A novel modeling technique for the supply chain allows scenario testing of strategic capacity decisions

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Principles of Flostock modeling

Principles

Your demand is caused by downstream demand, modified by the supply chain.

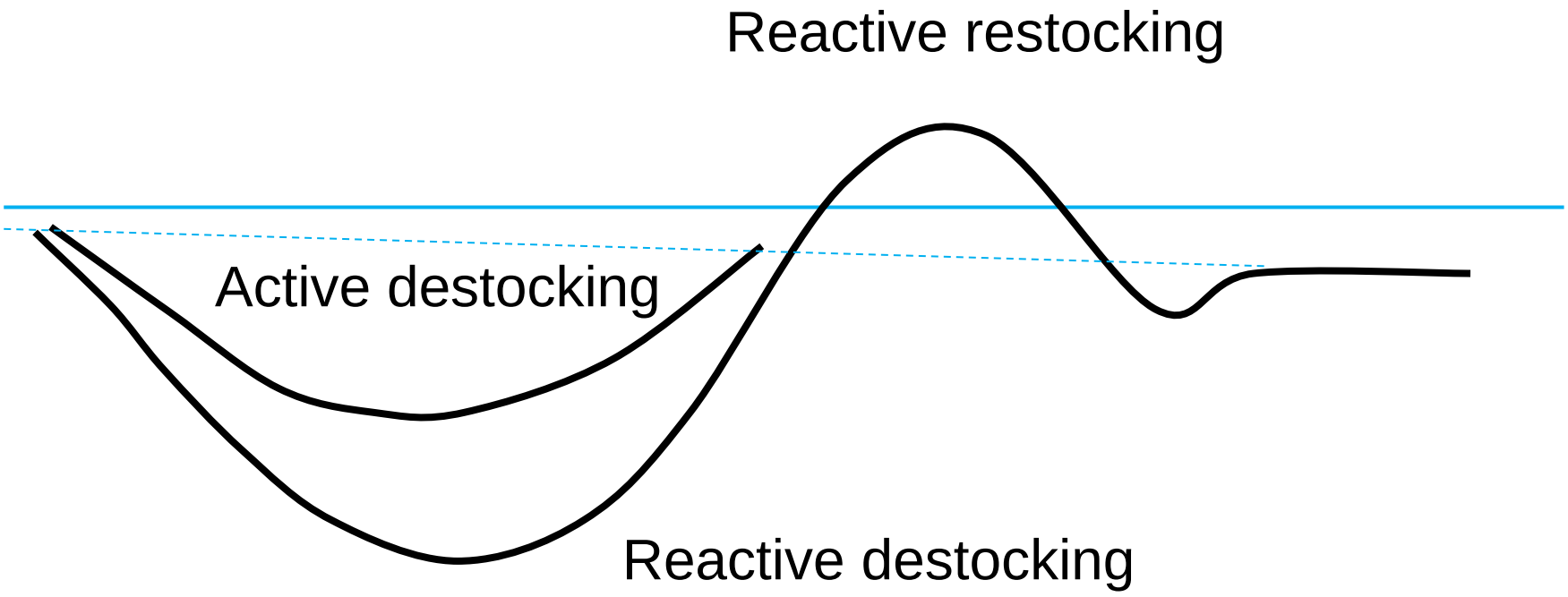
If we can capture the behavior of the chain in a model, we can translate downstream demand into your demand

It is not enough to look at key economic indicators for the end markets,. Challenge is to translate them to your demand.

Libor interest rate 2003 - 2010

The panic after Lehmann Brothers failed in September 2008, caused the Libor interest rate to peak sharply and made banks to stop lending.

This is an example of a trigger for behavior in the chain that needs to be included in the model. The Libor peaked after the bankruptcy of Lehman Brothers, all credit dissappeared overnight and all companies started to steer on cash. The only way to do that fast is by converting inventory into cash.

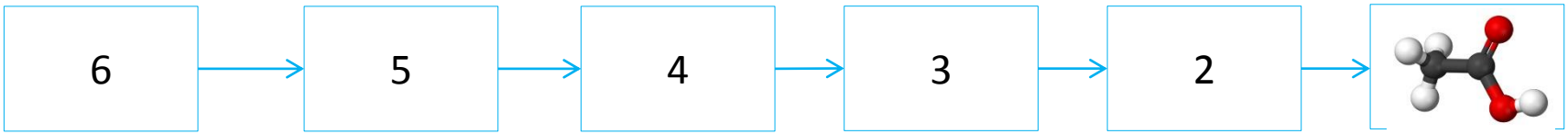


Credit squeeze triggered destocking and started the Lehman Wave

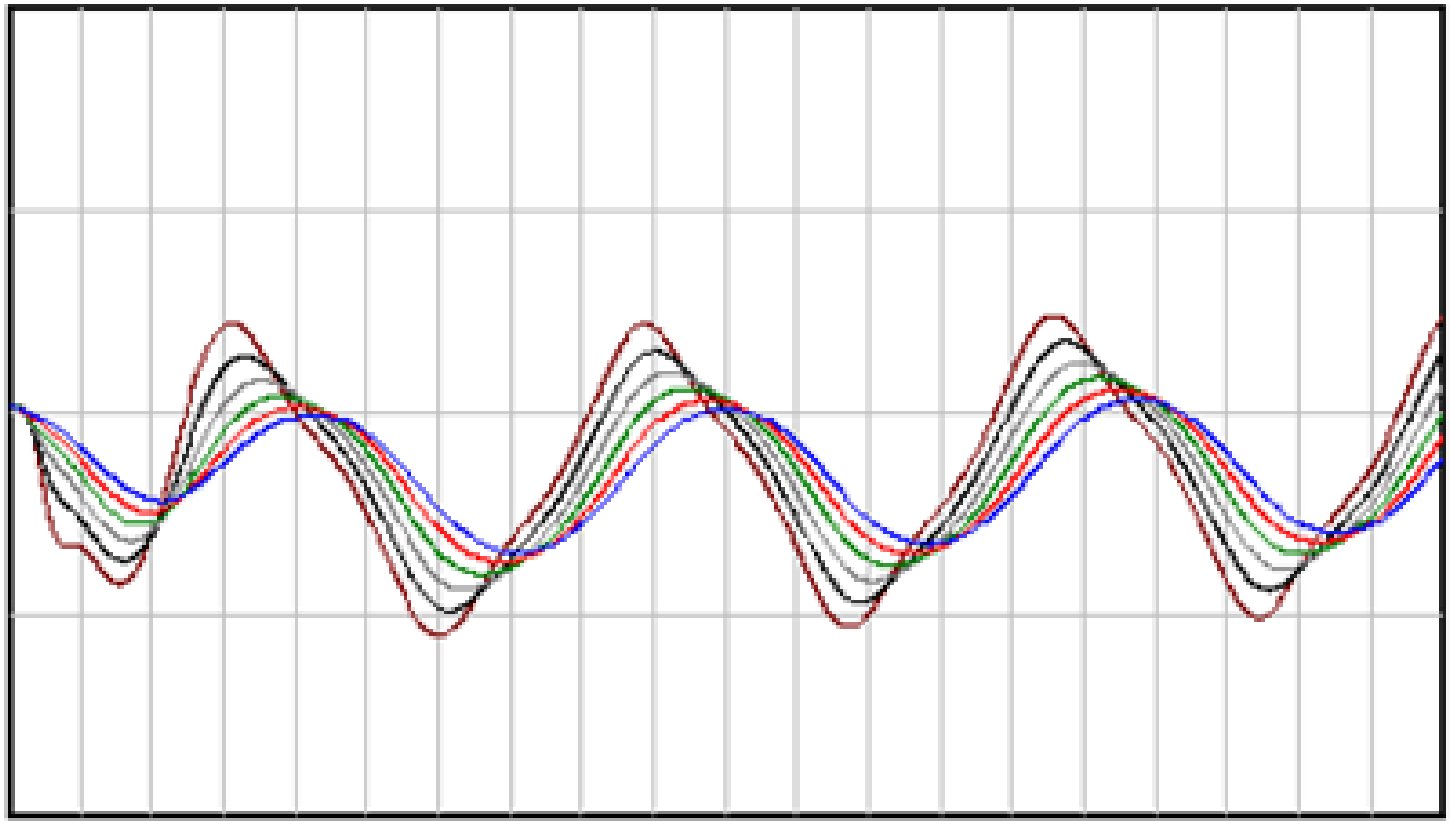
The conscious decision to reduce the stock/sales ratio ,resulted in what we call “Active destocking”. When suppliers experienced that as lower sales they responded with “Reactive de-stocking” to maintain their desired stock/sales ratio. When stock was gone, but end markets were still almost at the original level, stocks were too low and “Reactive restocking” had to take place to maintain the stock/sales ratio, resulting in an upward peak.

Stock depth

Stock depth is the sum of the stock coverage (inventory/sales) of the companies in the chain between you and the end market. It can be as long as a year or more. It is the time a molecule travels.



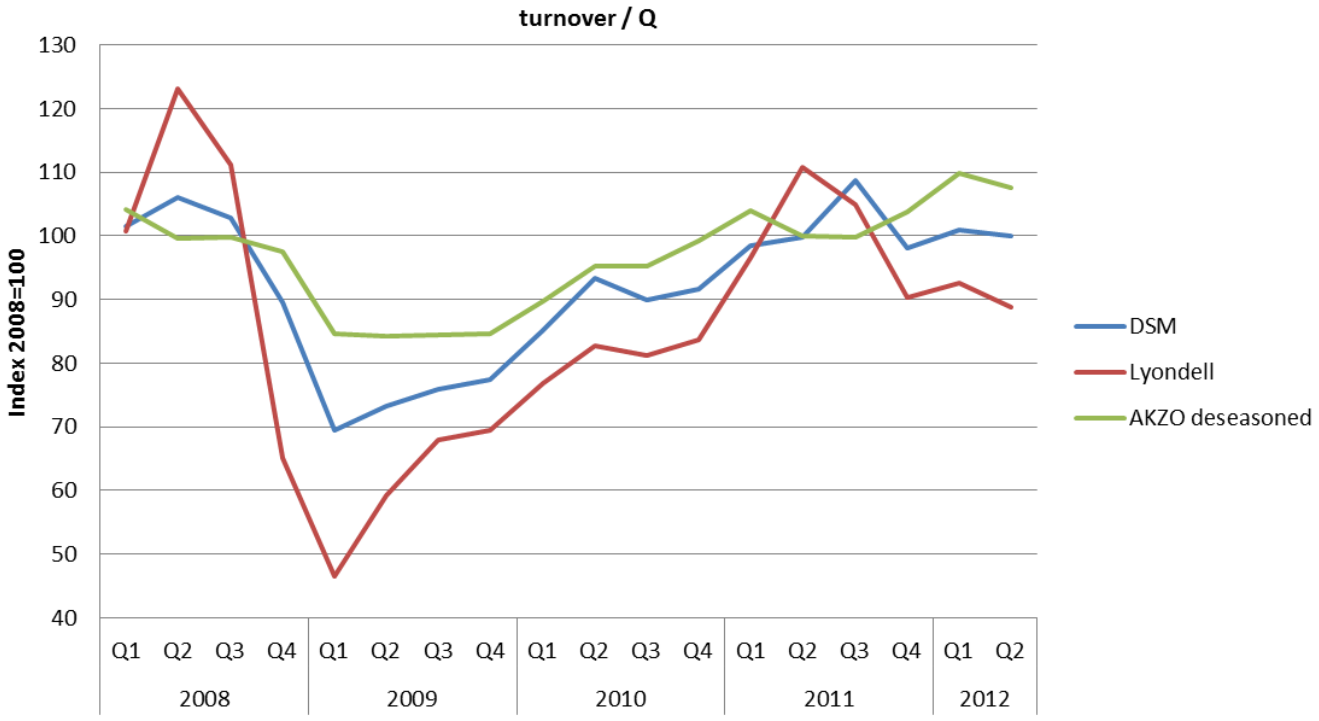
This is a second principle I'd like to explain. "Stock depth" is the total sum of the sales coverage that exists in the chain. NB: coverage calculated in units, not money. It is also the time it takes a molecule to travel the whole length of the chain.



Stock depth

Companies keep stock in proportion to sales, therefore stock building is the 2nd derivative of Sales (“follows changes in growth %”). That makes stocks very volatile and thus upstream companies volatile: basic industries.

Comanies that are further away from the end market, thus having a higher stock depth, have larger amplitudes in the economic wave.



Stock depth example

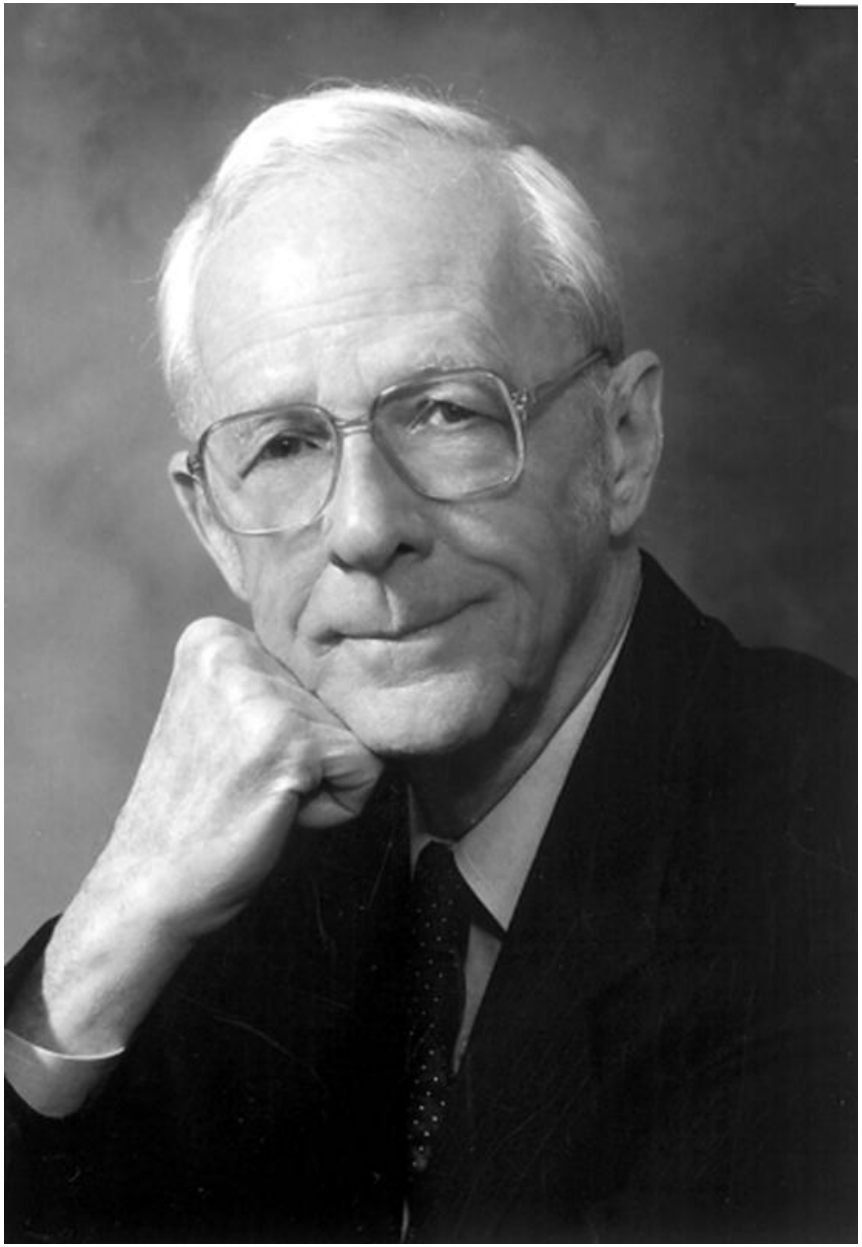
Quarterly turnover data 2008-2012 for LyondellBasell, DSM & AkzoNobel.

Lyondell has a longer Stock depth than DSM, which has a longer one than AkzoNobel. The sales decline in the Lehman Wave was deeper for longer Stock depths.

Modeling

Cause & Effect

Most models (CPB, banks etc) are based on correlation, not cause-and-effect. That means they do not work in times of unexpected volatility. Any model that does not take stocks into account will fail in volatile times. NB: every turn in the economy is volatile and therefore is missed by the correlation models. Without understanding cause-and-effect people tend to follow misleading early indicators, like employment or sentiment like PMI.



Jay Forrester

System Dynamics

System Dynamics was developed in the 70íes by Jay Forrester of MIT. It works with stocks and flows and feedback loops. It is very suitable for scenarios. SD is based on cause & effect relations.

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Massachusetts Institute of Technology

Jan Fransoo

Flostock & Fransoo:

1. Credit panic reduces stock ratios
2. Cumulative effects in the chain & Stock depth
3. Micro – Macro connection

Flostock and Fransoo have added to the existing body of knowledge the insight 1) that a credit panic reduces stock ratios, 2) that the cumulative effect of a supply chain can be modeled and is strogner for longer stock depths and 3) that a supply chain model with indexed data can make the connection between micro demand curves and macro indicators.

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TU/e Technische Universiteit Eindhoven University of Technology

Endorsements

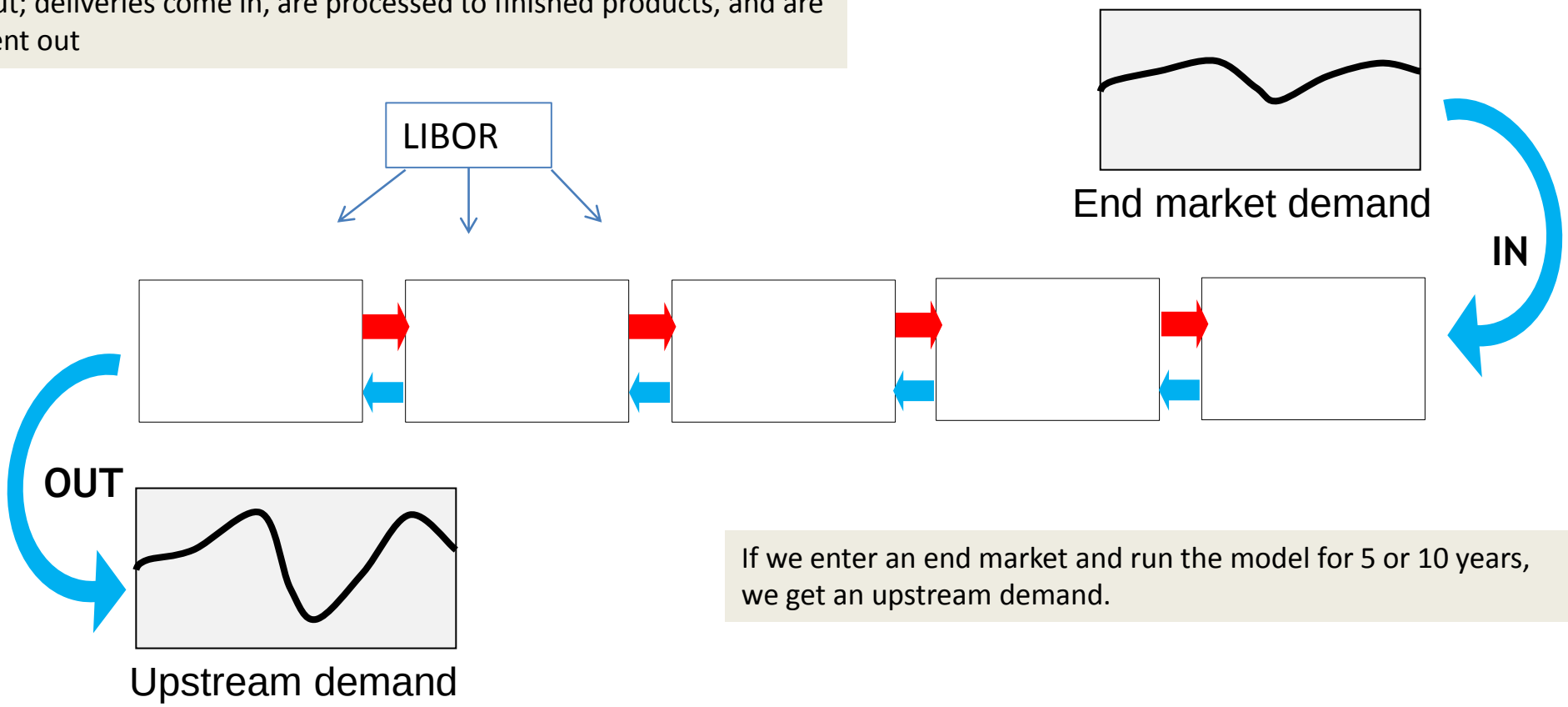
Wharton
University of Pennsylvania

TU/e Technische Universiteit Eindhoven University of Technology

MIT Massachusetts Institute of Technology

The ideas behind Flostock have already been adopted by TUE/e, Wharton, MIT, ECB and Rabobank . The Dutch Central Bureau of Statistic (CBS) decided to start collecting inventory data after our presentation.

Together with Eindhoven University we built in system dynamics software a supply chain model consisting of modules that represent steps in the chain. In each step orders come in and go out; deliveries come in, are processed to finished products, and are sent out



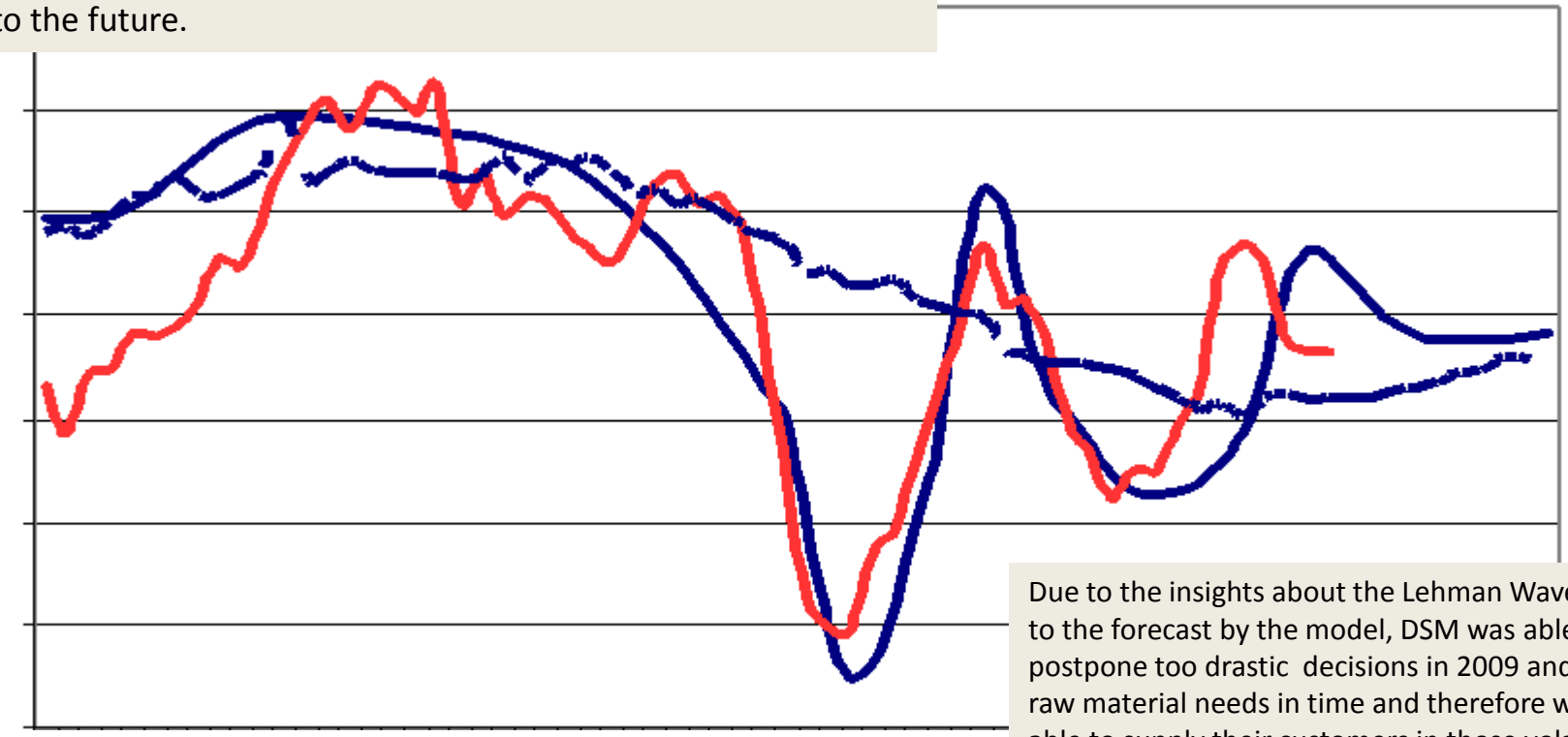
If we enter an end market and run the model for 5 or 10 years, we get an upstream demand.

Supply Chain Model

The Model translates key economic Indicators for end market and stock behavior into upstream demand.

Examples

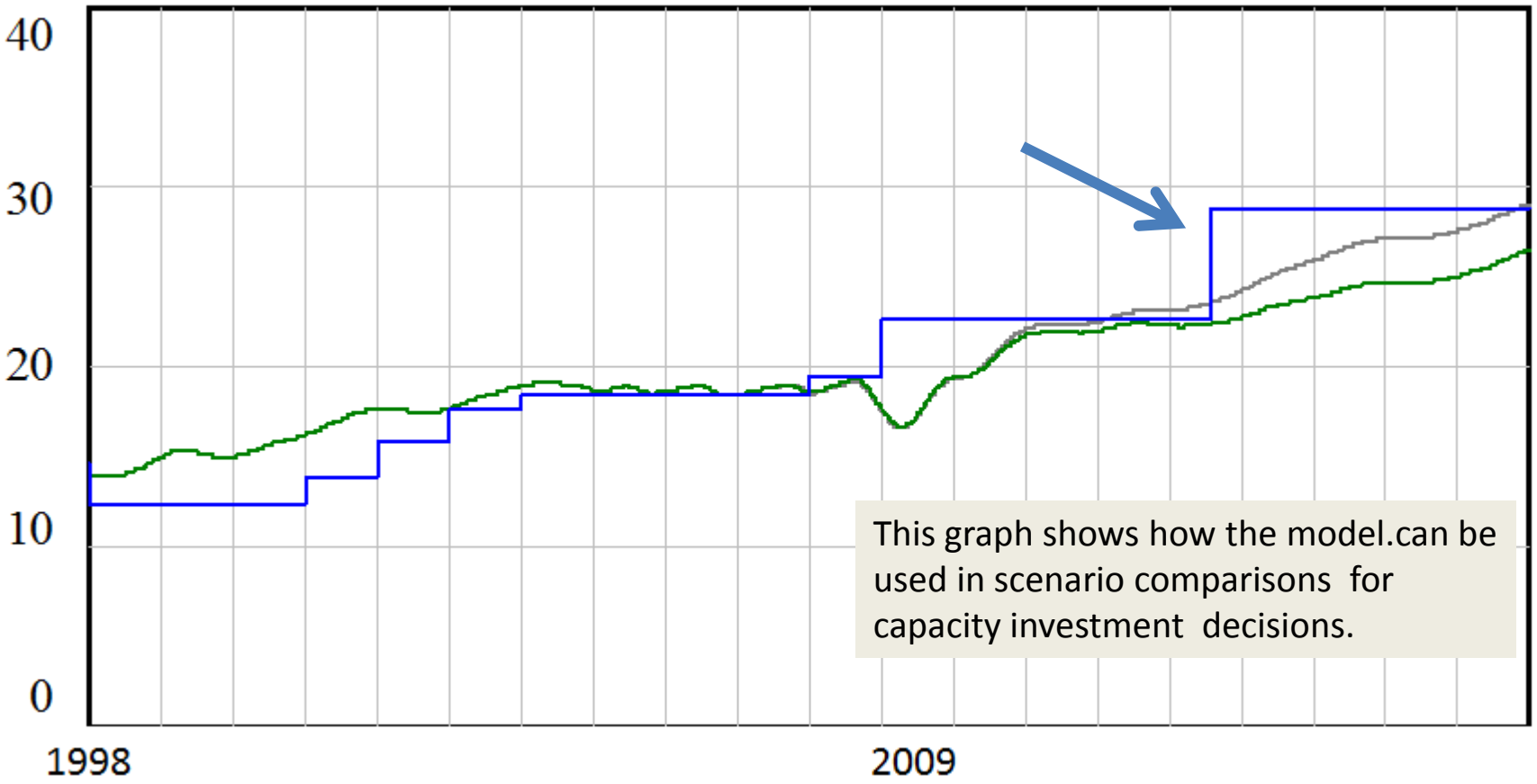
This example is Joinery resins from DSM.
Entering the Euroconstruct curve and the Lehman Wave de-stocking into the model, we created this model sales forecast graph in September 2009. When comparing it with the actual sales we can conclude – in retrospect – that the forecast was very accurate for 2 ½ years into the future.



Construction end market

- Construction
- Model sales
- Actual sales DSM

Due to the insights about the Lehman Wave and due to the forecast by the model, DSM was able to postpone too drastic decisions in 2009 and cover its raw material needs in time and therefore was better able to supply their customers in those volatile times than many other companies. By chance we can compare the turnover with a direct competitor, who did take harsh measures early and could not supply, which may have resulted in a 15% MS gain for DSM. These results were published by Flostock and DSM in the ECJ of October 2011.



Capacity investment decisions

5 % extra capacity mid 2013 is enough to cover demand in an average or good scenario until 2017.

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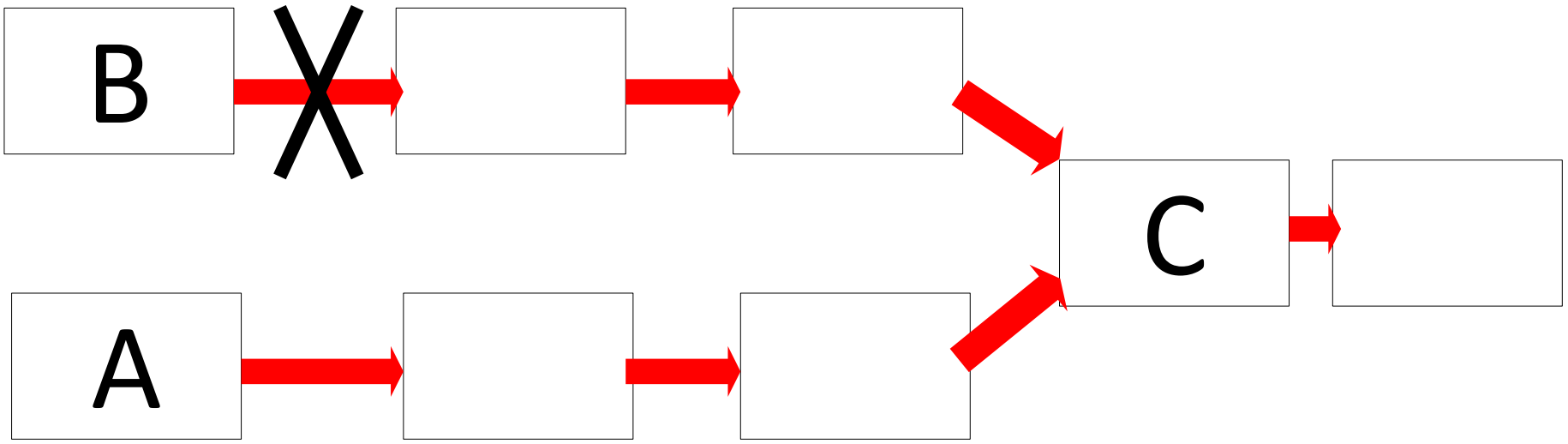
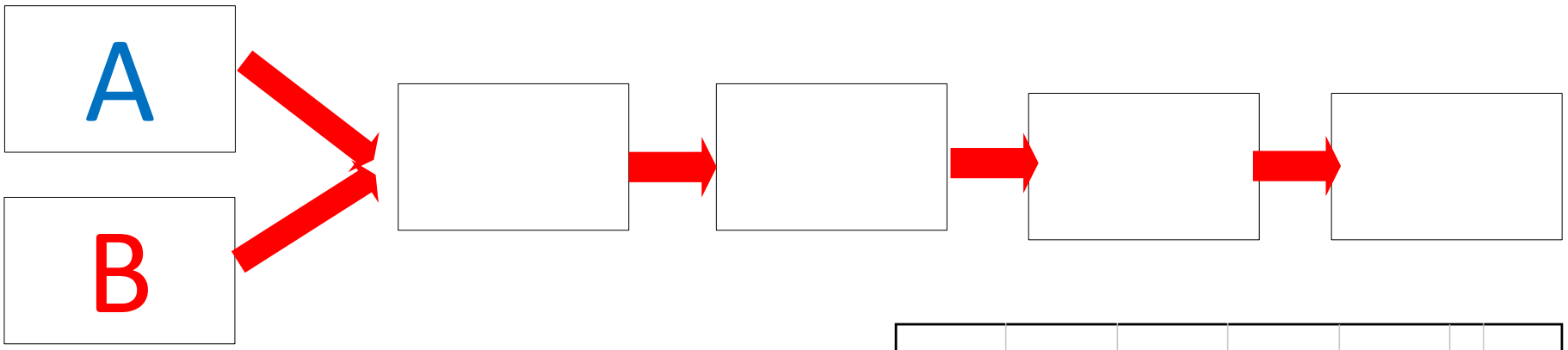
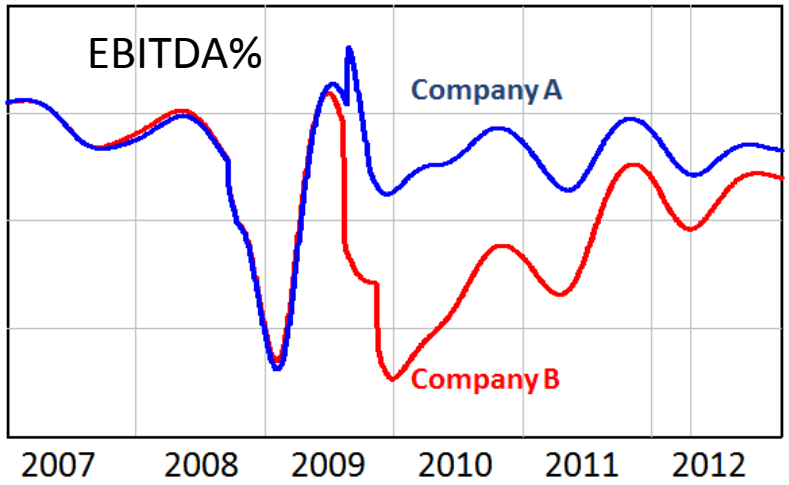


Parallel Supply Chain

This example shows how the model can be used to assess the impact of a blockade (natural disaster?) in a parallel supply chain. Chain B is blocked and will deplete. When C does no longer get parts from B, also the orders to A will stop. When B re-opens, both chains will re-start with waves going through the echelons.





2 Competitors with different policies

The model can also be used to assess the impact of two competing policies. The model can calculate the results not only in volume but also in financial indicators such as EBITDA, NPV etc.

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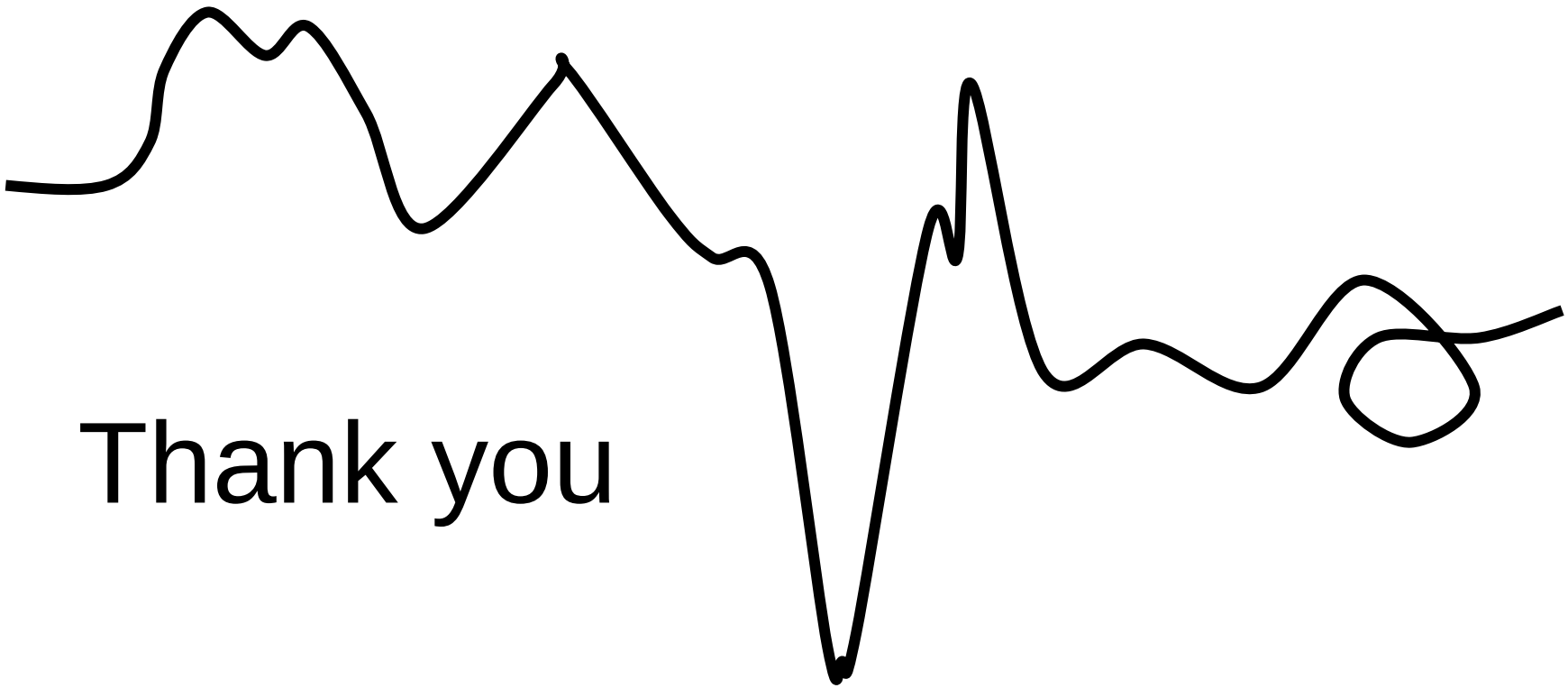
Conclusions

Volatility increases the relative influence of stock: therefore more accurate.

Supply chain model can translate downstream economic indicators for the end market into upstream demand, taking behavior into account. False beacons should be avoided.

System dynamics was designed for scenario testing: when combined with the Flostock insights about supply chain and stock depth it is a powerful tool for industry.

Flostock is still a small company, a start-up from 2011, but last month I hired my first full time employee, a cum laude graduate from Eindhoven University of Technology. We are the only one in the world doing what we do, but I expect that not for long other companies will follow. I believe that within 5 or 10 years it will be as common to have a supply chain analysis tool as it is now to have an ERP system.



Thank you

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We predict what you promise…