

Reading the News: Telling Supply from Demand in Commodity Markets

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The views expressed are solely those of the authors and do not necessarily reflect the views of the Banque de France.

Motivation

Understanding commodity-price fluctuations is **important**.

- **Implications** for **economic growth**, countries' **financial resources** and **income distribution**, **terms of trade**, **inflation** and **real exchange rates**.
- Unprecedented interest in **commodity investing** during the past decade and increased **flow of institutional funds** into futures markets of commodities: **financialization**.
[Basak and Pavlova, 2016]
 - Implications for **portfolio allocation** and **market segmentation**.

Motivation

Disentangling Supply & Demand in Commodity Markets

Classifying commodity price developments into **supply** and **demand** components is **non-trivial**.

- Model-based methods
 - Conventional measures subject to **endogeneity critique**
 - Most approaches cannot adequately **identify** movements driven by **exogenous shocks** from others that mirror **endogenous responses to structural shocks**

Addressing endogeneity considerations is **crucial** for **econometric** analysis because, under its presence, the estimates of the effects of commodity price shocks are **biased**.

This paper

We build **indexes** of commodity **supply** and **demand** using a **computer-based narrative approach**.

- Starting from a **general framework** that captures a **market-wide commodity sentiment**, we tailor our approach to cover **different commodity categories** such as energy, industrial and precious metals, agricultural commodities etc.
- Preliminary analysis suggests **differential implications** for **volatility** and **correlations** across asset markets depending on the **nature** of price developments.

Contribution

- Our approach is **flexible, unified**, and can span the **global** commodity market.
- Our indexes can be used **independently** or enrich and improve structural model-based predictions.
- They track commodity price developments and are available at **higher frequencies** than standard macro variables.
 - Mitigation of the **temporal aggregation bias** in prediction.
- Relying on narrative measures helps relax a number of **assumptions** between supply and demand shocks often employed in quantitative and structural approaches.
 - Important for analysis of **COVID-19 crisis**.

Findings

- Our indexes **track the post-crisis collapse** of commodity markets, other **market-specific developments**, as well as the recent **COVID-19 crisis**.
- They have a wide range of **applications** and can directly address open questions in the **international macroeconomics** and **finance** literatures.
 - Differential effects of commodity supply and demand on **stock market volatility**.
 - Different implications for **portfolio diversification** and **market segmentation**.

Methodology

- We build supply and demand indicators by complementing **market-wide news outlets** with **commodity specific publications**.
 - Measurement of **coverage**, **direction** and **intensity** of commodity news.
- Extensive **human checks**.

Positioning in the Literature

- **Textual analysis** for the **measurement** of various **economic outcomes**; [Tetlock, 2007], [Gentzkow and Shapiro, 2010], [Hoberg and Phillips, 2010], [Boudoukh et al., 2013], [Alexopoulos and Cohen, 2015] [**Baker et al., 2016**], and [Allcott and Gentzkow, 2016].
- **Identification** of **supply** and **demand** shocks in **commodity markets** (focus on oil): [Kilian, 2008; 2009], [Kilian et al., 2009], [**Wu and Cavallo, 2012**], [Kilian and Vigfusson, 2016], [Känzig, 2018], [**Datta and Dias, 2019**], [Loughran et al., 2019].
- **Narrative approaches** in **economics**: [**Romer and Romer, 2010**].

Data description

- **Market-wide news outlets** for the construction of the global commodity index; and for the individual commodity indexes.
 - **Reuters** (May 2000 to date, 1,035,286 articles)
 - **Dow Jones** (Jan 2000 to date, 2,760,967 articles)
- We complement our market-wide news providers with **commodity specific publications** such as Oil Daily (Dec 1996 to date, 110,333 articles); Platts Gas Daily (Nov 2001 to date, 89,146 articles); Metal Bulletin News Alert Service (Jan 2010 to date) etc.
- Outlets accessed through **Factiva - Dow Jones**.

Methodology

Article Selection

- We **remove** articles that place the **focus** on **different** / competing commodities as they are often covered by the same outlets.
- Binding restriction for commodities that form **part of the same group**.
 - For example for the construction of **wheat indices** competing commodities (key words) are “corn”, “soy”, “soybean”, “soybeans”, “barley”, “rice”, “soymeal”, “soyoil”, “maize”, “coffee”, “cocoa”, “sugar”, “cotton”, “palm”, “oilseed”, “oilseeds”, “fruits”, and “fruit”.

Methodology

Article handling: original version



HD Strategie Grains lifts EU wheat stocks forecast on virus demand hit

WC 285 words

PD 16 April 2020

ET 12:00

SN Reuters News

SC LBA

LA English

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LP

PARIS, April 16 (Reuters) - Consultancy Strategie Grains raised sharply its forecast for European Union soft wheat stocks this season as reduced domestic demand during the coronavirus crisis outweighed an improved export outlook.

In a monthly report, the French-based firm increased its projection of EU soft wheat stocks at the end of the 2019/20 season on June 30 to 13.7 million tonnes from 12.5 million estimated in March.

TD

Weaker demand within the EU, including a 1.3 million tonne downward revision to milling industry demand, reflected lockdown measures to counter the coronavirus that have notably hit out-of-home eating, Strategie Grains said.

Worsening prospects for crop-based biofuels, due to a collapse in fuel demand and oil prices, also led the firm to cut expected wheat use in ethanol.

Forecast EU soft wheat exports this season were raised to 32.4 million tonnes from 31.2 million last month, with Strategie Grains citing continuing brisk overseas demand and limited disruption to trade flows from the coronavirus crisis.

The drag on overall demand was expected to continue next season, with soft wheat stocks at the end of 2020/21 expected at a similar level to 2019/20 despite the prospect of a much smaller EU harvest, the consultancy said.

It reduced its forecast of EU soft wheat production in 2020/21 by 1.7 million tonnes to 135.0 million, down nearly 8% on a year earlier, as it made a further cut to the estimated crop area after a poor sowing campaign in northwest Europe.

(Reporting by Gus Trompiz; Editing by Susan Fenton)

RF Released: 2020-4-16T11:00:00.000Z

CO eunuo : European Union

IN i0100132 : Oilseed/Grain Farming | i0 : Agriculture | i01001 : Farming

Methodology

Article handling: article body

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In [104]: document[-188]
```

```
Out[104]: 'PARIS, April 16 (Reuters) - Consultancy Strategie Grains raised sharply its forecast for European Union soft wheat stocks this season as reduced domestic demand during the coronavirus crisis outweighed an improved export outlook. In a monthly report, the French-based firm increased its projection of EU soft wheat stocks at the end of the 2019/20 season on June 30 to 13.7 million tonnes from 12.5 million estimated in March. Weaker demand within the EU, including a 1.3 million tonne downward revision to milling industry demand, reflected lockdown measures to counter the coronavirus that have notably hit out-of-home eating, Strategie Grains said. Worsening prospects for crop-based biofuels, due to a collapse in fuel demand and oil prices, also led the firm to cut expected wheat use in ethanol. Forecast EU soft wheat exports this season were raised to 32.4 million tonnes from 31.2 million last month, with Strategie Grains citing continuing brisk overseas demand and limited disruption to trade flows from the coronavirus crisis. The drag on overall demand was expected to continue next season, with soft wheat stocks at the end of 2020/21 expected at a similar level to 2019/20 despite the prospect of a much smaller EU harvest, the consultancy said. It reduced its forecast of EU soft wheat production in 2020/21 by 1.7 million tonnes to 135.0 million, down nearly 8% on a year earlier, as it made a further cut to the estimated crop area after a poor sowing campaign in northwest Europe. (Reporting by Gus Trompiz; Editing by Susan Fenton)'
```

Methodology

Article handling: tokenizing into sentences

```
In [107]: tokens_sentence[-188]
```

```
Out[107]: ['PARIS, April 16 (Reuters) - Consultancy Strategie Grains raised sharply its forecast for European Union soft wheat stocks this season as reduced domestic demand during the coronavirus crisis outweighed an improved export outlook.',  
'In a monthly report, the French-based firm increased its projection of EU soft wheat stocks at the end of the 2019/20 season on June 30 to 13.7 million tonnes from 12.5 million estimated in March.',  
'Weaker demand within the EU, including a 1.3 million tonne downward revision to milling industry demand, reflected lockdown measures to counter the coronavirus that have notably hit out-of-home eating, Strategie Grains said.',  
'Worsening prospects for crop-based biofuels, due to a collapse in fuel demand and oil prices, also led the firm to cut expected wheat use in ethanol.',  
'Forecast EU soft wheat exports this season were raised to 32.4 million tonnes from 31.2 million last month, with Strategie Grains citing continuing brisk overseas demand and limited disruption to trade flows from the coronavirus crisis.',  
'The drag on overall demand was expected to continue next season, with soft wheat stocks at the end of 2020/21 expected at a similar level to 2019/20 despite the prospect of a much smaller EU harvest, the consultancy said.',  
'It reduced its forecast of EU soft wheat production in 2020/21 by 1.7 million tonnes to 135.0 million, down nearly 8% on a year earlier, as it made a further cut to the estimated crop area after a poor sowing campaign in northwest Europe.',  
'(Reporting by Gus Trompiz; Editing by Susan Fenton)']
```

Methodology

Article handling: lemmatization, stop words and punctuation

```
In [110]: lemmas[-188]
```

```
Out[110]: [['PARIS', 'april', '16', 'Reuters', 'consultancy', 'Strategie', 'Grains', 'raise', 'sharply', 'forecast', 'Europea  
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'improved', 'export', 'outlook'], ['monthly', 'report', 'French', 'base', 'firm', 'increase', 'projection', 'EU', 'so  
ft', 'wheat', 'stock', 'end', '2019/20', 'season', 'june', '30', '13.7', 'million', 'tonne', '12.5', 'million', 'esti  
mate', 'march'], ['weak', 'demand', 'EU', 'include', '1.3', 'million', 'tonne', 'downward', 'revision', 'mill', 'indu  
stry', 'demand', 'reflect', 'lockdown', 'measure', 'counter', 'coronavirus', 'notably', 'hit', 'home', 'eating', 'Str  
ategie', 'Grains', 'say'], ['worsen', 'prospect', 'crop', 'base', 'biofuel', 'collapse', 'fuel', 'demand', 'oil', 'pr  
ice', 'lead', 'firm', 'cut', 'expect', 'wheat', 'use', 'ethanol'], ['forecast', 'eu', 'soft', 'wheat', 'export', 'sea  
son', 'raise', '32.4', 'million', 'tonne', '31.2', 'million', 'month', 'Strategie', 'Grains', 'cite', 'continue', 'br  
isk', 'overseas', 'demand', 'limited', 'disruption', 'trade', 'flow', 'coronavirus', 'crisis'], ['drag', 'overall',  
'demand', 'expect', 'continue', 'season', 'soft', 'wheat', 'stock', 'end', '2020/21', 'expect', 'similar', 'level',  
'2019/20', 'despite', 'prospect', 'small', 'EU', 'harvest', 'consultancy', 'say'], ['reduce', 'forecast', 'EU', 'sof  
t', 'wheat', 'production', '2020/21', '1.7', 'million', 'tonne', '135.0', 'million', 'down', 'nearly', '8', 'year',  
'earlier', 'cut', 'estimate', 'crop', 'area', 'poor', 'sowing', 'campaign', 'northwest', 'Europe'], ['report', 'Gus',  
'Trompiz', 'editing', 'Susan', 'Fenton']]
```

Methodology. A four-layer approach

We simulate news reading in **four steps**.

- **News intensity.** Count the **number** of commodity-specific **articles**.
- **Content analysis.** Identify **words** and **word combinations** that can be **attributed** to **supply** and **demand** factors.
- **Refinement.** Overlay the process with an additional algorithm that caters to **exceptions** and **negations**. Creation of **thematic indexes** that capture financial developments, trade war, COVID-19 (ongoing).
- Extensive **Human Auditing**.

Methodology

Measuring news intensity

- We proxy **news coverage intensity** using the **number of articles** published per day.
 - The **larger** the commodity price change, the **higher** the news coverage.
 - Potential **asymmetric** relationship between positive and **negative** news and news coverage.
- When more than one news outlet is used on a particular day, we **scale** the number of articles by the **number of outlets** used.

Methodology

Content analysis: creating dictionaries

- **Content analysis.** Identify **words** and **word combinations** that can be **attributed** to **supply** and **demand** factors.
- Running a search for the most “**popular**” words over our selected articles.
- Classification of words into **supply** and **demand lists**. [▶ dictionaries](#)
 - **Human checks** on the use of the words in a sample of articles.
- Use of standard dictionaries of “**increase**” and “**decrease**” words typically used in textual analysis with minor modifications for the construction of **word combinations**.

Methodology

Word combinations with directional words

- Retrieve the number of supply, demand, increase and decrease words.
- Count the number of **combinations** of **supply** or **demand** words with **directional** words, within the same sentence and within a certain range to the left and to the right of the supply or demand words.
- Build **net supply** (supply decrease minus supply increase) and **net demand** measures (demand increase minus demand decrease).

Methodology

Refinement

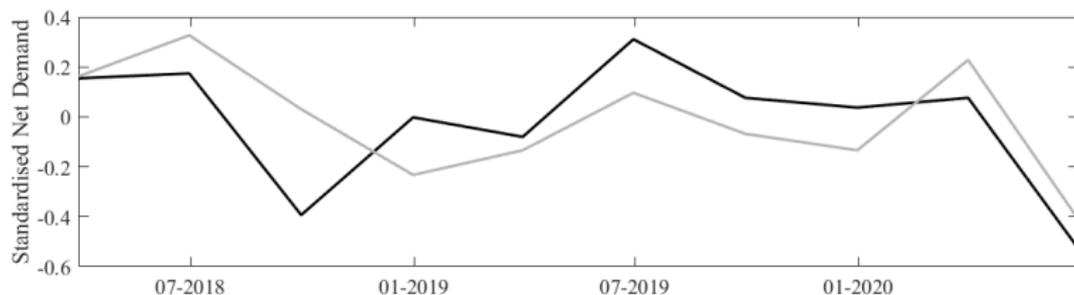
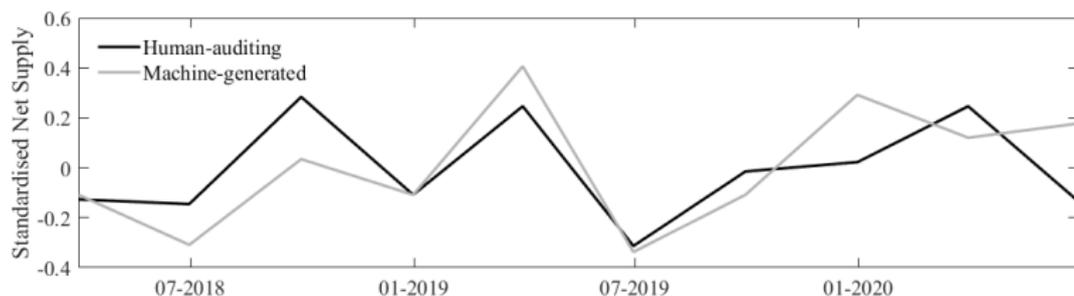
- Enrich the dictionaries to provide **commodity-specific refinements** and exceptions “producer” (supply word) would be ignored if followed by words “costs” or “prices”; separating plant crops (supply) from pasta plant (demand).
- Build a more **sophisticated algorithm** that caters to weather-related words for agricultural and energy commodities and maintenance-related words for energy and industrial metals.
- Address **negations** (not, but, while etc.) according to the **writing style** of news articles.

Human Auditing

- **Randomly** sample (without replacement) a **fixed** number of articles per month to **insulate** sample from changes in number of articles (trends in coverage, differential effect of supply and demand developments etc.).
- **Randomize** the **order** in which a given auditor reviews and codes assigned articles to ensure that the auditors' "learning" does not bias the assessment of differences over time.
- Assign same sample to **two auditors**, trading off coverage of larger samples for accuracy.
 - **Correlation** between human- and computer-built indexes fluctuates around 0.70 (reaches 0.85 for demand increase in quarterly data).

Human and computer standardized net supply and demand

Global commodity indexes

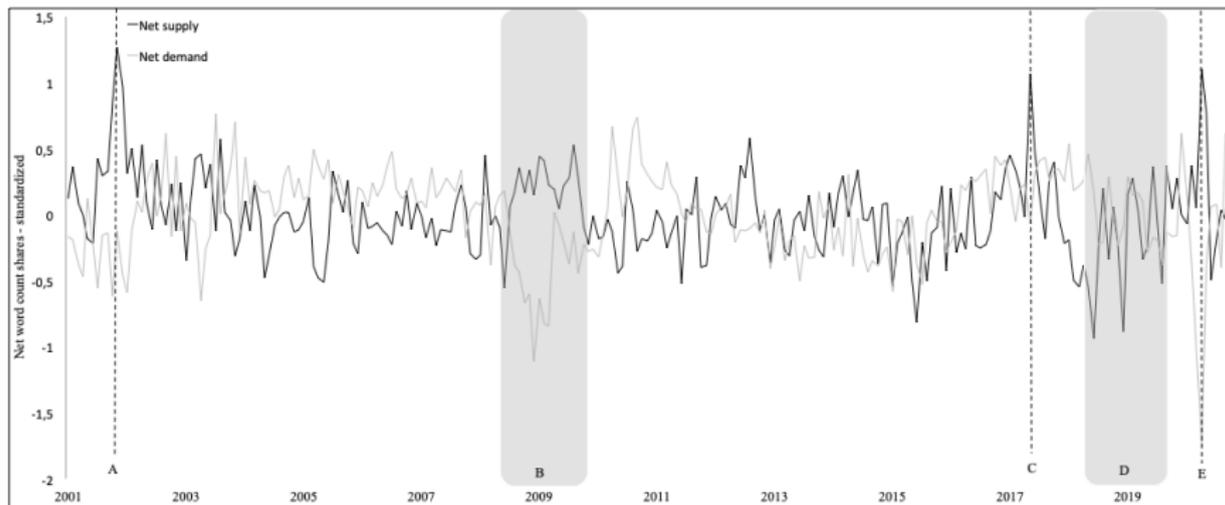


Standardized net supply and demand

Global commodity indexes

Net supply = supply decrease - supply increase

Net demand = demand increase - demand decrease



Note: This table plots the standardized net supply and demand indicators for the period between 2001 and 2020. The bars map a number of well-known commodity-wide developments. These events are: [A] 2001 US Recession, [B] Global Financial Crisis, [C] 172nd Meeting of the OPEC Conference – Production Cut, [D] Trade War, [E] COVID-19 Crisis.

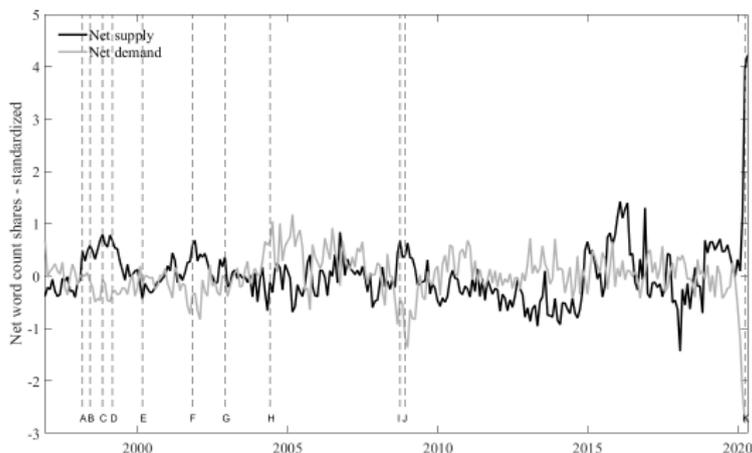
Relationship with commodity returns

Regression of S&P GSCI composite daily returns on supply & demand indicators

	Net Supply	Net Demand	Net Supply & Net Demand
Net supply	0.00233*** (4.07)		0.00313*** (5.58)
Net demand		0.00435*** (6.44)	0.00476*** (7.15)
N	4019	4019	4019
R2	0.005	0.021	0.03

Standardized net supply and demand

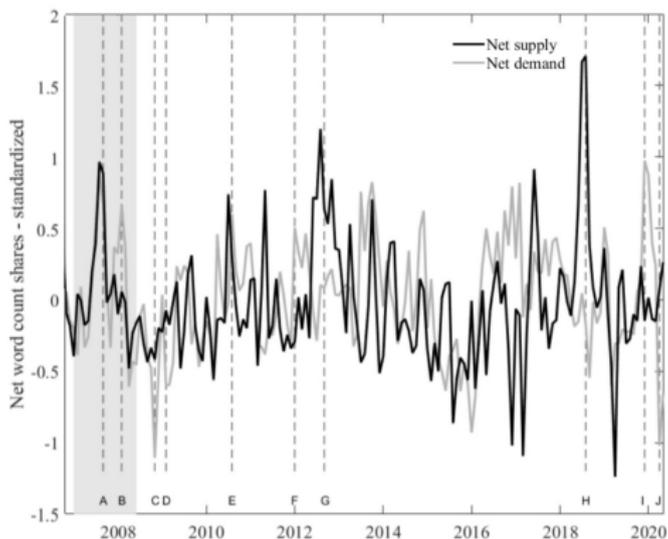
Crude Oil



Note: This table plots the standardized net supply and demand indicators for the period between 1997 and 2020. The bars map a number of well-known oil sector developments. These events are: [A] 104th Extraordinary Meeting of the OPEC Conference – Production Cut (Asian Crisis), [B] 105th Ordinary Meeting of the OPEC Conference – Production Cut (Asian Crisis), [C] 106th Ordinary Meeting of the OPEC Conference (Asian Crisis), [D] 107th Ordinary Meeting of the OPEC Conference – Production Cut (Asian Crisis), [E] 109th Ordinary Meeting of the OPEC Conference: Production Increase Decision, [F] 118th Extraordinary Meeting of the OPEC Conference – Emergency OPEC Meeting after 9/11, [G] 122nd Extraordinary Meeting of the OPEC Conference – Production Cut, [H] 131st Extraordinary Meeting of the OPEC Conference: Production Increase, [I] 150th Extraordinary Meeting of the OPEC Conference – Production Cut (Global Financial Crisis), [J] 151st Extraordinary Meeting of the OPEC Conference – Production Cut (Global Financial Crisis), [K] 9th & 10th Extraordinary OPEC and non-OPEC Ministerial Meeting: Production Cut (COVID-19 Crisis).

Standardized net supply and demand

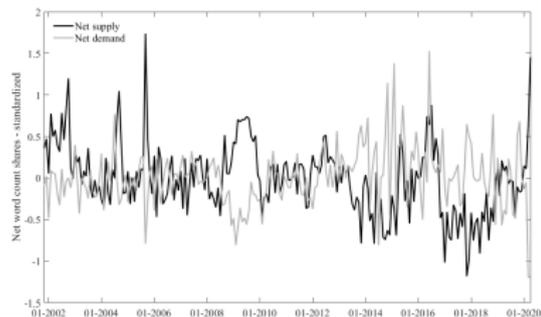
Wheat



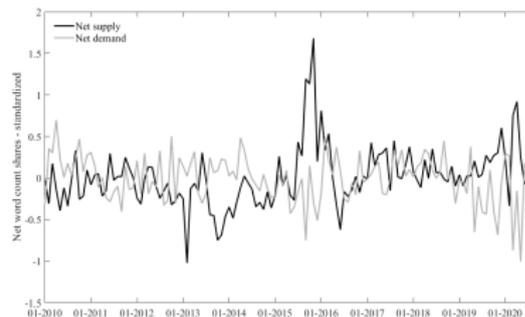
Note: This table plots the standardized net supply and demand indicators for the period between 2001 and 2020. The bars map a number of important developments in the wheat sector. These events respectively are: [A] 2007-2008 World Food Price Crisis, [B] International supply shortages following large purchases from Japan and Egypt, [C] Replenishing of wheat stock and favorable global crop prospects, [D] Production of wheat is higher than utilization, [E] Drought in Russia and disruptive rainfall, [F] Projected utilization exceeding production, [G] Russian crop failure, [H] Major downward revisions in production projections due to heatwave across Russia, Australia, and EU countries, [I] Global wheat production is down with smaller crops in Russia and Australia more than offsetting larger crops in the European Union, [J] COVID-19.

Standardized net supply and demand

Individual commodity indexes



Natural Gas



Copper

Commodity-specific results

Regression of S&P GSCI Commodity-Specific Monthly Returns on Net Supply and Demand Indicators

	Crude Oil	Natural Gas	Copper	Wheat
Net Supply	-0.00125 (-0.10)	0.0634*** (3.44)	0.00365 (0.31)	0.0581*** (4.68)
Net Demand	0.0481** (2.53)	0.0839*** (4.27)	0.0388*** (3.27)	0.0365*** (3.00)
N	281	221	127	228

Impact of supply and demand shocks on stock market volatility

- Documented **impact** of **oil shocks** on **stock market volatility**.
- Structural decompositions point to the **significance** of demand shocks, while the impact of **supply** shocks appear to be **negligible** [Bastianin and Manera, 2015].
- Test for the significance of the difference channels using **disaggregated** indices of **supply-increase**, **supply-decrease**, **demand-increase** and **demand-decrease**.

Application I. Impact on stock market volatility

	Supply only	Demand only	Supply and Demand
Supply Increase	-1.927*** (-15.14)		-1.543*** (-12.89)
Supply Decrease	0.391** (2.34)		-0.0198 (-0.13)
Demand Increase		-1.620*** (-12.14)	-1.317*** (10.09)
Demand Decrease		2.482*** (12.38)	2.330*** (11.98)
N	4911	4911	4911
Adj. R2	0.041	0.067	0.096

Implications for diversification & market segmentation

- Hypothesis: Upon the arrival of a large **supply shock**, **prices of risk** in the directly affected asset class become **disconnected** from those in others [Greenwood et al., 2018], [Passari and Topaloglou, 2020].
- Look at the change in correlations among different assets following supply and demand developments.

Application II: Diversification & market segmentation

Across asset classes

Correlations of Daily Returns Following a Crude Oil Supply Shock

	Full Sample			
	S&P 500	Moody's Aaa CB	S&P GSCI	10-Y Treasury
S&P 500	1,00			
Moody's Aaa CB	0,41	1,00		
S&P GSCI	-0,02	0,30	1,00	
10-Y Treasury	0,34	0,23	-0,06	1,00

Correlations of Daily Returns Following a Crude Oil Demand Shock

	Full Sample			
	S&P 500	Moody's Aaa CB	S&P GSCI	10-Y Treasury
S&P 500	1,00			
Moody's Aaa CB	0,70	1,00		
S&P GSCI	0,15	0,42	1,00	
10-Y Treasury	0,44	0,44	-0,14	1,00

Difference in Correlations of Daily Returns: (Demand - Supply)

	Full Sample			
	S&P 500	Moody's Aaa CB	S&P GSCI	10-Y Treasury
S&P 500	0,00			
Moody's Aaa CB	0,29	0,00		
S&P GSCI	0,17	0,12	0,00	
10-Y Treasury	0,10	0,21	-0,08	0,00

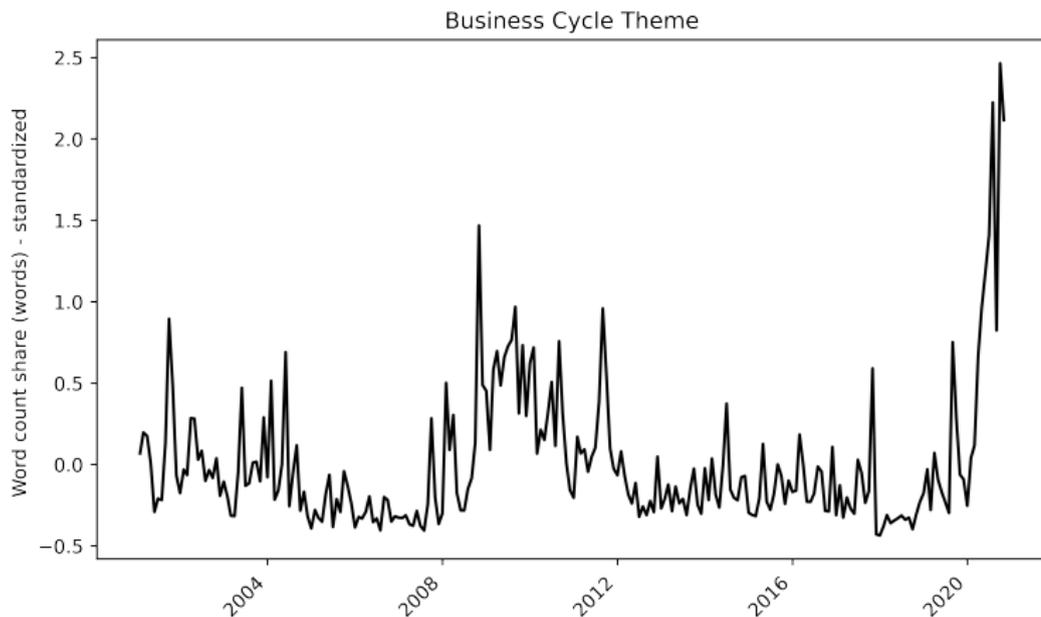
Going forward

Decomposition of commodity developments

- **Decompose** commodity indexes into different components (themes).
- Importance of themes is **time-varying**.
- Business cycle, environmental regulation, geopolitical risk, natural disasters and trends are identified as main drivers of commodity developments.

Decomposition of commodity developments

Business cycle



Going forward

Inflation and commodities – [Gospodinov and Ng, 2013]

- *Rapidly rising prices for globally traded **commodities** have been the major **source** of the relatively high rates of **inflation** we have experienced in recent years, underscoring the importance for **policy** of both forecasting commodity price changes and **understanding the factors** that drive those changes. [Bernanke, 2008]*
- Although monetary authorities seem to support the view that inflation and commodities are **linked**, this has yet to be **formalised**. Some hypotheses include:
 - Commodity prices are leading indicators of inflation because they **respond quickly** to general economic conditions.
 - Idiosyncratic movements in commodity prices work **through the distribution channel** and subsequently affect prices in general.

Going forward

Inflation and commodities

Important to understand what **triggers** changes in commodity prices

- Exploit **aggregate and disaggregated** commodity indexes.
- Use PCA (or factor analysis) to:
 - discern common (and idiosyncratic) drivers of demand and supply across commodities and **isolate variations** in commodity prices that have **inflationary consequences** (e.g. demand-pull inflation or cost-push inflation).
 - **group** commodities and **explore differences** across price indexes (CPI – headline and core –, PPI, GDP deflator).
- Test whether implications on inflation are different depending on whether the country in question is a **commodity-exporting** country or not [Chen et al., 2014].

Going forward

Inflation and commodities – Covid 19

- Price indexes are typically based on **fixed weights** (that change annually, or every two years).
- During the Covid 19 pandemic, **relative importance changes**.
- Demand and supply indexes can inform about inflation dynamics during this period.

Conclusion

- We build **indexes** of commodity price **supply** and **demand** developments using **textual analysis**.
- Our indexes measure the **coverage**, **direction** and **intensity** of commodity news and **track** the major **developments** in commodity markets.
- **Useful** tool in the light of the recent **COVID-19** crisis when supply and demand **shocks** are **frequent**, **large**, and **not necessarily orthogonal**.
- Supply and demand developments appear to have **different implications** for the **volatility** and **correlation dynamics** across **asset markets**. Implications for diversification and market segmentation.

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– Appendix –

Methodology

Dictionary examples

▶ back

TABLE B1. Supply and demand words: Global Commodity Index

<i>Supply</i>				
suppl*	produc*	output		
<i>Demand</i>				
demand*	consum*	buy*	purchas*	

TABLE B2. Supply and demand words: Crude Oil

<i>Supply</i>				
suppl*	produc*	output	discovery	glut*
reserve*	surplus*	rig*		
<i>Demand</i>				
demand*	consum*	buy*	util*	drain*
deplet*	refin*			

TABLE B3. Supply and demand words: Natural Gas

<i>Supply</i>				
suppl*	produc*	output	capacity*	inject*
explor*	extract*	rig*	drill*	
<i>Demand</i>				
demand*	consum*	buy*	plant*	util*
emission*	costumer*	electric*	heating*	

Auditing process

▶ back

- **Assess** whether article refers to **commodity-in-question** [if yes, 2; if only to a limited extent, 1; else, 0].
- **Verify** whether article refers to **supply** and **demand** market developments [if yes, supply_demand = 1, else supply_demand = 0].
- **Identify** developments as supply increase, supply decrease, demand increase, and or demand decrease.
- **Count** the number of supply, demand, increase, decrease words and combinations.
- **Examine** whether supply and demand words imply the **right** market developments (e.g. increased number of planted crops (supply increase) vs pasta plants boosted orders (demand increase)).
- **Examine** if any relevant demand or supply words are **missing** from the current dictionaries.