



Fracking, Cracking and the Mass Balance of TPE precursors

Cologne, December 2016

@RobertPeels



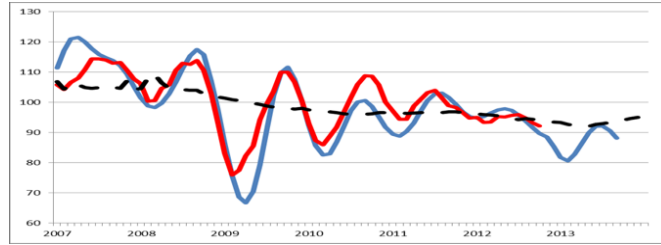
Content

- Fracking
- Cracking
- Mass balance
- Volatility



Flostock

Specialized in Volatility



- Spin-off from project DSM – Eindhoven University.
- DSM gained substantial, a.o. extra market share, security of supply and buying cheap.
- Forecasting based on Stocks & Flows, Supply Chains, Economics.

The Flostock insights are being picked up:

Part of curriculum at MIT, Wharton
and at least 6 European Universities.

First PhD, in Eindhoven;
2nd coming



Called best practice by McKinsey

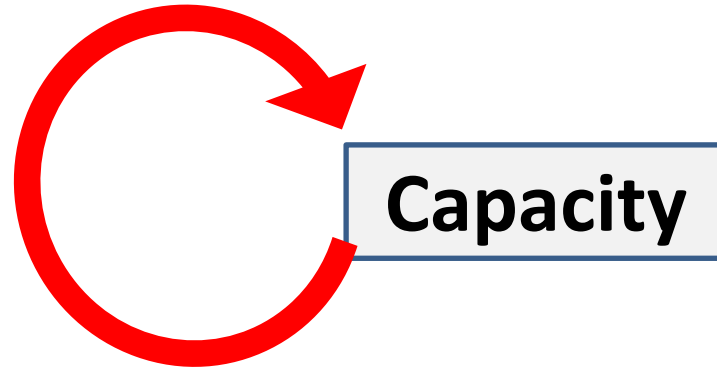
Described in the FT and
ICIS Chemical News



14-3-2017

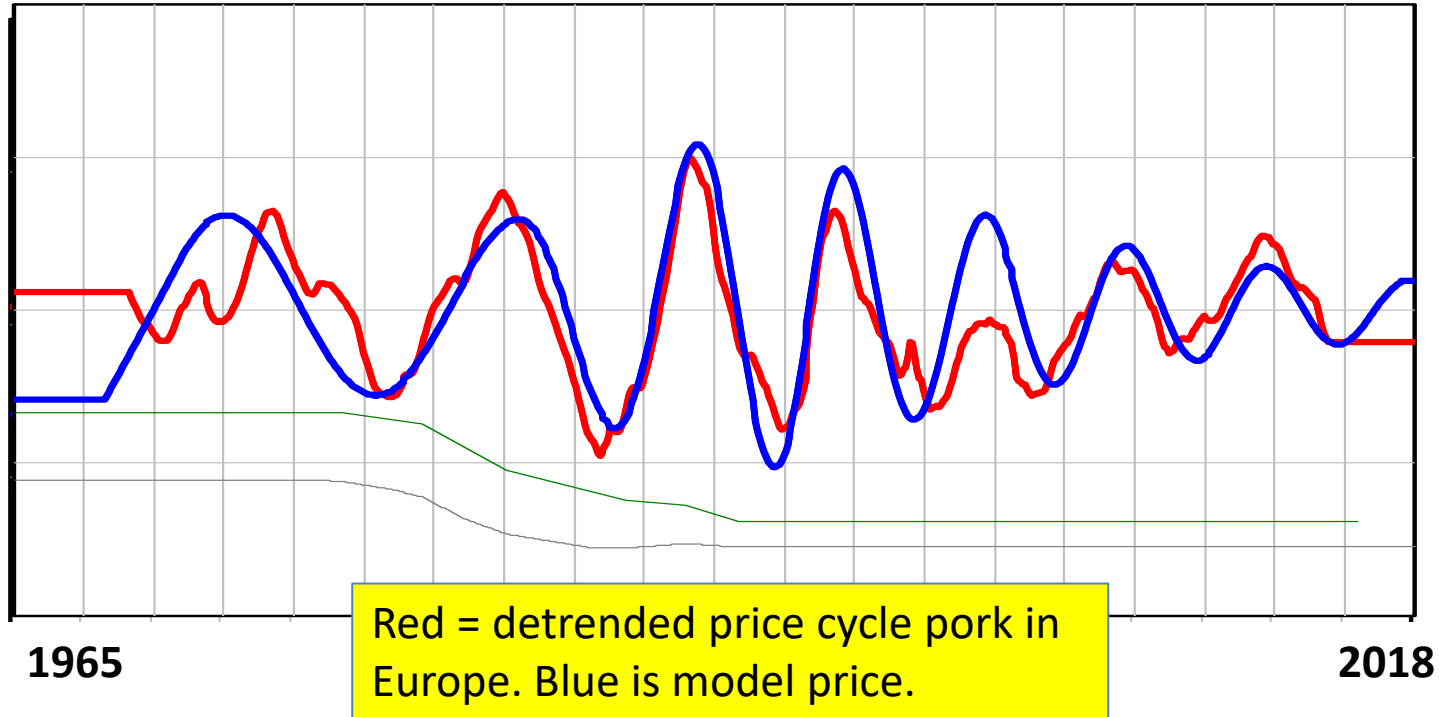
First scientific article published;
several in preparation.

Modeling Pork Cycles



- In case of Capex with long leadtime.
- Several publications with TU/e in progress
- Applied in Housing, Food, Semi-conductors, Chemistry, Agro.

Example: Pork Cycle





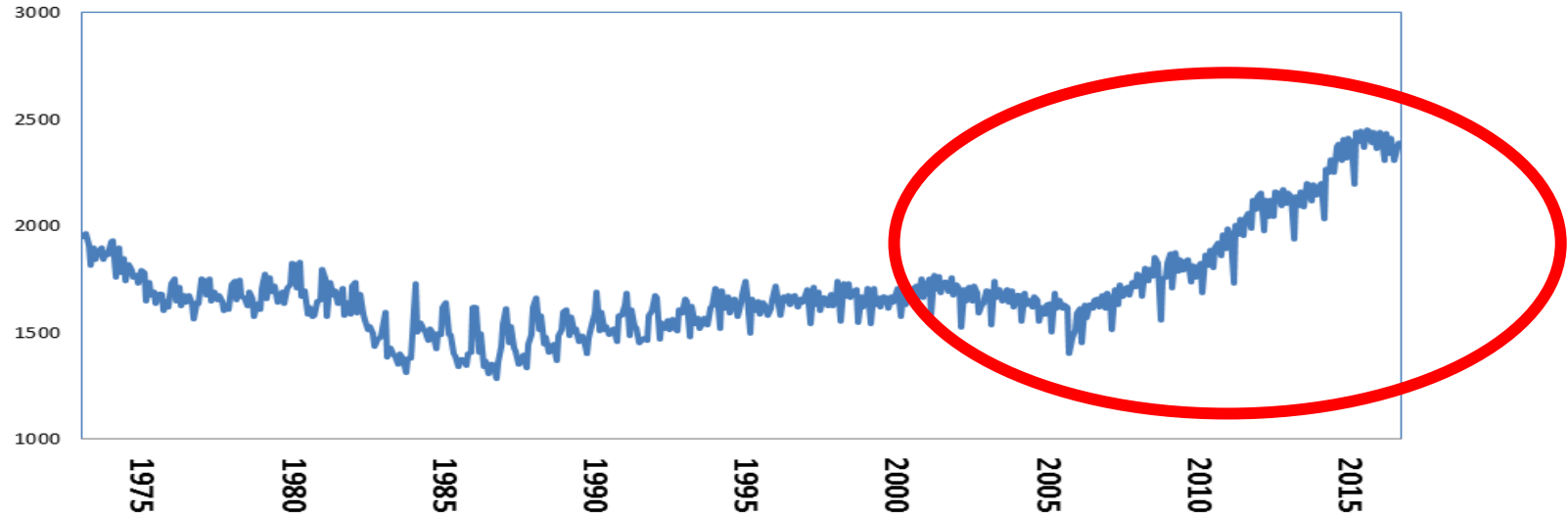
Fracking

Fracking

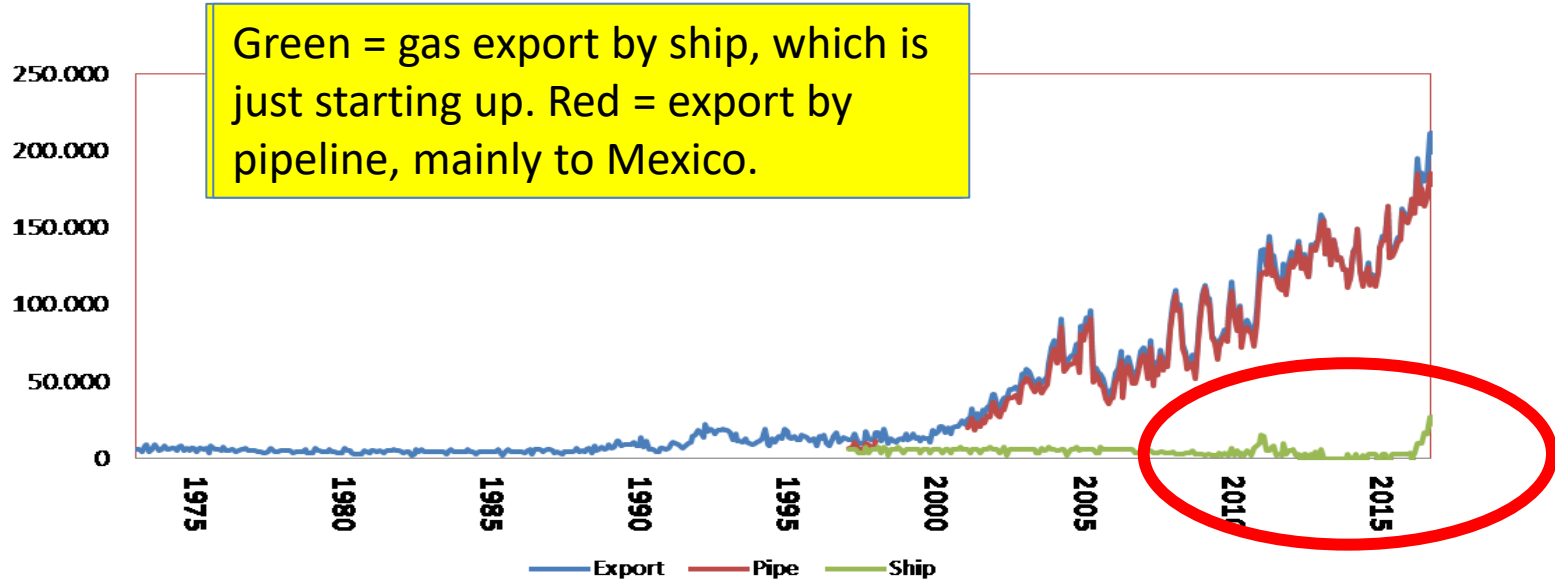


Fracking & Horizontal drilling

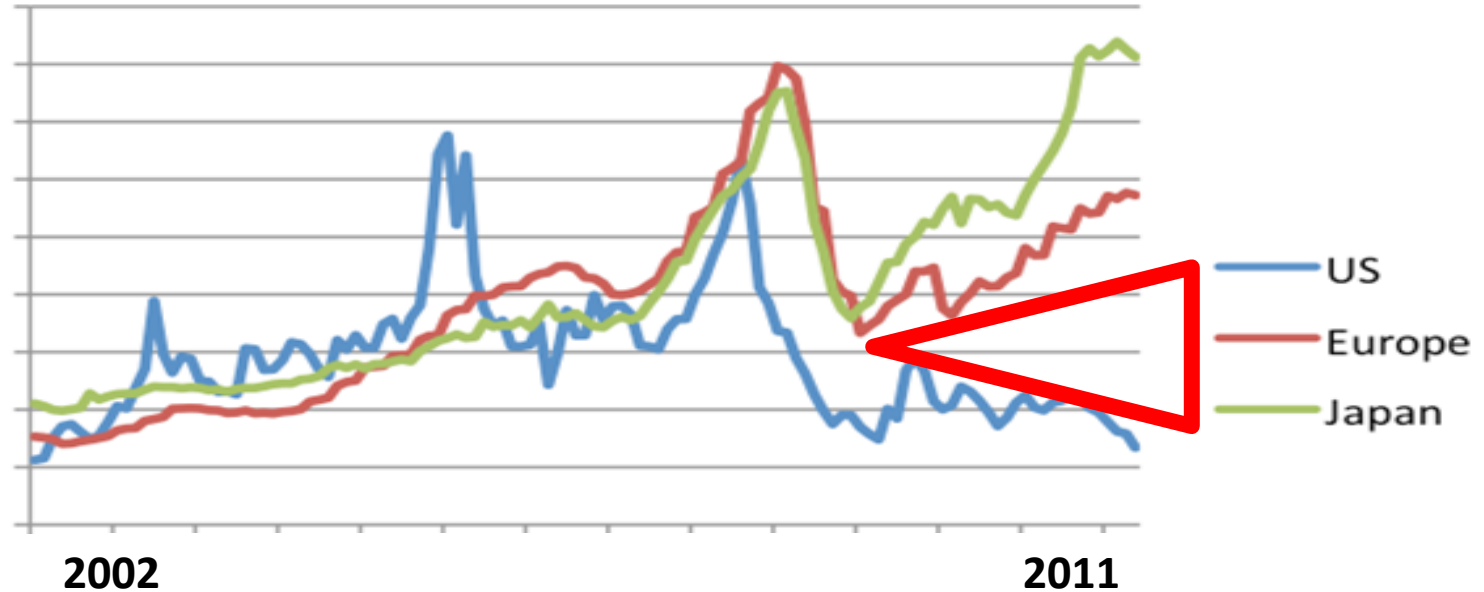
Fracking revolution in gas



US has become a net gas exporter



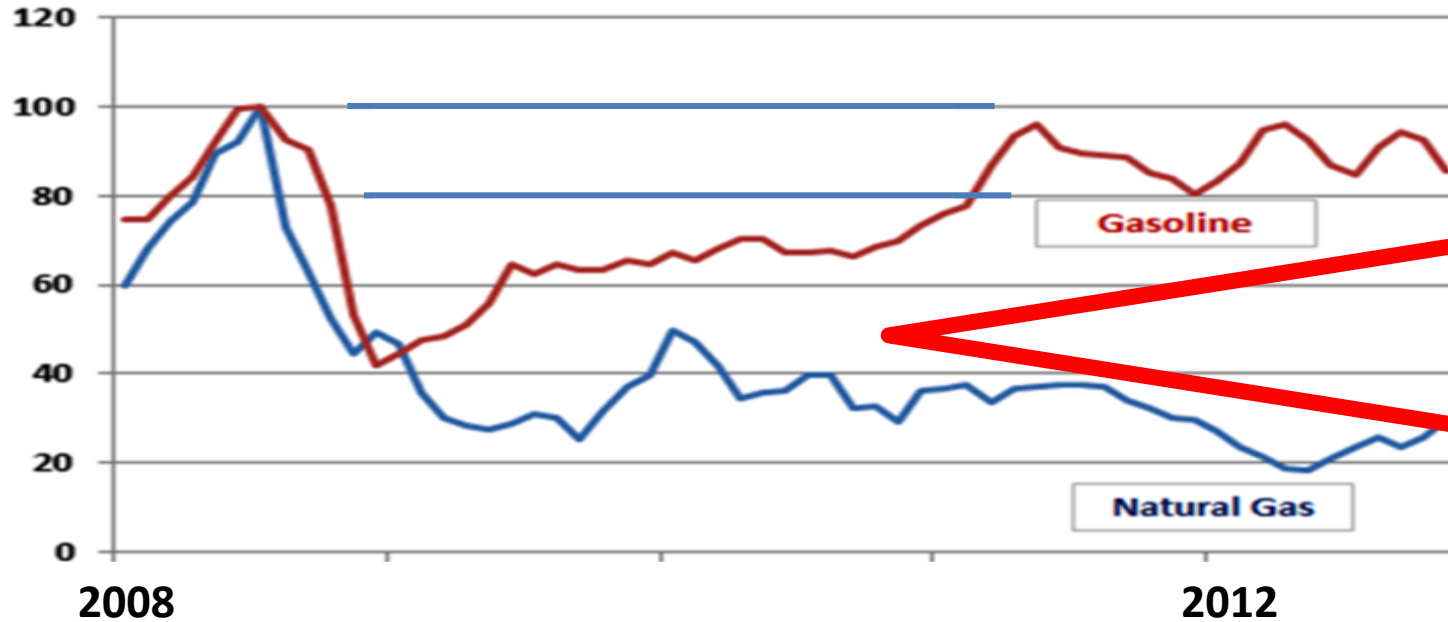
US Gas behaves independent from EU and JP



The Gap gives strong benefits for users of Gas in the USA.



US Gas behaves independent from Oil



The Gap gives strong benefits for users of Gas versus Oil



Two main effects of fracking

- Gas price declined versus Oil
- US gas price declined versus Europe



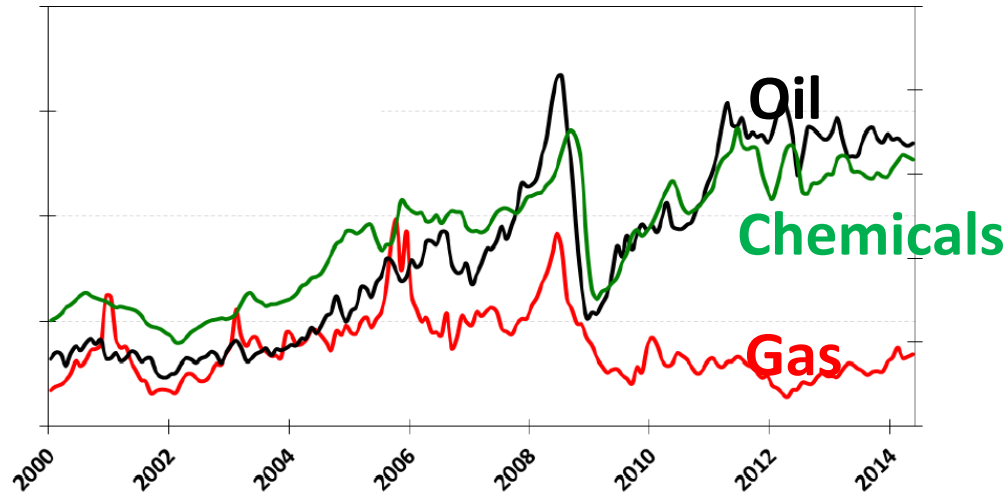
Cracking

Steam Crackers





Prices of chemicals follow Oil, not Gas.



Source: ICIS

When gas is cheaper than oil, the margin of the gas-based supply chain explodes.

New US Ethane Crackers (ICIS, 2014)

Company	Capacity	Downstream	Location	Start-up	Status
Chevron Phillips	1.5m tonnes	HDPE, LLDPE	Cedar Bayou, Texas	Mid-late 2017	Under construction

New US Ethane Crackers (Platts 2016)

Project	Location	Estimated Startup	Nameplate Capacity
Appalachian Resins (AR)	Salem Township, Ohio	2019	275
Axiall	Lake Charles, Louisiana	2019	1000
Badlands	North Dakota	2019	1500
Formosa Plastics	Point Comfort, Texas	2019	800
Total	Port Arthur, Texas	2019	1000
Ascent	Parkersburg, West Virginia	2020	1000
PTTGC	Ohio	2021	n/a
Shell	Monaca, Pennsylvania	2021	1400
Shintech	Louisiana	2021	500
Source: Platts, Platts Petrochemical Analytics		Total	7,475

Shintech	500,000 tonnes	NA	U
----------	----------------	----	---

Gas crackers are added ...

European Cracker closures

Company	Location	Capacity	Shutdown
Total	Antwerp, Belgium (NC1)	250,000 tonnes	2013
Versalis	Priolo, Italy (1 of 2 lines)	470,000 tonnes	Aug-Sep 2013
INEOS	Grangemouth, UK (G4)	320,000 tonnes	Q1 2014
Total	Carling, France	320,000 tonnes	H2 2015
Repsol	Puertollano, Spain	155,000 tonnes (reduction)	2015

...while Naphtha crackers are closed...



Two main shifts in Cracking

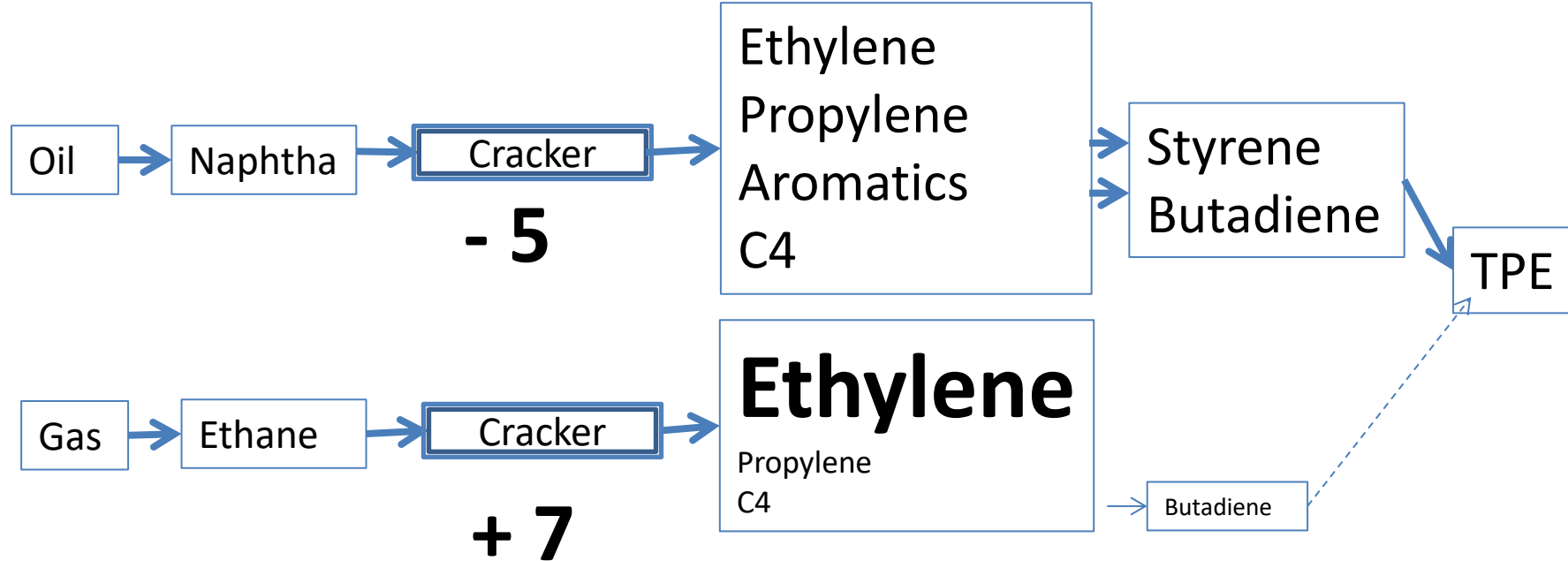
- From Naphtha to Gas
- From Europe to the US

US export of Gas/Ethane by ship will reduce the shift of crackers from Europe to the US, but stimulate conversion from Naphtha to Gas.



Mass Balance

Flows





On purpose production of Butadiene and Aromatics

- Several projects started.
- Most will be more expensive.



By-product credits

- Naphtha crackers can stay open if by-products bring enough credits to compensate for the cost disadvantage.
- Cost advantage* Gas vs. Naphtha:
 - 7x in 2012 - 2013,
 - 3x in 2015 - 2016.
- The price of by-products will increase till the crackers are marginally competitive.

Non-Ethylene credits

Ethane Cracker

Mt BE**

Feedstock	1	1,2
Other Cost		0,2
Sale Ethylene	1	1,4
Sale Byproduct	0	0
Profit		0,2

Naphtha Cracker

Mt BE

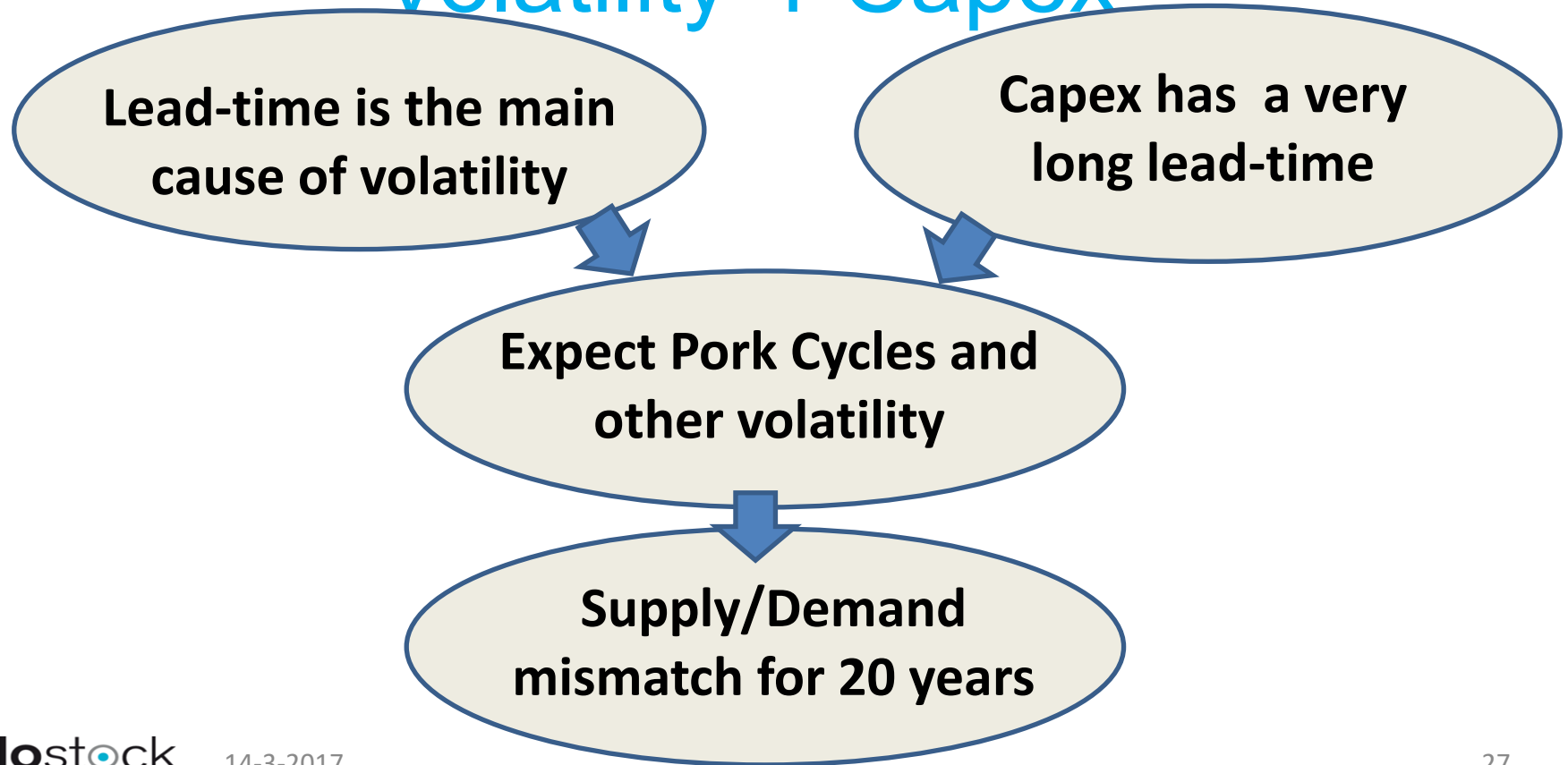
Feedstock	1	1,5
Other Cost		0,2
Sale Ethylene	0,95	1,3
Sale Byproduct	0,05	0,4
Profit		0

Byproduct = 5% → Δ price = 20 x Δ Feedstock advantage



Volatility

Volatility-1 Capex



Volatility-2 Run-Aways

**These are capital
intense industries,
running at high
Utilization Rate.**

**Disruptions
immediately cause
shortages.**

**A shortage may
cause a price run-
away.**



Volatility-3 Prices

- Dedicated production is expensive.
- Small byproducts need to provide big credits for naptha crackers.

Volatility-4 Oil

Shale Oil*



BBC News (World) @BBCWorld · 4h
Price of crude oil surges after
involved for first time



The Associated Press @AP · 6h

BREAKING: OPEC agrees to cut 1.2 million barrels a day from its output to 32.5 million barrels, effective January.



Reuters Top News
Why OPEC cuts may not boost oil

The falling cost of U.S. shale production

changes in oil price
crude to \$60



Conclusions

- Balancing by the ‘invisible hand of the free market’ will be messy,
- TPE precursors will be shifting source and location. Price will be high and volatile.
- Forecasting is possible due to long lead-times and inert capacities. It will give you strong advantage.



Questions? Call Flostock.com!

