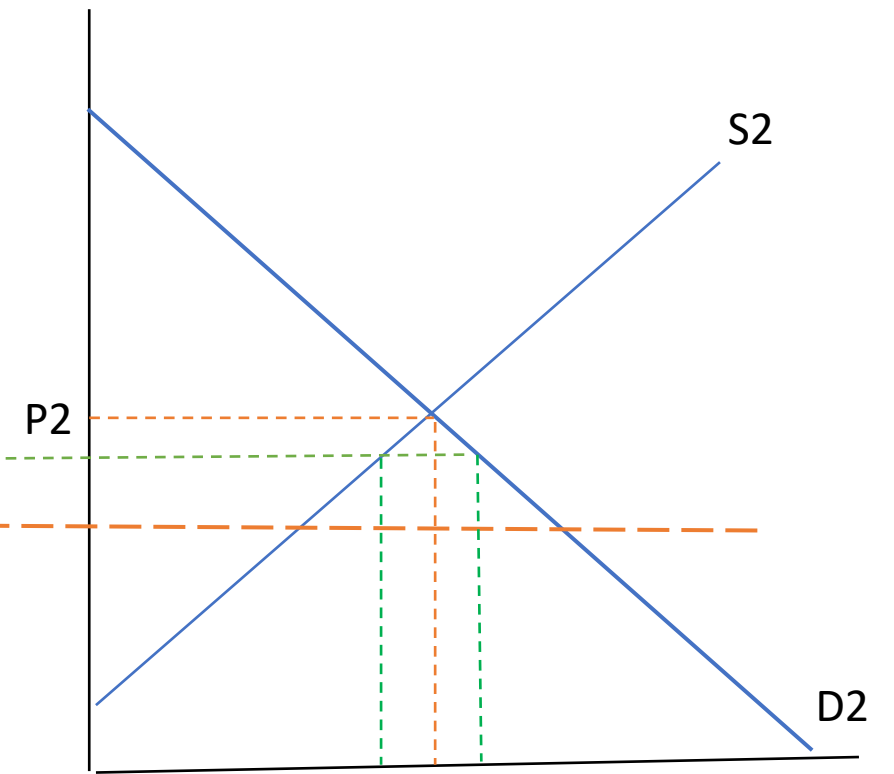
In war zones the cost of
transport increases because
of risk and insurance

Excess supply
shifts up as
costs of
transport rise
in war zone



Y1,2

Importer (region 2)



R2
produces
less at
world
price

Y2
Imports

R2
consumes
more at
world
price

Consequences of War on Prices and Trade

- The effects of supply restrictions to the exporting country are to increase equilibrium prices in importing nations while creating disequilibrium in the domestic (Ukrainian market).
 - Increase prices in trading countries
 - Increase domestic demand price
 - Decrease domestic supply price (fob)
- Effects of Black Sea blockade
 - Increase prices in importing countries reducing export demand
 - Increase supply in Ukraine, reducing Ukrainian prices
 - Increase domestic demand in Ukraine with lower prices
- Increased transportation costs
 - Transportation costs rose with risk and insurability
 - Exports are FOB, forcing cost on importers, increasing prices making Ukraine wheat less competitive
 - Transportation costs, thus must be absorbed by domestic shippers, reducing local prices further
 - This appears to be dominating case
 - Low Ukrainian wheat prices causing wide-spread

Analysis of war's impact on 'Relationships' between CME, Ukrainian and Black Sea Wheat Futures

- Ukrainian and Black Sea wheat futures are cash settled contracts
- Expectation is that despite differences in wheat quality, the 3 futures contracts would be highly cointegrated, similarly affected by macro trade and global supply/demand
- What were the pricing relationships before the war, and how did the war affect these relationships.
- Daily futures prices obtained from BarChart
- Econometrics (Vector autoregression) was used to determine direction of causality in price setting before war, at start of war, progression of war

Futures price correlations by sub-period in levels and % change

Prices				Pre War	% Change			
	Chicago	Black Sea	Ukrainian			Chicago	Black Sea	Ukrainian
Chicago	1				Chicago	1		
Black Sea	0.840279	1			Black Sea	0.740258	1	
Ukrainian	0.822275	0.95551	1		Ukrainian	0.339903	0.447107	

War study period: February 24, 2022 to February 28, 2023

	Chicago	Black Sea	Ukrainian			Chicago	Black Sea	Ukrainian
Chicago	1				Chicago	1		
Black Sea	0.846627	1			Black Sea	0.455382	1	
Ukrainian	0.862687	0.980527	1		Ukrainian	0.36393	0.830776	

Post Study: March 1, 2023-July 19, 2023

	Chicago	Black Sea	Ukrainian			Chicago	Black Sea	Ukrainian
Chicago	1				Chicago	1		
Black Sea	0.243801	1			Black Sea	-0.0505	1	
Ukrainian	0.168358	0.95296	1		Ukrainian	0.172851	-0.41352	

War Period: February 24, 2022-July 19, 2023

	Chicago	Black Sea	Ukrainian			Chicago	Black Sea	Ukrainian
Chicago	1				Chicago	1		
Black Sea	0.890164	1			Black Sea	0.373667	1	
Ukrainian	0.899762	0.986385	1		Ukrainian	0.325254	0.659363	

Summary of Causal Relationships

- Pre War
 - Black Sea Wheat causally influenced Ukrainian Wheat futures
 - Chicago Wheat causally influenced Ukrainian Wheat
 - Black Sea Wheat causally influenced Chicago Wheat
- At War
 - (January 2022)
 - Ukrainian Wheat causally influenced Chicago Wheat as possibility of war loomed
 - Chicago Wheat causally influenced Black Sea Wheat
 - (by July 2022)
 - Causality between Black Sea Wheat and Ukrainian Wheat fractured (Ukrainian Wheat blockaded)
 - (July 24 2022 Black Sea Grain Deal Initiative)
 - Ukrainian Wheat causally influenced Black Sea Wheat (reverse causality from pre war)
 - Chicago Wheat causally influenced Ukrainian Wheat
 - Ukrainian Wheat causally influenced Chicago wheat
 - On shorter time scales (6 month sub periods) no predictive causality existed between Chicago, Ukrainian and Black Se Wheat: neither could usefully predict the other between 6/22-11/22 and 8/22-1/23
 - Despite Black Sea Agreement, Insurance companies began cancelling insurance

Concluding Thoughts

- Russia's invasion of Ukraine in February 2022 caused major disruption in world wheat futures prices
- Presence of CME, Ukrainian Wheat and Black Sea Wheat futures prices provided a rare opportunity to investigate the effects of conflict on futures price relationships
- The pre war causality pattern of influence was $BSW \rightarrow UW$, $CME \rightarrow UW$ and $BSW \rightarrow CME$
- In times of conflict when the invader (Russia with Black Sea Wheat) and the invaded (Ukraine with Ukrainian Wheat) the traditional patterns of price inference, influence and prediction became weakened and fractured as world markets adjusted to shifts in global trade, supply and demand
- The war continues, with shifting dynamics, and with each dynamic the statistical relationships between the 3 futures contracts changes
- Inter-connected or or co-integrated futures prices are only as stable as the economic forces that determine them
- Exogenous shocks such as war and conflict can have profound effects on what would otherwise be seemingly related markets