Does the Commodity Super Cycle Matter?

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Motivation

• World commodity prices display long cycles known as super cycles.

• Much of the existing literature on commodity price super cycles focuses on documenting their frequency, amplitude, and turning points.

• Less work has been devoted to estimating the importance of commodity price super cycles for economic activity.

• The contribution of this paper is to identify global disturbances that cause regular cycles and super cycles in world commodity prices and to estimate their contribution to aggregate fluctuations in emerging and developed countries.

Elements of the Empirical Model

• Foreign Block: The cyclical components of 11 commodity prices and the world interest rate driven by permanent and transitory world shocks. • Domestic Block: The cyclical components of output of a set of countries, driven by transitory/permanent domestic/world shocks.

• State-Space Formulation: Shocks and cyclical components are unobserved, so the model is cast in terms of latent variables.

• **Observables.** Estimation exploits the fact that the model delivers precise predictions for observable variables: the growth rate of 11 commodity prices, the world interest rate, and the growth rate of 24 (quarterly data) or 41 (annual sample) countries.

• Estimation: Bayesian.

• Sample: Quarterly/annual from 1960 to 2018.

Recapping

The empirical model is

$$\begin{aligned}\widehat{p}_t &= \sum_{i=1}^{4} B^i_{pp}\widehat{p}_{t-i} + C_{pxp}\Delta X^p_t + C_{pzp}z^p_t \\ \widehat{y}_t &= \sum_{i=1}^{4} B^i_{yp}\widehat{p}_{t-i} + \sum_{i=1}^{4} B^i_{yy}\widehat{y}_{t-i} + C_{yxp}\Delta X^p_t + C_{yzp}z^p_t + C_{yx}\Delta X_t + z_t\end{aligned}$$

The exogenous driving force,

$$u_t \equiv \begin{bmatrix} \Delta X^p_t \\ \Delta X_t \\ z^p_t \\ z_t \end{bmatrix},$$

is assumed to be AR(1)

$$u_t = \rho u_{t-1} + \psi\nu_t,$$

with ρ diagonal and $\nu_t \sim N(\emptyset, I)$.

The model cannot be estimated as is because it is cast in terms of unobservable variables.

Observables

$\Delta p_t^i =$ growth rate of commodity price $i = 1, \ldots, 11$.
$\Delta y_t^i =$ growth rate of output in country $i = 1, \ldots, 24$.
$r_t =$ world interest rate.

The observation equations linking unobservable and observable variables are

$$\begin{aligned} \Delta p_t^i &= \widehat{p}_t^i - \widehat{p}_{t-1}^i + \Delta X_t^p; \quad i = 1, \ldots, 11, \\ \Delta y_t^i &= \widehat{y}_t^i - \widehat{y}_{t-1}^i + \Delta X_t^i + \alpha^i \Delta X_t^p; \quad i = 1, \ldots, 24, \end{aligned}$$

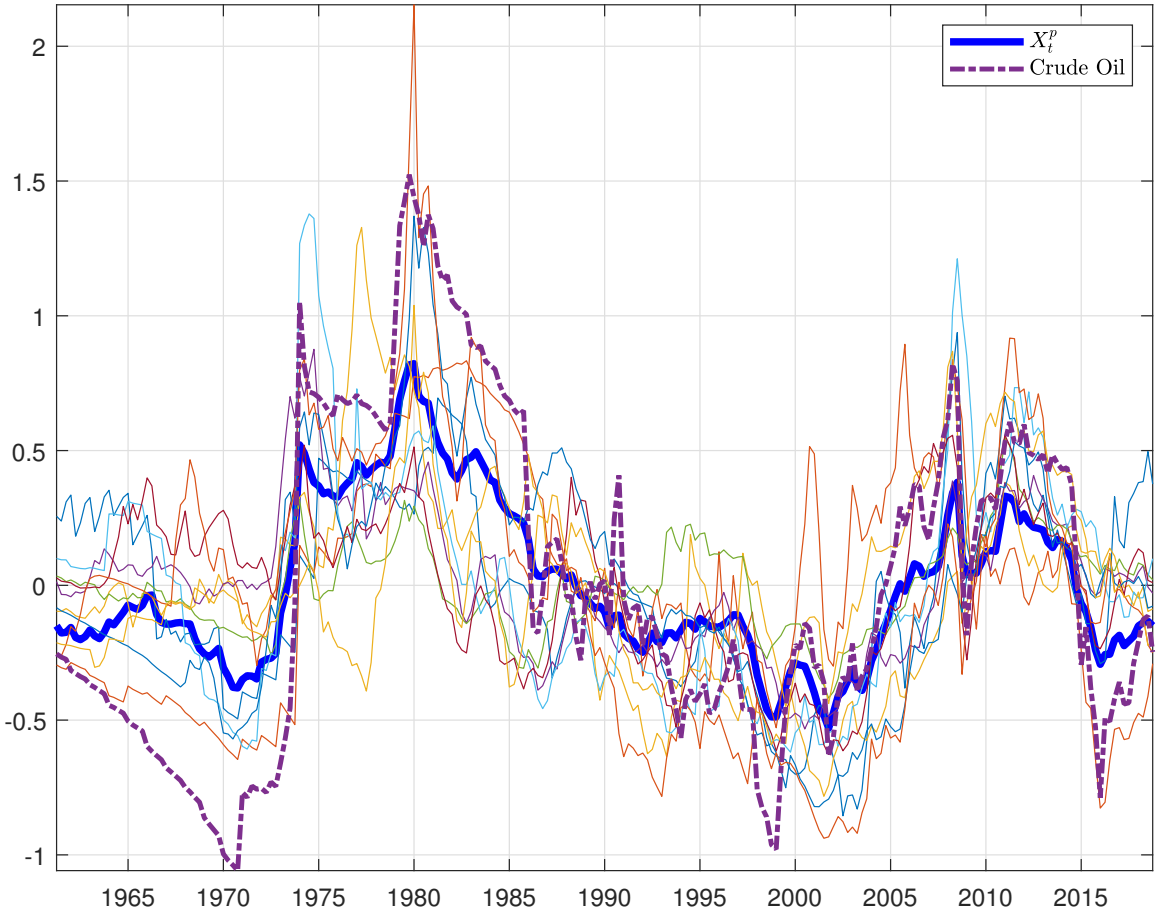
These equations make it possible to calculate the likelihood of the data, which can be used to estimate all parameters of the model.
Estimation Approach: Bayesian, with Minnesota-type priors.

The Data

- **Frequency:** quarterly.
- **Sample period:** 1960.Q1 to 2018.Q4.

- **World Variables:** the world real interest rate (Treasury Bill rate minus measure of expected inflation) and 11 commodity prices deflated by the US CPI (beverages, food, agricultural raw materials, fertilizers, metal and minerals, gold, platinum, silver, coal, crude oil, and natural gas)
- **Country Variables:** Growth rate of the real, s.a., gross domestic product of 24 small open economies.
- **Countries and Inclusion Criterion:** At least 50 years of quarterly observations of real output, excluding large economies: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Iceland, Ireland, Italy, S. Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.
- **Sources:** Commodity prices, World Bank. Output, OECD.

The Commodity Price Super Cycle



Note. The permanent component of the eleven real commodity prices, X_t^p is computed by Kalman smoothing.

Percent of Variance of the Growth Rate of Real Commodity Prices Explained by ΔX_t^p

Price of	Mean	Std. Dev.
Coal	26	3
Crude Oil	60	2
Natural Gas	20	3
Beverages	11	1
Food	21	2
Agr. Raw Materials	20	3
Fertilizers	33	2
Metal and Minerals	30	2
Gold	30	2
Silver	28	2
Platinum	19	1
Mean across prices	27	2
Real Interest Rate	15	8

Note. The reported figures are based on 100,000 draws from the posterior distribution of the variance decomposition.

Variance Decomposition of Output Growth

	Shock			
Country	ΔX_t^p	z_t^p	ΔX_t^i	z_t^i
Australia	7	61	1	32
Belgium	8	84	7	1
Canada	10	71	1	19
Denmark	7	65	0	28
France	8	60	1	31
Iceland	5	47	45	2
Italy	10	74	0	17
Luxembourg	10	50	23	18
Netherlands	8	58	33	1
Norway	4	55	19	22
South Africa	9	61	0	29
Sweden	8	54	0	37
Turkey	4	51	0	44
Mean	8	62	12	19

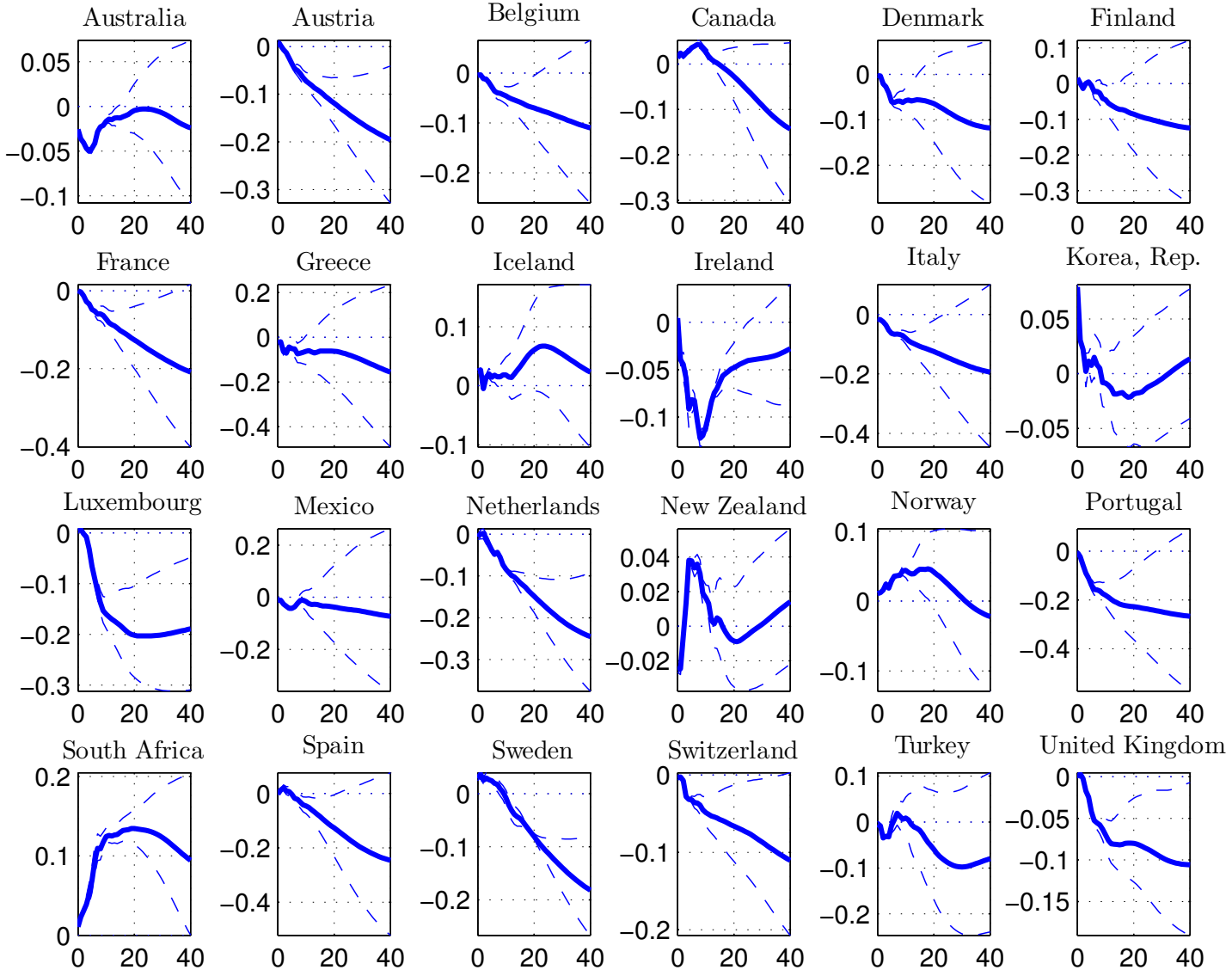
Notes. Averages over 100,000 draws from the posterior distribution of the variance decomposition. To save space, the table shows only every other country (12 out of 24) in the sample from a list sorted alphabetically. See discussion on next slide.

Forecast Error Variance Decomposition of the Level of Output

Shock	X_t^p				z_t^p				X_t^i				z_t			
Horizon	5	10	20	30	5	10	20	30	5	10	20	30	5	10	20	30
Australia	5	2	2	7	82	89	87	80	5	6	8	11	8	3	2	2
Austria	19	27	33	36	74	70	65	63	1	1	1	1	6	2	1	1
Belgium	9	10	13	13	88	87	82	79	3	3	5	8	0	0	0	0
Canada	2	12	33	41	92	85	64	56	3	2	3	3	3	1	0	0
Denmark	6	13	22	24	88	84	76	74	0	0	0	0	6	3	2	2
Finland	5	8	11	10	60	59	50	42	34	32	39	48	1	0	0	0
France	20	27	36	41	70	69	61	56	2	2	2	2	8	2	1	1
Greece	1	2	5	5	95	96	92	91	3	2	2	3	0	0	0	0
Iceland	0	1	1	1	25	22	16	12	65	70	78	84	9	8	5	4
Ireland	4	2	1	2	26	18	11	7	69	79	88	91	1	1	0	0
Italy	12	14	15	14	81	83	83	84	0	0	0	1	7	3	1	1
Korea, Rep.	1	0	1	2	19	11	6	4	80	88	93	94	1	0	0	0
Luxembourg	29	35	36	33	43	36	27	22	25	28	36	44	3	1	1	1
Mexico	1	1	1	3	85	93	94	93	0	0	1	1	13	5	3	3
Netherlands	19	27	30	29	75	67	60	55	4	5	10	16	1	0	0	0
N. Zealand	1	1	3	5	21	18	11	8	74	80	85	86	3	2	1	1
Norway	6	4	5	4	77	77	70	63	14	17	24	32	3	2	1	1
Portugal	24	23	25	25	69	74	74	73	0	0	0	0	7	3	2	1
S. Africa	43	42	38	50	49	55	59	47	1	1	1	1	6	3	1	1
Spain	7	18	30	33	87	80	69	65	0	0	1	1	6	1	1	1
Sweden	8	36	59	67	74	58	38	30	2	2	1	2	16	5	2	1
Switzerland	8	15	29	33	75	75	65	61	1	1	2	3	16	9	4	3
Turkey	1	7	7	9	67	74	77	75	0	0	1	1	31	19	15	15
U.K.	17	28	39	42	77	67	56	52	2	3	4	5	4	2	1	1
Mean	10	15	20	22	67	64	58	54	16	18	20	22	7	3	2	2

Note. Computed at the posterior mean of the estimated parameters and expressed in percentage points.

Response of Output to an Increase in X_t^p



: mean : 95% Sims-Zha asymmetric confidence bands

Conclusion

• This paper investigates empirically the importance of the shock responsible for the commodity price super cycle as a driver of aggregate activity in emerging and developed economies.

• The shock driving the commodity price super cycle is defined as a common permanent component in real commodity prices.

• Estimates indicate that permanent and stationary world shocks explain more than half of the variance of output growth on average across countries.

• However more than two thirds of this contribution stems from stationary world shocks.

• This result suggests that world shocks causing low frequency movements in commodity prices play an important but not dominant role in driving fluctuations in aggregate activity.