Russia's Invasion of Ukraine Increased the Synchronisation of Global Commodity Prices

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Special Section on Agricultural and Food Prices in Times of Crises

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The last few years have brought up disruptions to supply chains that we have not seen since the
80's. These were precipitated by the two years of the COVID-19 pandemic, immediately followed
war in Ukraine. As a result, agricultural and food markets have seen large price increases and
increased price volatility, threatening the food security of large number of people especially in m
and low-income countries. To understand the mechanisms of how markets and prices have resp
to these large shocks, AJARE has put together a Special Section on Agricultural and Food Prices i
Times of Crises. The Special Section comprises of three original research papers authored by so
the foremost scholars in this area. These papers provide an excellent overview of the current
conditions and trends in agricultural markets since the beginning of the war in Ukraine, and poi
possible directions that markets can take. They also deal with the specific issue of price insulatio
individual countries, where certain policies designed to stabilise domestic markets can in fact
exacerbate the condition of global markets, and the issue of price synchronization, where large
to the supply chains, such as the war in Ukraine, can create a contagion across markets– even m
that are not directly affected by the shock–, putting enormous pressure on consumers exposed
food prices, and to the overall economy through fueling inflation. Overall, these papers show ho
serious the current disruptions are and how they affect billions of people across the globe, as w
pointing to policies that government can take to alleviate the situation.

--Associate Professor Tihomir Ancev, Co-Editor-in-Chief, *The Australian Journal of Agricultural and Resource Economics*

Link

Preview

- Russia & Ukraine crucial for global food & energy security
- Abrupt supply chains disruptions due to invasion

  → Substantial uncertainty around the globe
- To what extent did this major shock induce global commodity prices to move more synchronously?
- Time-varying co-movement
  - Concordance index (Harding & Pagan 2002, 2006)
  - 15 key global commodity price indices (Jan 2010 to July 2022)
- Global covariate shock to food and energy security due to contagion across numerous food and non-food markets
- Food and energy affordability severely challenged at global level
- Ability of consumers to mitigate the adverse effects of food and energy price inflation severely restricted

Outline

1. Global supply chains disrupted by the invasion
2. Economic effects of supply chain disruptions (SCDs)
3. Conceptual Framework
4. Data and methods
5. Results
6. Conclusions

1. Global supply chains disrupted by the invasion

- Major suppliers in global food and non-food commodity markets
- Russia largest exporter of natural gas (25%), palladium (23%), nickel (22%), and fertilizers (14%)
  - 18% of global exports of coal, 14% of platinum
  - 11% of crude oil, 10% of refined aluminum

Source: World Bank (2022a)

1. Global supply chains disrupted by the invasion

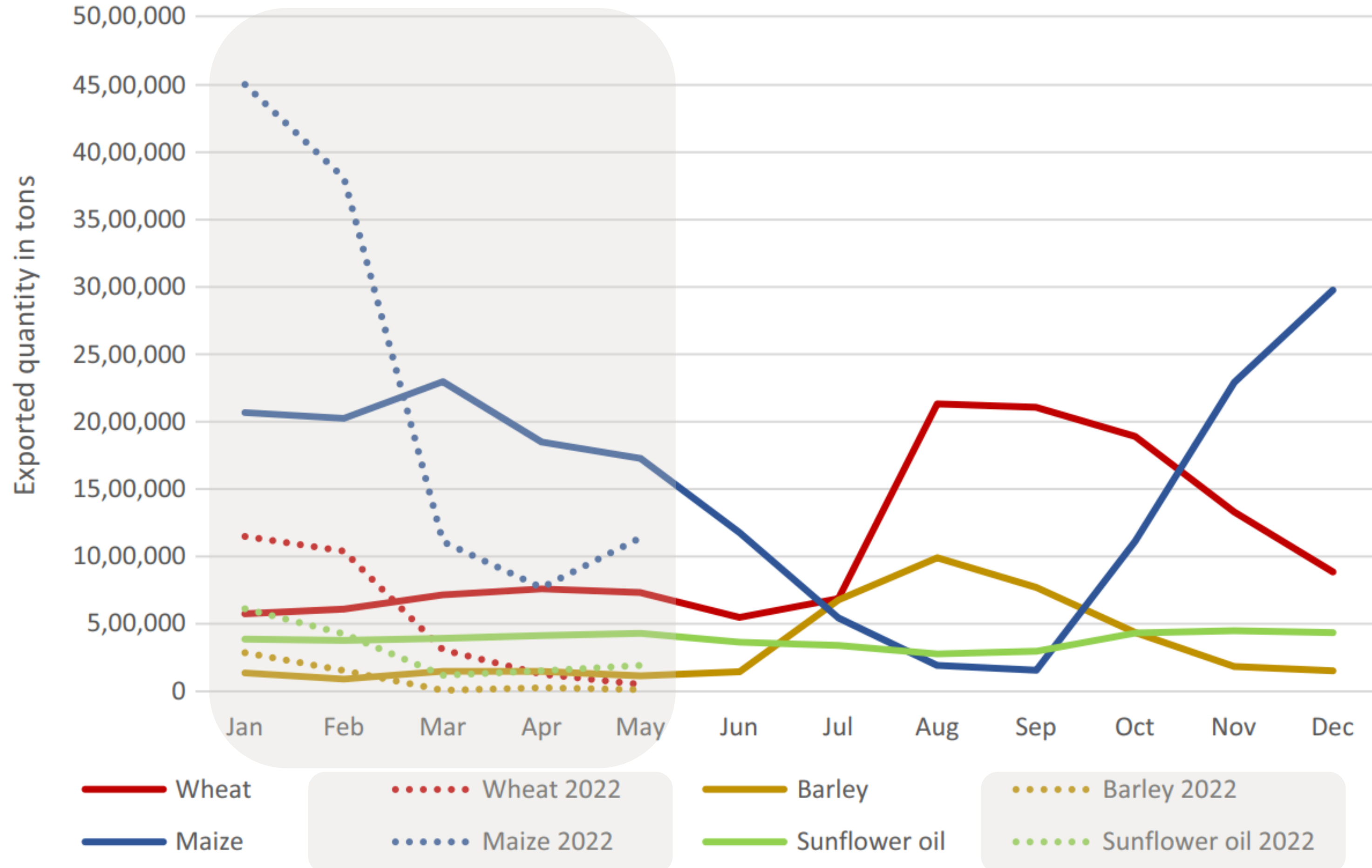

FIGURE 1. Average monthly export quantities from 2010 to 2021 versus 2022. *Note*: For 2022, data were only available until May. *Source*: Authors, based on Comtrade (2022).

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2. Economic effects of supply chain disruptions (SCDs)

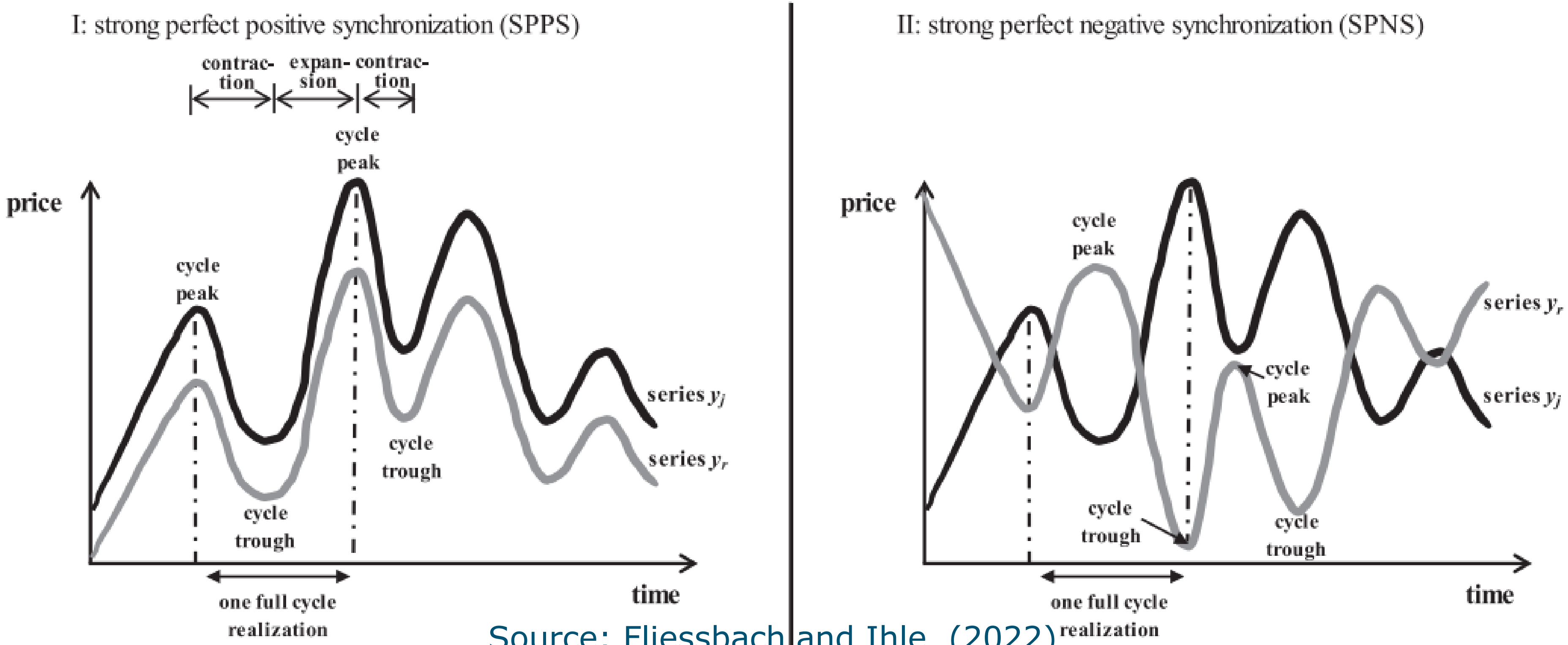
- Caused within or outside supply system (Kochan & Nowicki, 2018)
    - **Internal**: uncertainties regarding demand, yields, supply capacity, supply cost or policy decisions about trade flows
    - **External**: natural disasters or human-made factors

Comprehensive socio-economic effects:

- Internal SCDs in **Black Sea** food trade (Svanidze et al., 2021, and Götz et al., 2016)
- Large-scale **natural disasters**: food markets (Davis et al., 2021) and stock markets (Bourdeau-Brien & Kryzanowski, 2017)
- Rich evidence on effects of SCDs caused by **COVID-19** (Akter, 2020, Béné, 2020; Savary et al., 2020)
- SCDs caused by **(civil) war** negatively affect food markets (Ali & Lin, 2010; Bar-Nahum et al., 2020)
- **Rise of external SCDs** due to human-induced climate change (IPCC, 2021), the recent pandemic and wars (Ukraine, Sudan etc.)

3. Conceptual Framework

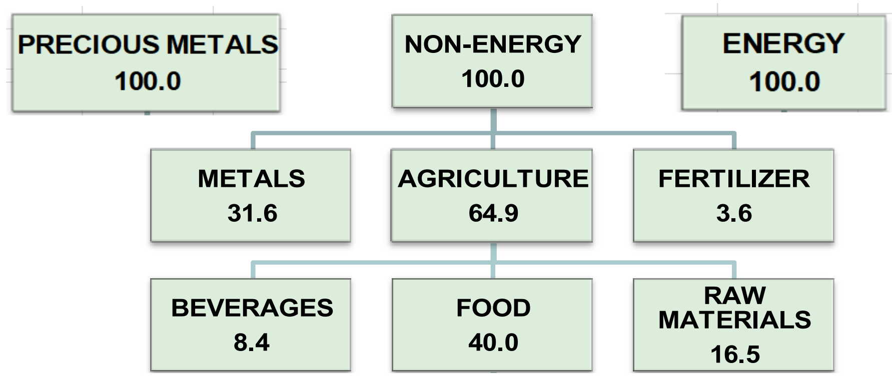
- Why does synchronization of price (indice)s matter?
- Excess co-movement hypothesis (Pindyck and Rotemberg, 1990)
    - Prices of unrelated raw commodities move together
    - Co-movement between prices of agricultural and energy



Source: Fliessbach and Ihle (2022)

4. Data and methods

- 15 series 151 observations each (12.5 years)
  - 6 **global grain** price indices (International grains council)
  - 9 **global commodity** price indices (World Bank)



Source: World Bank (2022b)

- Smoothing of series by moving average of four months
  - $y_t = \mu_t + c_t + s_t + \varepsilon_t$
  - Eliminating short run idiosyncratic noise ε_t

4. Data and methods

- Core index set:
    - Wheat
    - Maize
    - Barley
    - Complete SCDs
- Global price indices
    - Aggregation across global markets
      → Showing the globally dominating price developments of a commodity

Index set

Set of global price indices	**Code**
Wheat, maize and barley	M1
M1 and energy and fertiliser	**M2**
M1 and rice and soybeans	**M3**
M1 and ICG GOI	**M4**
M1 and food	**M5**
M1 and beverages	**M6**
M1 and agriculture	**M7**
M1 and raw materials	**M8**
M1 and metals & minerals	**M9**
M1 and nonfuel commodities	**M10**
M1 and precious metals	**M11**
M1, energy, nonfuel and precious metals	**M12**
M1, food, beverages and raw materials	**M13**

4. Data and methods

- 3 phases of uncertainty

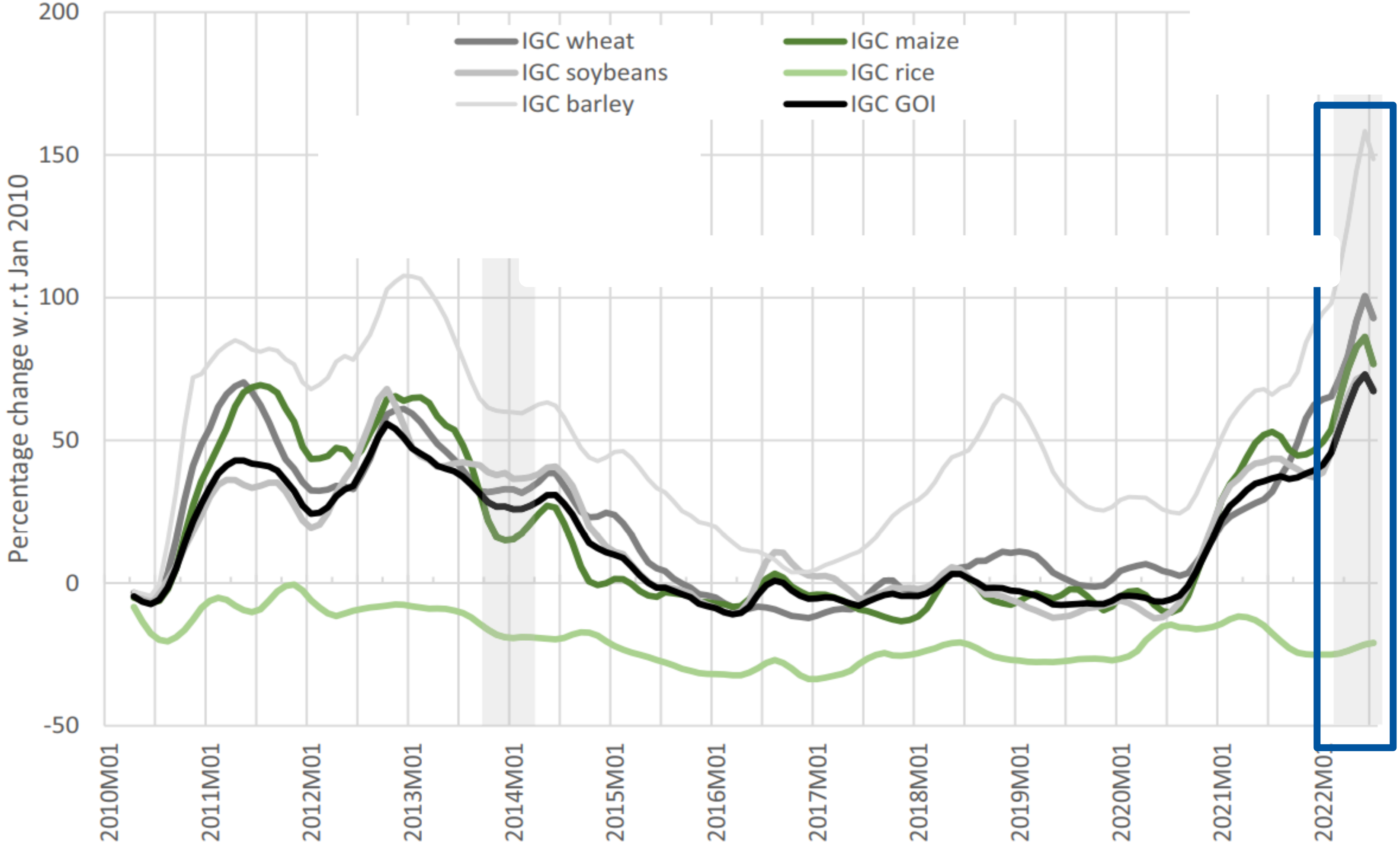


FIGURE 2 Smoothed price indices of the International Grains Council. *Source*: Authors based on IGC (2022).

4. Data and methods

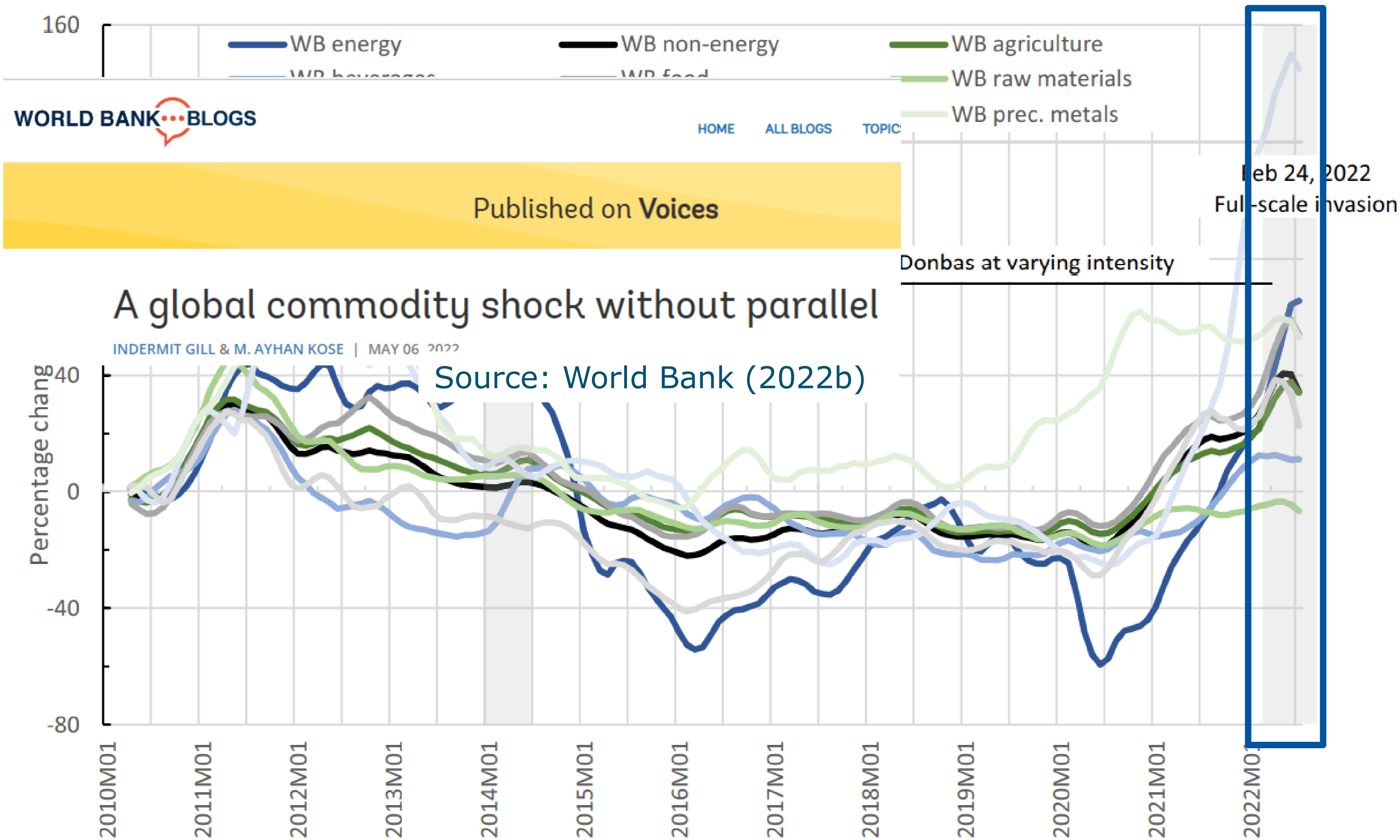


FIGURE 3 Smoothed World Bank commodity price indices. *Source*: Authors, based on World Bank (2022c)

4. Data and methods

- Synchronization: identical behavior of all series in past 6 months
- Transformation of indices into indicators:

Direction indicator:

- $S_{jt} = \begin{cases} 1 & \text{if } y_{jt} - y_{jt-1} > 0 \\ 0 & \text{otherwise} \end{cases}$

$$I_t^{\Omega} = \frac{1}{\Omega}\left[\sum_{\theta_t=1}^{\theta_t+\Omega}\left(\prod_{j=1}^{N} S_{j\theta_t} + \prod_{j=1}^{N}\left(1 - S_{j\theta_t}\right)\right)\right] = I_{t,\text{inc}}^{\Omega} + I_{t,\text{dec}}^{\Omega}$$

Magnitude indicator:

- $Z_{jt} = \begin{cases} 1 & \text{if } |y_{jt} - y_{jt-1}| > z \\ 0 & \text{otherwise} \end{cases}$

$$H_N^T = \frac{1}{T}\left[\sum_{t=1}^{T}\left(\prod_{j=1}^{N} Z_{jt}\right)\right]$$

- Regression of indices:

$$\mathbf{I} = \begin{bmatrix} \square_1 \\ \dots \\ \square_K \end{bmatrix} = \alpha_1 + \alpha_2 D_{invasion} + e_{kt}$$

$$\mathbf{I} = \begin{bmatrix} \square_1 \\ \dots \\ \square_K \end{bmatrix} = \beta_1 + \sum_{k=2}^{K} \beta_k D_k + \sum_{k=1}^{K} \gamma_k D_k D_{\text{invasion}} + e_{kt}$$

Synchronization strength

Average invasion effect

Set-specific invasion effect

Hypotheses:

- Indices of wheat, maize and barley most strongly synchronized
- Global energy and fertilizer prices exhibit identical pattern
- Spill-overs to globally traded commodities without SCDs

5. Results

TABLE 2 Results of the testing for a general effect of the invasion

Model	Synchronisation strength		Percentage change
	Before the invasion	During the invasion	
Synchronised trajectory direction	0.46***	0.78***	+70%
Synchronised trajectory change of more than three percentage points (rare magnitude of change)	0.05***	0.41***	+688%
Synchronised trajectory change of more than five percentage points (extremely rare magnitude of change)	0.007**	0.28***	+3929%

Note: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. Table S4 presents detailed results.

Source: Authors.

Synchronization strength **Average invasion effect**

$$\mathbf{I} = \begin{bmatrix} \square_1 \\ \dots \\ \square_K \end{bmatrix} = \alpha_1 + \alpha_2 D_{invasion} + e_{kt}$$

5. Results

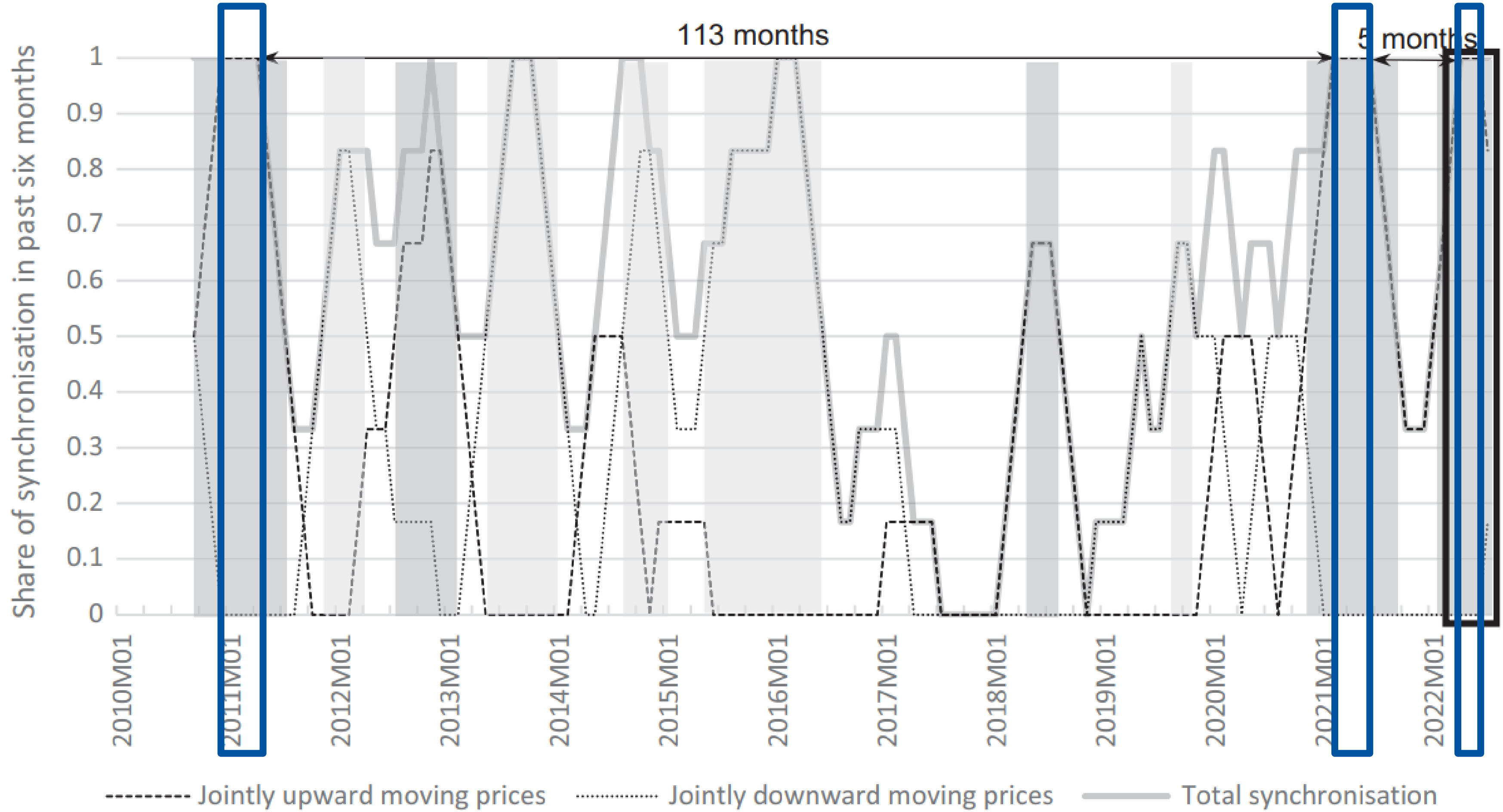


FIGURE 4 Synchronisation in increasing and decreasing global wheat, maize and barley prices. *Note*:

5. Results

TABLE 3 Results of the testing for index-set-specific effects of the invasion

Index set		Synchronised direction		Synchron. change >3 percentage points		Synchron. change >5 percentage points	
Set of global price indices	**Code**	**Before invasion**	**During invasion**	**Before invasion**	**During invasion**	**Before invasion**	**During invasion**
Wheat, maize and barley	**M1**	**0.61*** **	1.00*	**0.15*** **	0.83***	**0.04** **	0.67***
M1 and energy and fertiliser	**M2**	0.33***	0.83**	0.02***	0.67***	0.00***	0.50***
M1 and rice and soybeans	**M3**	0.32***	0.83**	0.01***	0.00	0.00***	0.00
M1 and ICG GOI	**M4**	0.56	1.00**	0.13	0.83***	0.03	0.67***
M1 and food	**M5**	0.56	1.00**	0.06***	0.67***	0.01	0.50***
M1 and beverages	**M6**	0.47**	0.33	0.02***	0.00	0.00***	0.00
M1 and agriculture	**M7**	0.57	1.00**	0.04***	0.67***	0.00***	0.17***
M1 and raw materials	**M8**	0.49**	0.83*	0.03***	0.00	0.00***	0.00
M1 and metals & minerals	**M9**	0.42***	0.67	0.07***	0.67***	0.01	0.50***
M1 and nonfuel commodities	**M10**	0.54	0.83	0.05***	0.50***	0.00***	0.50***
M1 and precious metals	**M11**	0.39***	0.83**	0.07***	0.33**	0.01	0.17***
M1, energy, nonfuel and precious metals	**M12**	0.29***	0.67*	0.01***	0.17*	0.00***	0.00
M1, food, beverages and raw materials	**M13**	0.37***	0.33	0.01***	0.00	0.00***	0.00

Synchronization strength

Set-specific invasion effect

$$\mathbf{I} = \begin{bmatrix} \square_1 \\ \dots \\ \square_K \end{bmatrix} = \beta_1 + \sum_{k=2}^{K} \beta_k D_k + \sum_{k=1}^{K} \gamma_k D_k D_{\text{invasion}} + e_{kt}$$

6. Conclusions

- Various global supply chains disrupted by the invasion
  - Price hike unprecedented since the oil crises in 1970s
  - Asynchronous effects depending on trade profile

- Focus: effects of external SCDs on global commodity prices
- Method: Time-varying synchronization (direction and magnitude)
- Pattern **before** invasion:
  - **Rare & short-lived co-movement** upwards/downwards
  - Joint month-to-month changes of large magnitude very rare
- Pattern change **during (& due to)** invasion:
  - Trajectories of most sets of global commodity prices **substantially stronger or even perfectly synchronized**
  - **Massive spillovers** to commodities not affected by SCDs

→ All three hypotheses confirmed
→ Global challenge to food and energy affordability

Questions?

Comments?

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ORIGINAL ARTICLE | Open Access

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Abstract

The Russian Federation's efforts to expand its regional political influence culminated in launching a full-scale war of aggression on Ukraine on 24 February 2022. As both countries are large exporters of commodities crucial for global food and energy security, the resulting abrupt supply chains disruptions created substantial uncertainty in commodity markets worldwide. This study quantifies to what extent this major shock induced global commodity prices to move more synchronously by gauging their time-varying comovement. Using the concordance index, it analyses the development of 15 key global commodity price indices from January 2010 to July 2022. We find that the supply chains disruptions increased synchronisation of grain, energy and fertiliser prices at the global level in direction and magnitude. Moreover, they resulted in contagion across numerous food and non-food markets, creating a global covariate shock to food and energy security. Notably, the increased synchronisation at broad scale restricts the ability of consumers to mitigate the adverse effects of food and energy price inflation by resorting to inexpensive alternatives. Hence, policymakers must improve the resilience of global food supply chains sustainably such that adverse effects of attaining the Sustainable Development Goals in crises can be minimised.

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References

Comtrade (2022). UN Comtrade Database. Available from https://comtrade.un.org/data

FAO (2022). Information Note. The importance of Ukraine and the Russian Federation for global agricultural markets and the risks associated with the current conflict. 25 March 2022 Update. Executive Summary.

Harding, D. & Pagan, A. (2002) Dissecting the cycle: a methodological investigation. Journal of Monetary Economics, 49, 365–381.

Harding, D. & Pagan, A. (2006) Synchronisation of cycles. Journal of Econometrics, 132, 59–79.

World Bank (2022a). The Impact of the War in Ukraine on Global Trade and Investment. Equitable growth, finance and institutions insight. Washington DC.

World Bank (2022b). A global commodity shock without parallel. World Bank Blogs. Available from https://blogs.worldbank.org/voices/global-commodity-shock-without-parallel

World Bank. (2022c) World bank commodity price data. Available from: https://www.worldbank.org/en/research/ commodity-markets [Accessed 1st August 2022].