Comments on

Volatility Spillovers in Commodity Futures Markets: A Network Approach

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Paper summary

- Objective:
  - To investigate volatility spillovers of 25 major commodity futures markets (2006-2019).
- Contributions:
  - “First and foremost, this is the first study to **comprehensively** explore commodity spillovers across all major commodity futures with the perspective of **low frequency** (long term), **medium frequency** (medium term), and **high frequency** (short term), and investigate potential different **determinants of volatility spillovers** at various frequencies (or time horizons).”
  - “Second, the findings of this study also shed new light on the effect of the **financialization** of commodities.”
  - “Finally, we first time propose and **implement a modified network approach** based on the combination of recent advances in network analysis of Demirer et al. (2018) and Baruník and Křehlík (2018).”

Paper summary

- Findings:
  - "… the magnitude of the **total commodity volatility connectedness** is largely (on average about 60%) from the **high frequency** or short-term volatility spillovers."
  - "… the **fluctuation of the commodity volatility connectedness** arises mainly from commodity spillover at the **low frequency** or at longer horizon."
  - "… commodity **volatility connectedness across groups** is primarily driven by their linkages at the **low frequency**."
  - "… dominant role of **energy** (excluding natural gas) … exhibits **average net positive connectedness** against all the other five groups."
  - "… **strong relations** between the **low frequency volatility connectedness** and **economic factors** that reflect the changes in the broad economy."
  - "… **very weak relationship** between the commodity **volatility connectedness** and several **financial market related factors** under consideration."
  - "This result suggests that in terms of volatility connectedness, **commodities** are **probably** still more likely **driven by the economic fundamentals** than we previously thought, even during the post-financialization period."

Aside:
Studies on Volatility and Volatility Spillover

- VAR (or VECM) models
  - Granger causality tests
- Multivariate GARCH models
  - CCC
  - DCC
  - BEKK
- VAR-GARCH models
- Asymmetric GARCH models
- Stochastic volatility (SV) models
- Generalized forecast error variance decomposition (GFEVD)

Yang, Li, and Miao, using LASSO-VAR model, implement the connectedness methodology of Diebold and Yilmaz (2009, 2012, 2014) and the frequency connectedness approach of Baruník and Křehlík (2018)

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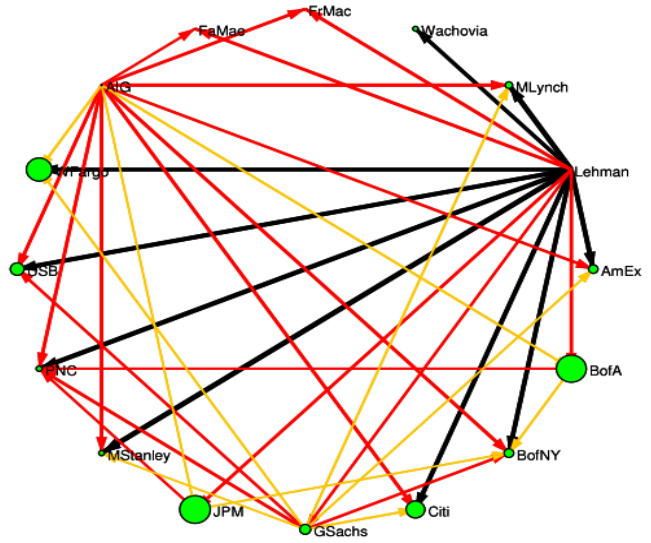

On the network topology of variance decompositions: Measuring the connectedness of financial firms

Francis X. Diebold [a,*], Kamil Yılmaz [b]

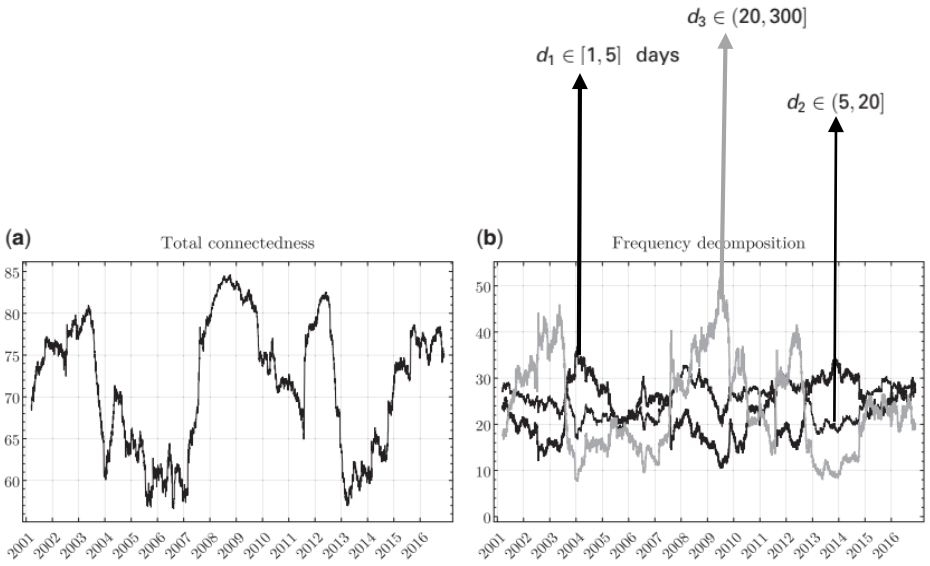

Figure 1. Dynamic frequency connectedness of the U.S. financial sector.

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doi: 10.1093/jjfinec/nby001
Advance Access Publication Date: 17 February 2018
Article

Measuring the Frequency Dynamics of Financial Connectedness and Systemic Risk*

Jozef Baruník[1] and Tomáš Křehlík[2]

Receivers

Senders

< 0 → Net Receiver

> 0 → Net Sender

TABLE 4 Means of From-index, To-index and Net connectedness at high, medium and low frequency bands

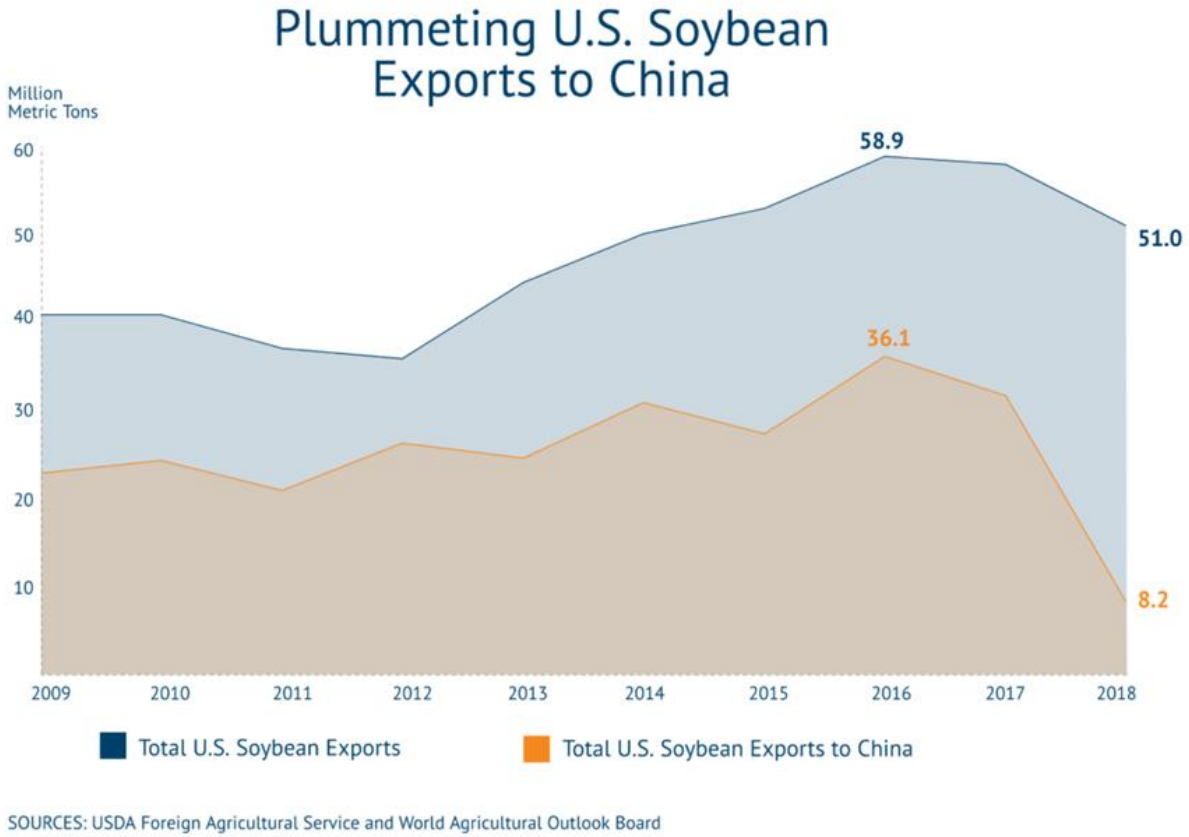
Commodity	Average of From-index					Average of To-index Mean					Average of Net-index Mean				
	High Freq	Medium Freq	Low Freq	Total	Rank	High Freq	Medium Freq	Low Freq	Total	Rank	High Freq	Medium Freq	Low Freq	Total	Rank
Corn	31.55	10.87	12.77	55.19	6	36.57	11.33	14.9	62.8	6	5.02	0.46	2.14	7.62	5
Soybean meal	34.63	9.98	11.01	55.62	5	35.7	10.06	12.43	58.19	7	1.08	0.08	1.42	2.57	10
Soybean oil	28.94	7.48	8.64	45.06	13	24.37	7.55	8.98	40.89	14	-4.57	0.07	0.34	-4.16	16
Soybeans	38.83	10.44	11.86	61.13	2	48.5	14.01	16.48	78.98	1	9.67	3.57	4.62	17.86	1
Wheat	27.39	8.34	11.23	46.96	12	24.75	8.35	11.48	44.58	12	-2.64	0.01	0.25	-2.38	12
Feeder cattle	20.52	6.59	9.02	36.13	17	20.35	5.71	6.62	32.68	17	-0.17	-0.88	-2.39	-3.45	15
Lean hogs	11.48	4.49	6.99	22.96	24	8.69	3.3	4.44	16.43	23	-2.78	-1.19	-2.55	-6.52	20
Live cattle	23.05	6.24	7.27	36.56	16	20.89	6.18	7.06	34.13	16	-2.17	-0.06	-0.21	-2.43	13
Cocoa	14.05	4.88	7.23	26.16	20	10	3.43	5.45	18.88	21	-4.06	-1.45	-1.78	-7.28	24
Coffee	14.69	4.85	6.51	26.04	21	10.45	3.54	5.83	19.82	20	-4.24	-1.31	-0.67	-6.23	19
Cotton	16.55	6.13	9.46	32.14	18	12.5	4.51	7.88	24.89	18	-4.05	-1.62	-1.58	-7.25	23
Lumber	12.23	3.95	5.89	22.06	25	7.47	2.59	3.71	13.77	25	-4.75	-1.36	-2.18	-8.29	25
Orange juice	12.96	4.25	5.85	23.06	23	8.41	3.06	4.62	16.09	24	-4.55	-1.19	-1.23	-6.97	22
Sugar	14.25	5.44	8.08	27.77	19	10.85	4.04	6.33	21.22	19	-3.4	-1.4	-1.75	-6.56	21
Crude oil	32.43	11.61	17.51	61.54	1	41.82	13.32	18.72	73.87	2	9.4	1.71	1.21	12.32	2
Gasoline	34.6	10.2	14.12	58.93	4	36.83	11.68	16.16	64.67	4	2.22	1.48	2.04	5.74	6
Heating oil	36.85	10.44	13.06	60.35	3	39.79	12.4	16.19	68.38	3	2.93	1.97	3.13	8.04	4
Natural gas	10.87	3.97	8.62	23.46	22	7.78	3.01	7.71	18.5	22	-3.09	-0.95	-0.91	-4.96	17
Aluminum	22.98	8.75	11.05	42.78	15	21.02	7.54	8.71	37.28	15	-1.96	-1.21	-2.34	-5.5	18
Copper	29.17	10.25	15.48	54.9	7	34.13	13.07	16.64	63.84	5	4.96	2.82	1.17	8.94	3
Lead	26.97	10.29	10.67	47.93	11	27.21	10.26	10.55	48.02	11	0.25	-0.03	-0.12	0.09	11
Nickel	23.11	10.32	11.58	45.01	14	23.4	8.96	9.33	41.7	13	0.29	-1.36	-2.25	-3.31	14
Zinc	30.4	11.31	11.36	53.07	8	33.09	11.78	11.95	56.83	9	2.69	0.48	0.59	3.75	8
Gold	29.16	9.09	10.84	49.09	10	29.53	9.56	12.94	52.03	10	0.37	0.47	2.1	2.94	9
Silver	29.37	9.93	13.46	52.76	9	32.91	10.84	14.43	58.18	8	3.54	0.9	0.97	5.41	7

- 14 net receivers
- 11 net senders

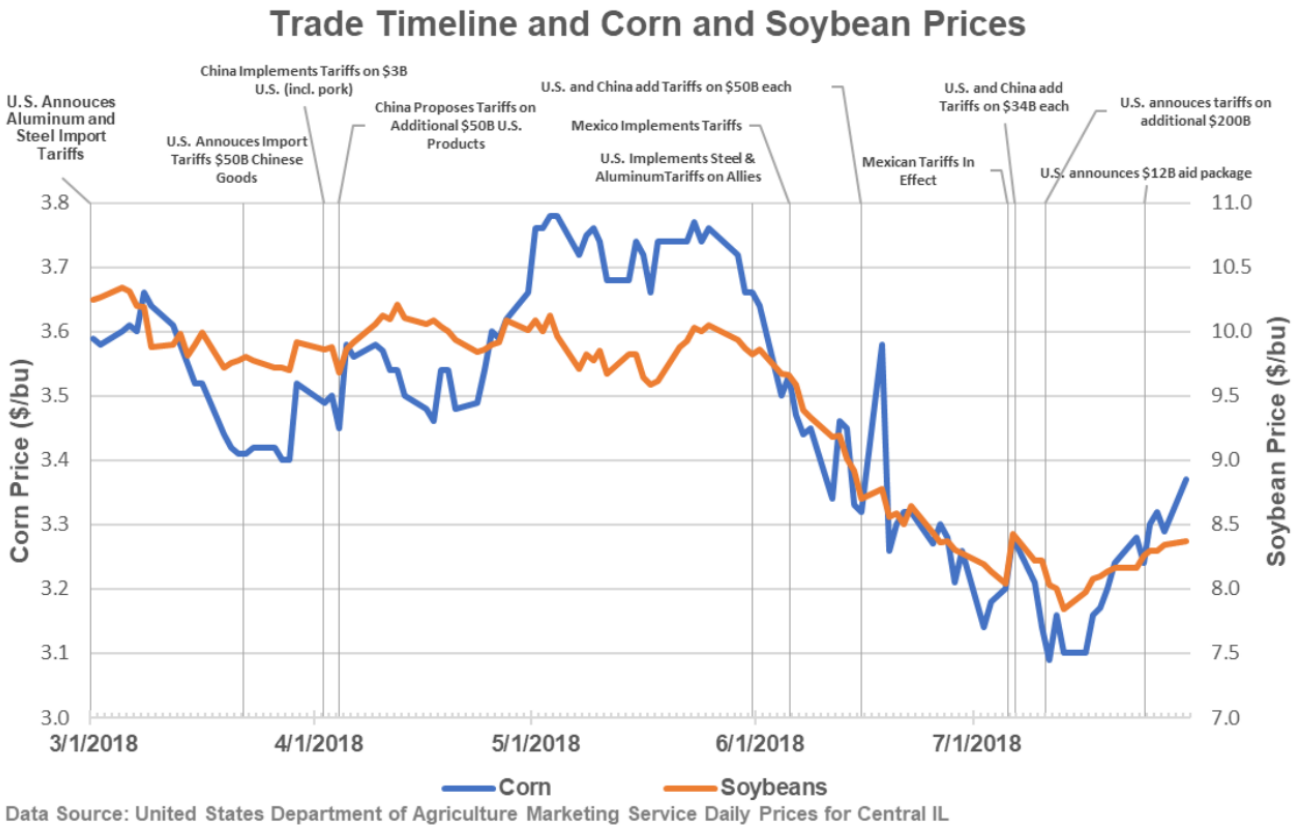
Observations

- Being a net receiver vs a net sender varies by frequency band
  - Possible intuitive/economic explanations?
- Soybean is the #1 net sender of volatility spillover
  - Role of recent changes in trade?
- Lumber is the #1 net receiver of volatility spillover
  - Role of futures contract liquidity?
  - Role of trade disputes with Canada?

Impact of U.S.-China trade war on soybeans



SOURCES: USDA Foreign Agricultural Service and World Agricultural Outlook Board



Data Source: United States Department of Agriculture Marketing Service Daily Prices for Central IL

U.S.-Canada softwood lumber war

- Zhang (2007) categorizes different episodes of the U.S. – Canada softwood lumber dispute as:
  - Lumber I (1982–1983)
  - Lumber II (1984–1986)
  - Free Trade Agreement (1987–1991)
  - Lumber III (1991–1994)
  - SLA (1996)
  - Lumber IV (2001–2006)
- Are there other phases for the recent years?

Close links to other studies

- "Measuring dynamic connectedness networks in energy commodities: evidence from the D-Y and frequency connectedness approaches."

  Polat, O. 2020. *OPEC Energy Review* 44(4):404-428

- Energy commodities connectedness between June 2006 and April 2020
  - crude oil, natural gas, unleaded gasoline, ultra-low sulphur diesel
- Implements "the connectedness methodology" of Diebold and Yilmaz (2012) and "the frequency connectedness" approach of Baruník and Křehlík (2018)
- Connectedness remarkably surged during **political upheavals** and alleviated during the calm periods
- During **unfavorable weather conditions**, connectedness considerably increased

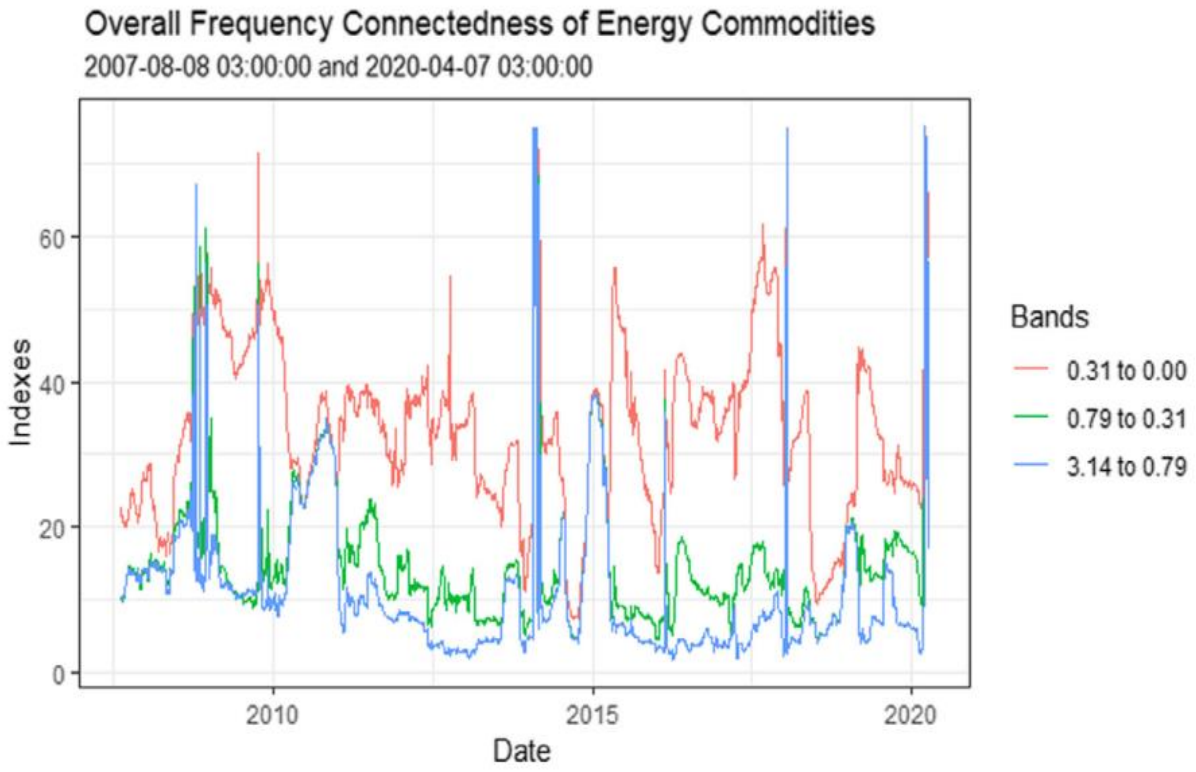


Figure 4 Overall connectedness of energy commodities on different frequency bands.

Close links to other studies

- "Dynamic Spillovers Between International Crude Oil Market and China's Commodity Sectors: Evidence From Time-Frequency Perspective of Stochastic Volatility"

  Li, Z. and Y. Su. 2020. *Frontiers in Energy Research* 8:45

- Focuses on the time-frequency dynamic spillovers among crude oil prices (WTI) and China's bulk commodity sectors between June 2009 and May 2019
- Implements "the connectedness methodology" of Diebold and Yilmaz (2012) and "the frequency connectedness" approach of Baruník and Křehlík (2018)
- Volatility spillovers:
  - react more violently to **extreme geopolitical** or **financial events**
  - are **driven mainly by short-term spillovers** (within a week)

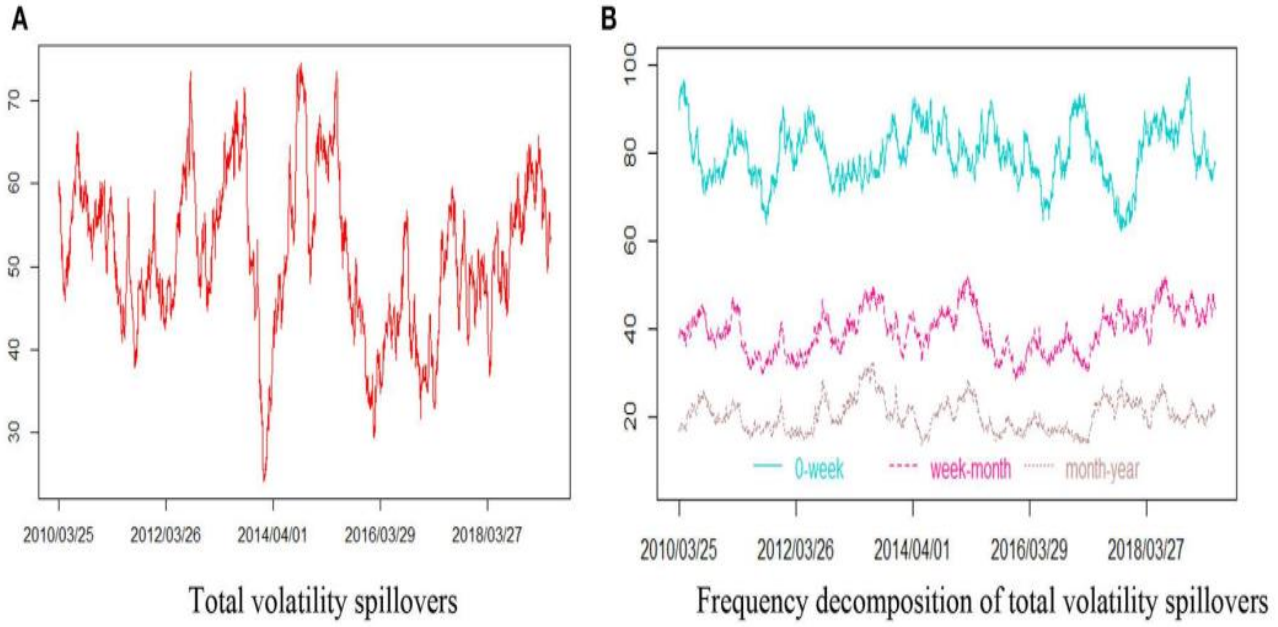


FIGURE 4 | Total volatility spillovers of West Texas intermediate (WTI) futures and China's bulk commodity sectors. **(A)** The total volatility spillovers measured by Diebold and Yilmaz (2012), lag = 2, window size = 200. **(B)** The frequency decomposition measured by Barunik and Krehlik (2018), lag = 2, window size = 200. Short-term: frequencies from 1 to 5 days period (0-week, dark turquoise). Medium-term: frequencies from 5 to 20 days period (week-month, deep pink). Long-term: frequencies from 20 days to 200 days period (month-year, rosy brown).

Close links to other studies

- "Return and volatility transmission between oil price shocks and agricultural commodities"

  Umar, Z., M. Gubareva, M. Naeem, and A. Akhter. 2021. *PLoS ONE* 16(2): e0246886

- S&P GSCI indices for eleven agricultural commodities and disentangled oil shocks (supply, demand, risk) from January 2002 to July 2020
- Implements "the connectedness methodology" of Diebold and Yilmaz (2012)
- **Livestock** is the **largest transmitter**, while the **lean hogs** is a **major receiver**
- Connectedness increases during the periods of **financial** and **economic stresses**, **global economic crises**

Table 3. Static connectedness to agricultural commodities volatility and oil price shocks.

	Soybeans	Wheat	Cocoa	Coffee	Cotton	Feeder Cattle	Grains	Lean Hogs	Live Cattle	Livestock	Sugar	Risk Shock	Demand Shock	Supply Shock	FROM
Soybeans	65.22	5.19	0.43	0.51	2.47	0.64	23.38	0.44	0.34	0.52	0.65	0.14	0.03	0.05	34.78
Wheat	4.64	58.52	0.2	0.3	0.63	0.41	34.21	0.18	0.27	0.15	0.28	0.1	0.06	0.05	41.48
Cocoa	0.65	0.18	95.72	0.7	0.23	0.19	0.44	0.11	0.31	0.15	0.59	0.34	0.1	0.28	4.28
Coffee	0.8	0.35	0.71	94.47	0.34	0.06	0.47	0.07	0.2	0.37	1.71	0.17	0.17	0.1	5.53
Cotton	3.1	0.76	0.21	0.34	90.84	0.13	1.96	0.44	0.34	0.6	0.54	0.56	0.01	0.16	9.16
Feeder. Cattle	0.63	0.4	0.14	0.05	0.08	61.13	0.89	0.39	20.68	15.3	0.1	0.11	0.04	0.07	38.87
Grains	17.59	28.97	0.21	0.29	1.19	0.67	49.64	0.28	0.24	0.29	0.45	0.1	0.02	0.06	50.36
Lean.Hogs	0.75	0.21	0.11	0.04	0.25	0.52	0.67	75.59	1.05	20.39	0.21	0.02	0.13	0.04	24.41
Live.Cattle	0.22	0.19	0.16	0.11	0.18	17.93	0.27	0.84	53.9	25.82	0.1	0.1	0.06	0.12	46.1
Livestock	0.47	0.07	0.05	0.13	0.3	12.29	0.3	13.52	23.58	49.03	0.16	0.02	0.04	0.06	50.97
Sugar	0.94	0.22	0.57	1.76	0.75	0.14	0.61	0.26	0.17	0.31	93.68	0.29	0.09	0.2	6.32
Risk Shock	0.16	0.16	0.27	0.38	0.5	0.09	0.15	0.09	0.1	0.04	0.32	97.63	0.07	0.04	2.37
Demand Shock	0.04	0.1	0.15	0.17	0.05	0.02	0.04	0.06	0.13	0.14	0.27	2.13	96.38	0.32	3.62
Supply Shock	0.04	0.14	0.15	0.18	0.07	0.17	0.21	0.06	0.19	0.17	0.06	0.35	0.53	97.68	2.32
TO	30.03	36.93	3.36	4.96	7.03	33.27	63.6	16.74	47.59	64.25	5.46	4.43	1.36	1.55	**TCI**
NDC	-4.75	-4.54	-0.92	-0.56	-2.13	-5.6	13.24	-7.67	1.49	13.28	-0.86	2.06	-2.26	-0.77	**22.9**

This table shows the connectedness of volatility of the eleven commodity indices and the three oil price shocks. NDC denotes Net directional connectedness and TCI (right bottom corner) denotes the total connectedness index.

Possible extensions

- Inclusion of commodity-specific variables to be able to infer impact of commodity fundamentals

***Aside*:**
Determinants of Commodity Futures Volatility

- Seasonality
  - Harvest, post-harvest, pre-harvest
  - Planning, planting, harvest
- Time to delivery (Samuelson effect)
- Inventories (theory of storage works on volatility as well)
- Production shocks (supply side)
- Exogenous events (hurricane, war, financial crisis, trade war, pandemic)
- OPEC meetings for energy
- USDA reports agricultural commodities

Possible extensions

- Inclusion of volatility asymmetry found in the literature
- Compare and contrast findings
  - Are the differences in the findings driven by methodology applied, the set of commodities selected, or in some cases by country?
- More economic intuition in relaying the findings
- How can we, as applied economists, use these findings to help farmers in their risk management decisions, price/volatility forecasts?
  - Farmers are interested in how much price they will receive for their crop/livestock
  - Farmers and commodity groups are interested in government policies that affect international trade, and thus, the prices
  - What can we tell to do when they see the volatility of, say, energy commodities surge?