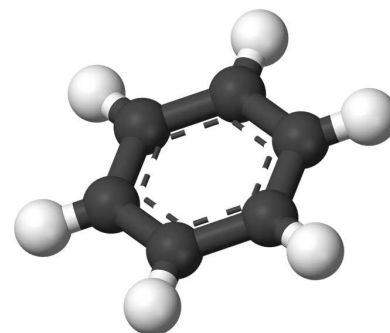
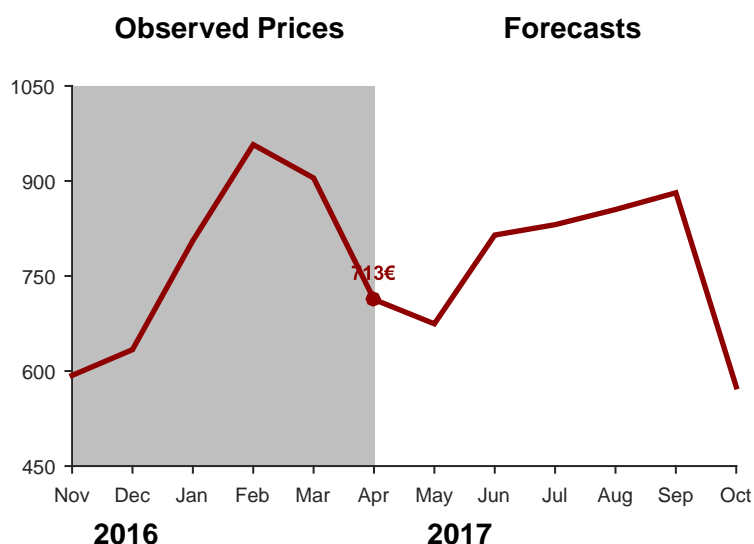


Forecasting the Price of Benzene

Commodity	Benzene (Spot FOB Rotterdam)
Forecast Period	May 2017 – October 2017
Currency	€
Unit	Metric Tonne
Observations	Monthly forecasts of the spot price in the first day of the month



Forecasts



Month/Year	Forecast	Prob. of Raise
May 2017	675€	49 %
Jun. 2017	815€	53 %
Jul. 2017	831€	53 %
Aug. 2017	855€	60 %
Sep. 2017	881€	55 %
Oct. 2017	575€	45 %

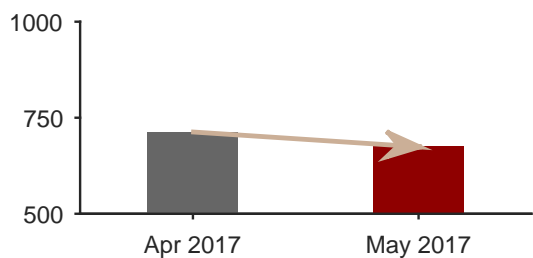
Suggested Action for Procurement

Purchase Limit Month	Suggested Action
May 2017	Buy in May
June 2017	Buy part of requirements
July 2017	Buy part of requirements
August 2017	Buy part of requirements
September 2017	Buy part of requirements
October 2017	Buy part of requirements

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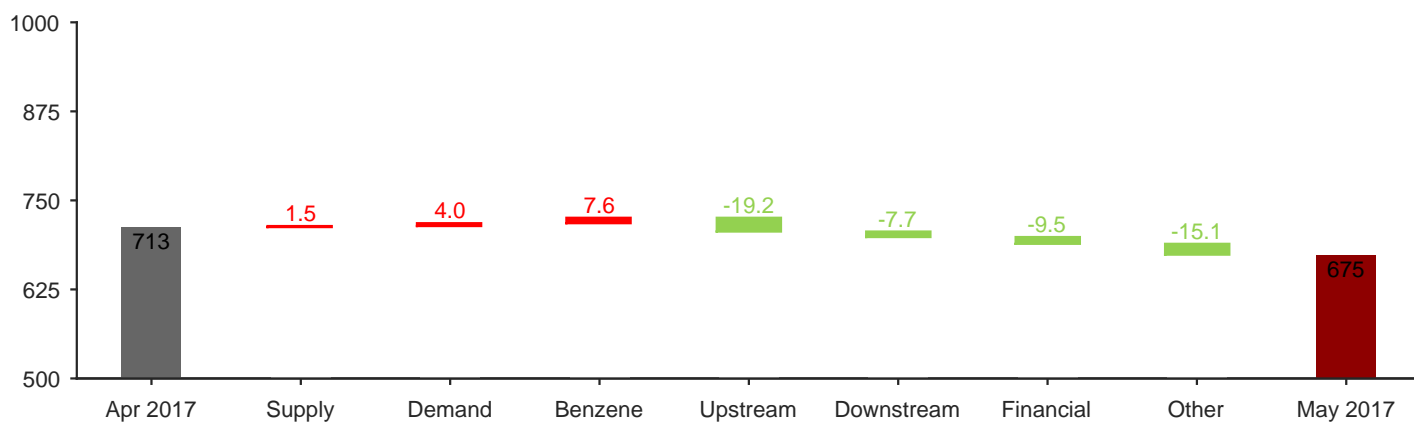
Forecasting the Price of Benzene

Impact Analysis: One Month Forecast



Our algorithm forecasts a lower price of Benzene in one month: it is expectable that the price decreases 5.39% from 713€ to 675€ until the beginning of May.

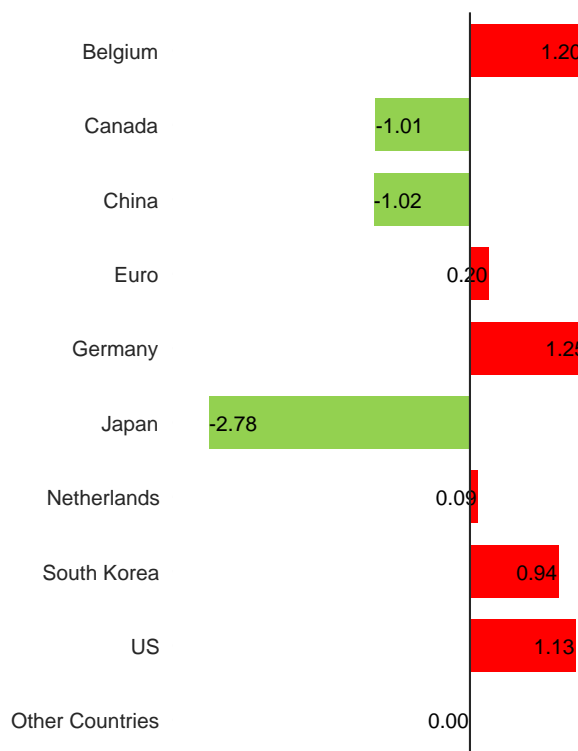
Indices of Factors



Interpretation

- Slight decrease of Supply: Positive pressure of the Supply index
- **Increase of Demand:** Positive pressure of the Demand index
- Positive pressure of the index of Benzene
- **Considerably negative pressure of the index of variables representing the market upstream**
- Negative pressure of the index of variables representing the market downstream
- Negative pressure of the financial index
- Negative pressure of other commodities and other factors
- Focus on Taiwan, Japan, and Thailand

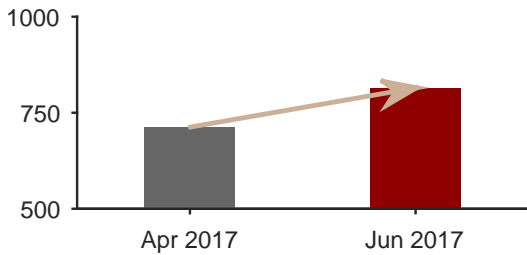
Impact per Country



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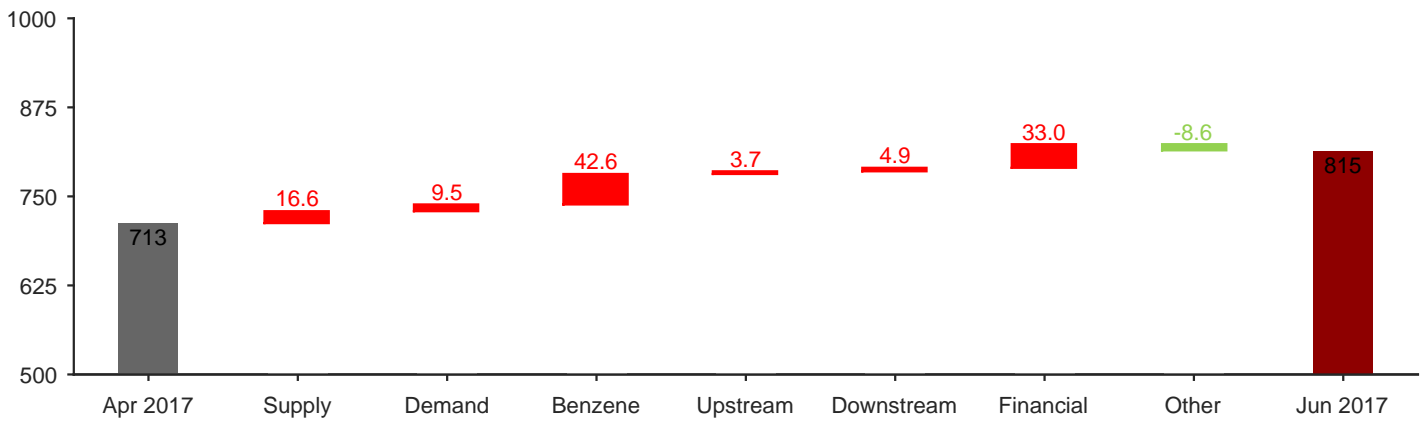
Forecasting the Price of Benzene

Impact Analysis: Two Months Forecast



Our algorithm forecasts a higher price of Benzene in two months: it is expectable that the price increases 14.25% from 713€ to 815€ until the beginning of June.

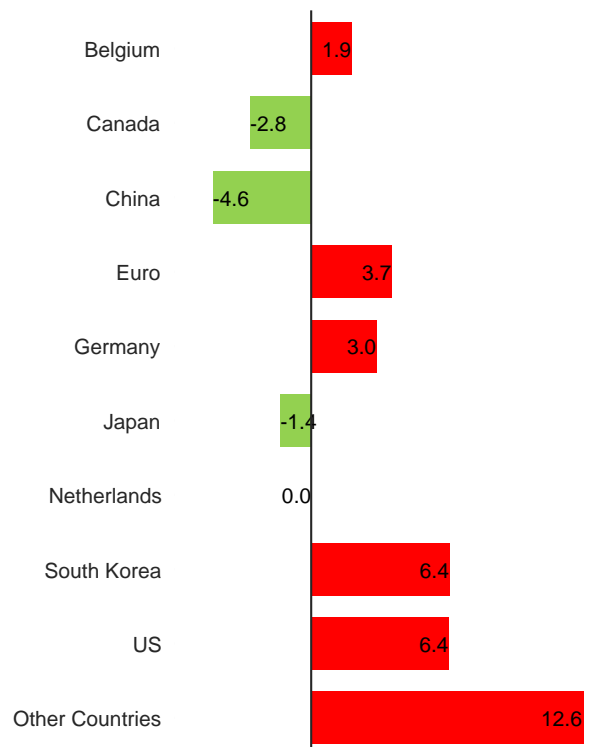
Indices of Factors



Interpretation

- **Decrease of Supply:** Positive pressure of the Supply index
- **Increase of Demand:** Positive pressure of the Demand index
- **Considerably positive pressure of the index of Benzene**
- Slightly positive pressure of the index of variables representing the market upstream
- Positive pressure of the index of variables representing the market downstream
- Positive pressure of the financial index
- Negative pressure of other commodities and other factors
- Focus on Thailand, UK, and South Korea

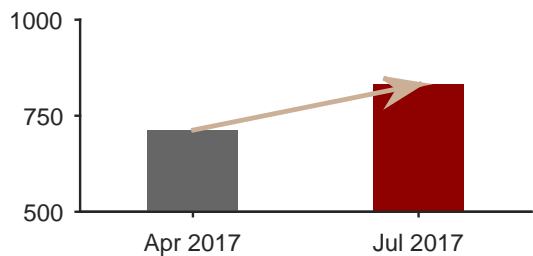
Impact per Country



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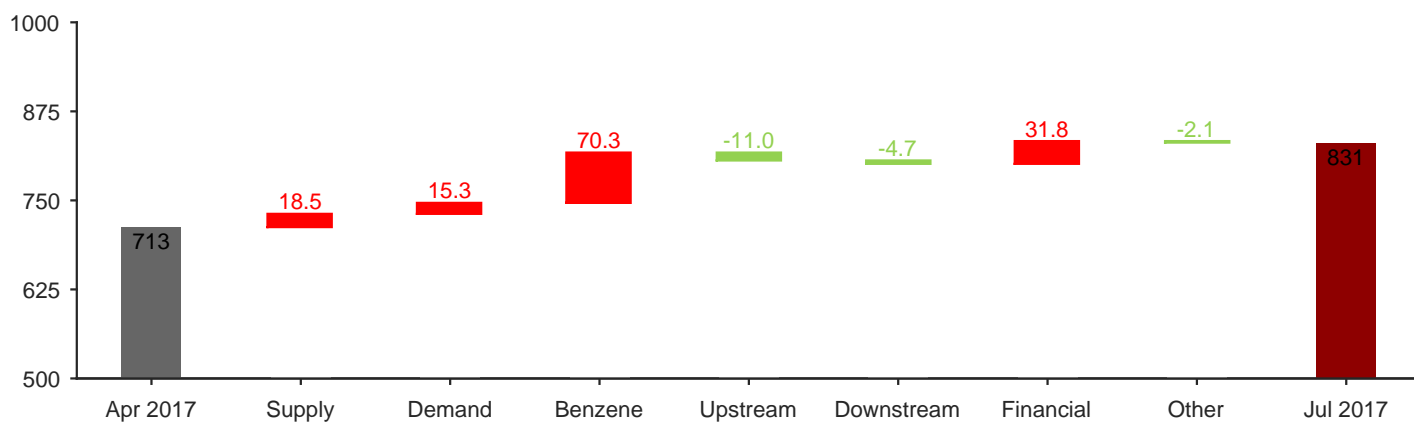
Forecasting the Price of Benzene

Impact Analysis: Three Months Forecast



Our algorithm forecasts a higher price of Benzene in three months: it is expectable that the price increases 16.55% from 713€ to 831€ until the beginning of July.

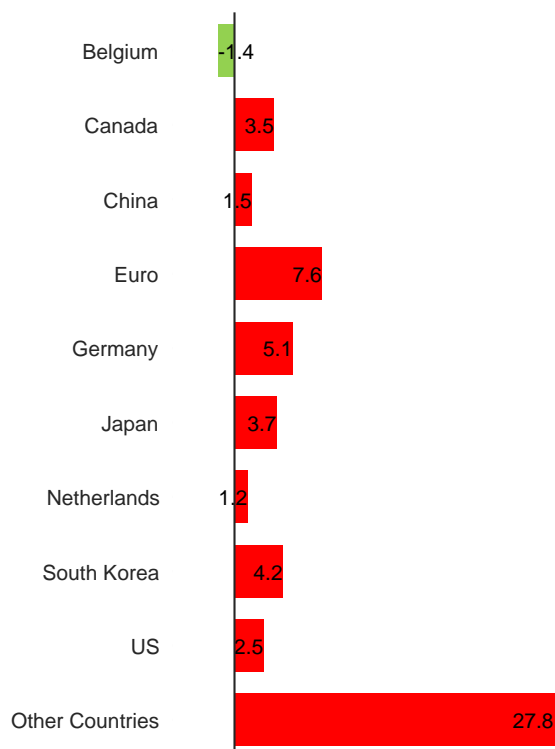
Indices of Factors



Interpretation

- **Decrease of Supply:** Positive pressure of the Supply index
- **Increase of Demand:** Positive pressure of the Demand index
- **Considerably positive pressure of the index of Benzene**
- Negative pressure of the index of variables representing the market upstream
- Slightly negative pressure of the index of variables representing the market downstream
- Positive pressure of the financial index
- Slightly negative pressure of other commodities and other factors
- Focus on Thailand, Euro, and UK

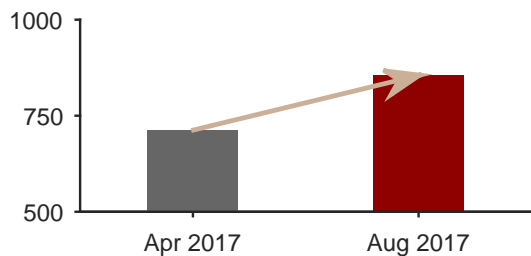
Impact per Country



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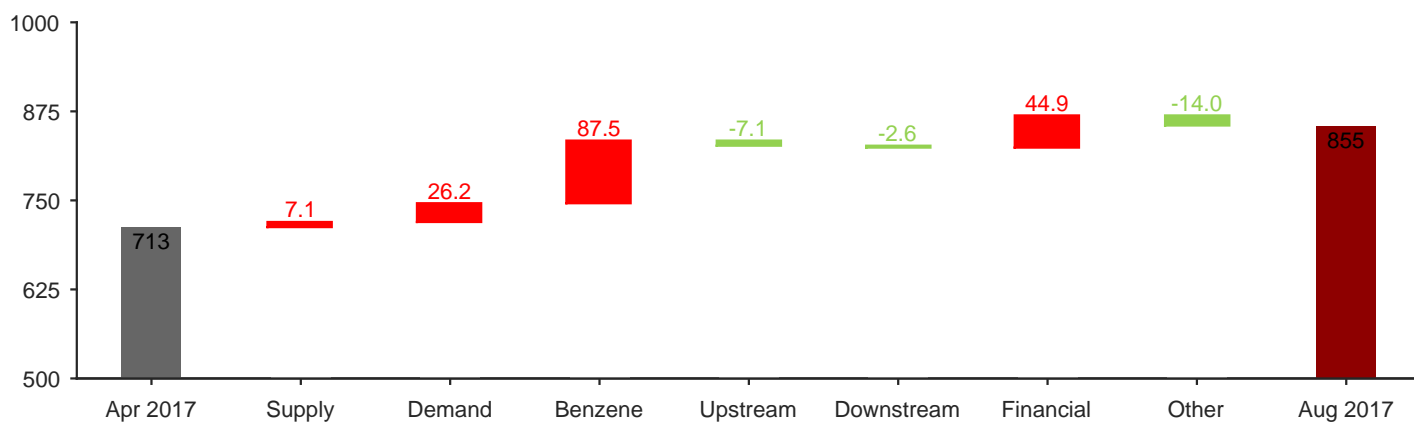
Forecasting the Price of Benzene

Impact Analysis: Four Months Forecast



Our algorithm forecasts a higher price of Benzene in four months: it is expectable that the price increases 19.90% from 713€ to 855€ until the beginning of August.

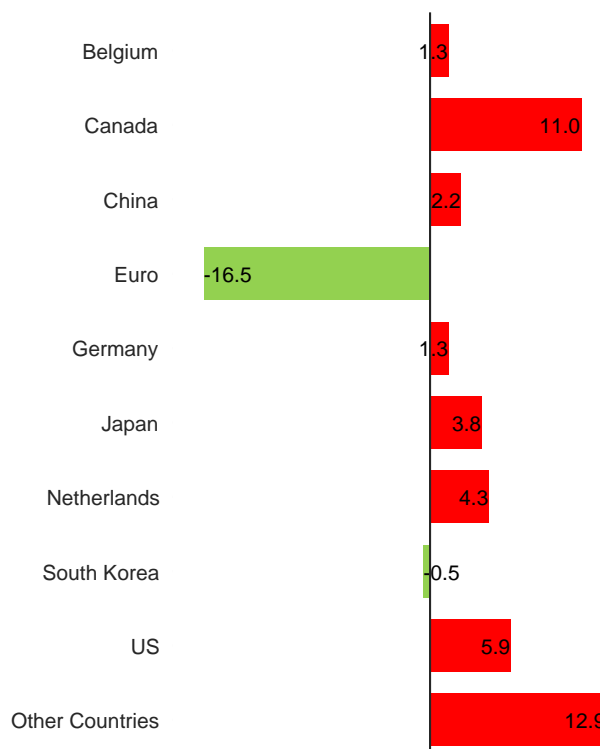
Indices of Factors



Interpretation

- **Decrease of Supply:** Positive pressure of the Supply index
- **Increase of Demand:** Positive pressure of the Demand index
- **Considerably positive pressure of the index of Benzene**
- Negative pressure of the index of variables representing the market upstream
- Slightly negative pressure of the index of variables representing the market downstream
- **Considerably positive pressure of the financial index**
- Negative pressure of other commodities and other factors
- Focus on Euro, UK, and Canada

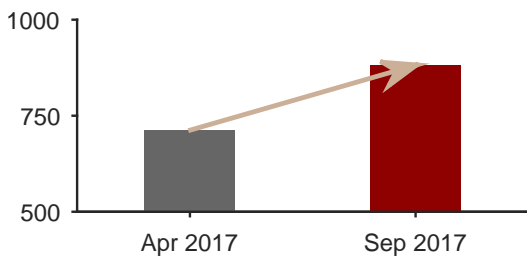
Impact per Country



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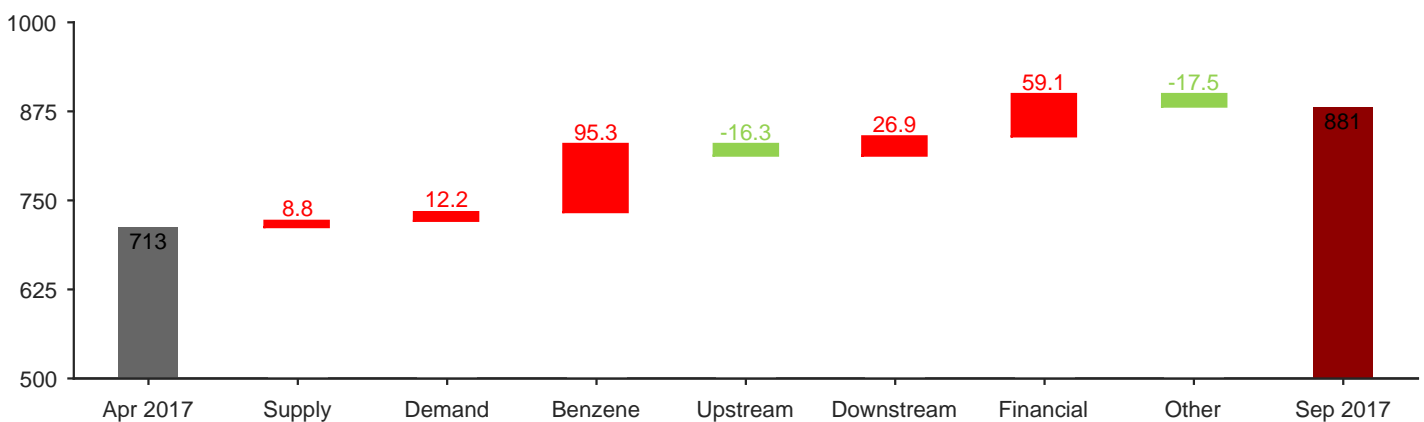
Forecasting the Price of Benzene

Impact Analysis: Five Months Forecast



Our algorithm forecasts a higher price of Benzene in five months: it is expectable that the price increases 23.61% from 713€ to 881€ until the beginning of September.

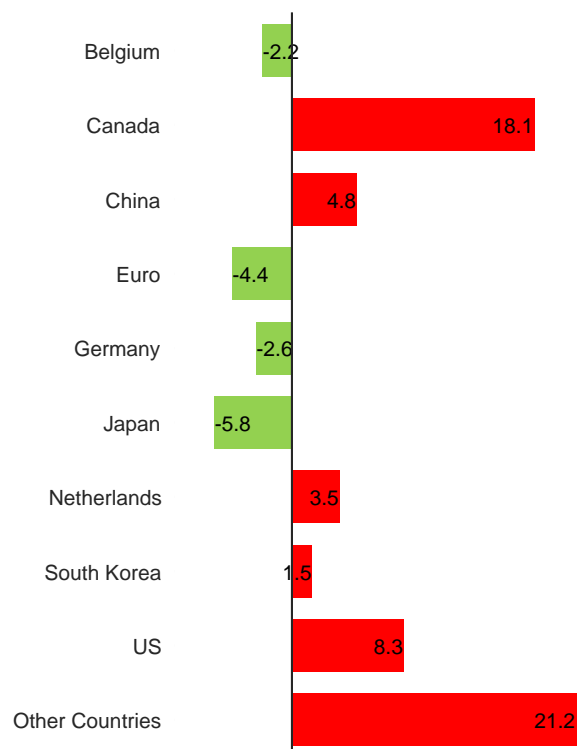
Indices of Factors



Interpretation

- **Decrease of Supply:** Positive pressure of the Supply index
- **Increase of Demand:** Positive pressure of the Demand index
- **Considerably positive pressure of the index of Benzene**
- Negative pressure of the index of variables representing the market upstream
- Positive pressure of the index of variables representing the market downstream
- **Considerably positive pressure of the financial index**
- Negative pressure of other commodities and other factors
- Focus on UK, Canada, and Taiwan

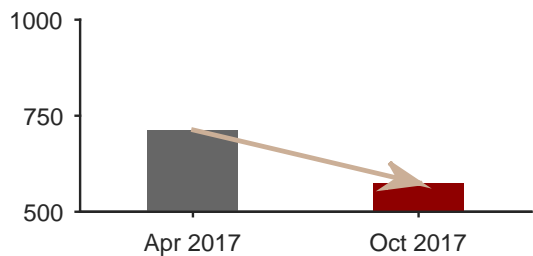
Impact per Country



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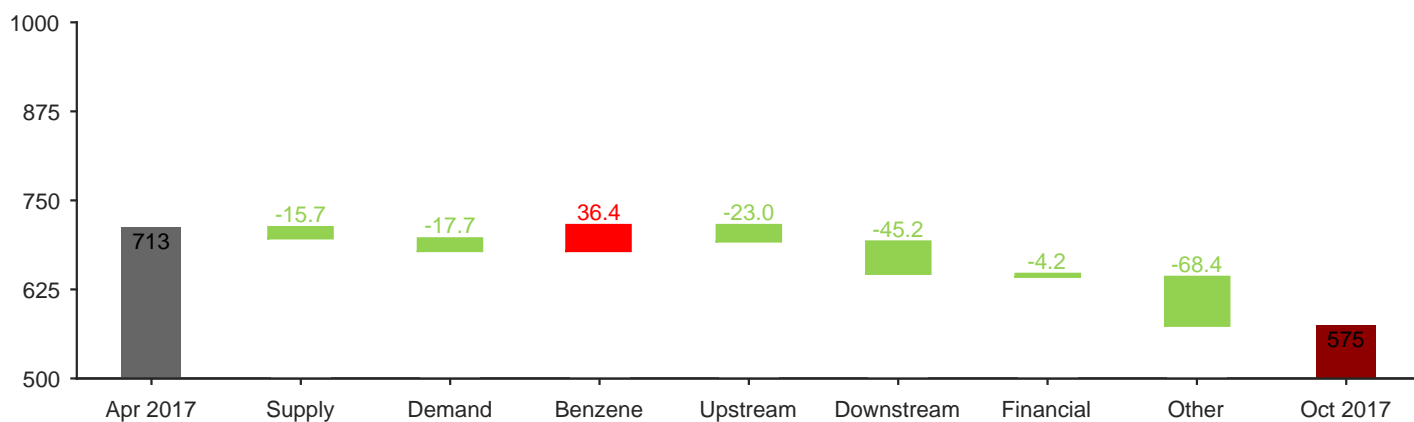
Forecasting the Price of Benzene

Impact Analysis: Six Months Forecast



Our algorithm forecasts a lower price of Benzene in six months: it is expectable that the price decreases 19.33% from 713€ to 575€ until the beginning of October.

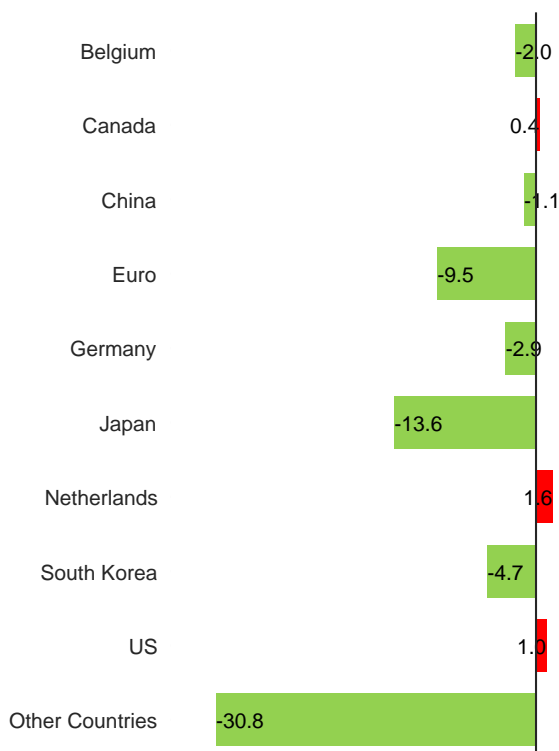
Indices of Factors



Interpretation

Impact per Country

- **Increase of Supply:** Negative pressure of the Supply index
- **Decrease of Demand:** Negative pressure of the Demand index
- **Considerably positive pressure of the index of Benzene**
- Negative pressure of the index of variables representing the market upstream
- **Considerably negative pressure of the index of variables representing the market downstream**
- Slightly negative pressure of the financial index
- **Considerably negative pressure of other commodities and other factors**
- Focus on Japan, Taiwan, and Singapore



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Forecasting the Price of Benzene

APPENDIX – Technical Explanation of the Impact Analysis

In this appendix, we explain the impact analysis of the factors that most contribute for our forecasts.

This Impact Analysis is conducted individually for **each time horizon**, allowing for a distinction between the indices of variables that contribute for our forecasts at short and medium run.

For each time horizon, our analysis has **two components**: first, we present the impact of variables grouped by **indices of factors**; second we present the impact of variables grouped by **indices of countries**.

Indices of Factors

Indices of factors are indices of the weighted contributions of the variables grouped in those factors.

Supply Index: composed of macroeconomic variables of the producing and exporting countries. It includes variables such as production, exchange rates, inflation, monetary policy, and wages. For example, an increase in wages implies higher production costs which should (in linear, general, and ceteris paribus terms) generate an incentive to increase prices;

Demand index: composed of macroeconomic variables of the consuming and importing countries. It includes variables such as production, exchange rates, inflation, monetary policy, and wages. For example, a decrease in a consumer confidence index should (in linear, general, and ceteris paribus terms) increase savings and decrease demand, leading to lower prices;

Benzene Index: composed of variables related to Benzene. It includes variables such as the price of Benzene in different regions of the world and exports, imports, and producer prices of Benzene in some countries. For example, an increase in the price of Benzene in other region may imply an increase in the price of Benzene in Europe due to arbitrage movements;

Upstream index: composed of variables related to Oil and Natural Gas. It includes variables such as the price and exports, imports, and producer prices of the inputs in some countries. For example, an increase in the price of Oil should (in linear, general, and ceteris paribus terms) generate an increase in the price of Benzene;

Forecasting the Price of Benzene

APPENDIX – Technical Explanation of the Impact Analysis (II)

Downstream index: composed of variables related to Styrene and downstream industries, such as Packaging. It includes variables such as the exports, imports, and producer prices of the Plastic Industry in some countries. For example, an increase in the demand of Plastic should (in linear, general, and ceteris paribus terms) generate an increase in the price of Benzene;

Financial Variables Index: composed of financial market variables. It includes the share price of companies that produce Benzene. It also includes financial indices related to this sector. For example, a positive change in the share price of a producer of Benzene should (in linear, general, and ceteris paribus terms) imply an increase in expected profitability of the firm. This may signal an expectation of increase in the price of Benzene;

Other Variables Index: composed of variables related to other commodities, such as Propylene, Toluene, and Ethylene. It includes the price, exports, and imports of these commodities. For example, a positive change in the price of a substitute commodity, should (in linear, general, and ceteris paribus terms) imply an increase of demand of Benzene, and thus, of the price of Benzene.

Indices of Countries

Indices of Countries: are indices of the weighted contributions of the macroeconomic variables of each country. The countries we present are the most relevant countries in the production, consumption, and international commerce of Benzene.

Interpretation Warning

It is important to note that the contribution of individual variables and indices of variables is not linear. The interaction between variables and between variables of different factors may not be neglectable, which means that the importance of each variable and indices of variables is determined together with the importance of all other variables.

Furthermore, the analysis of changes in variables is not linear. This means that the same variable with the same change in different moments of time may have different impacts given its previous evolution. For example, the algorithm contrasts the change in a variable with its expected change. A positive change but inferior to the expected change may originate an effect of price correction.