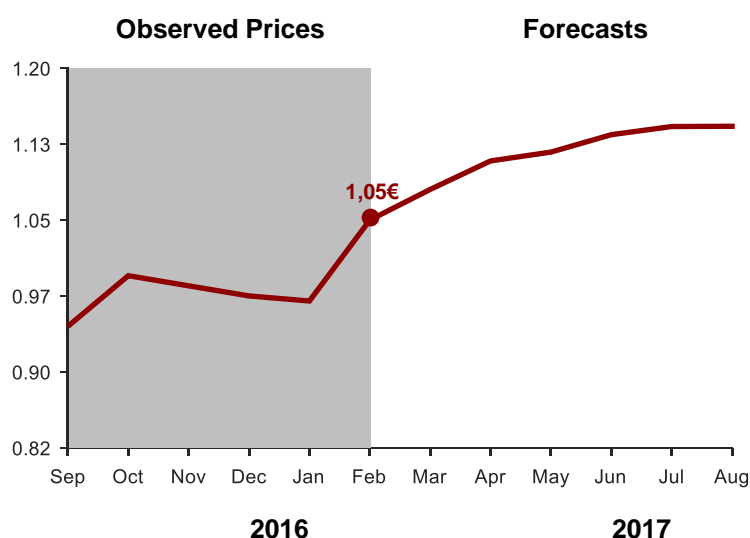


Forecasting the Price of Polypropylene

Commodity	Polypropylene Copolymer (Spot FD NW Europe)
Forecast Period	March 2017 – August 2017
Currency	€
Unit	Kilogram
Observations	Monthly forecasts of the spot price in the first day of the month



Forecasts



Month/Year	Forecast	Prob. Of Raise
Mar. 2017	1,08€	90%
Abr. 2017	1,11€	94%
Mai. 2017	1,12€	80%
Jun. 2017	1,13€	77%
Jul. 2017	1,14€	67%
Aug. 2017	1,14€	52%

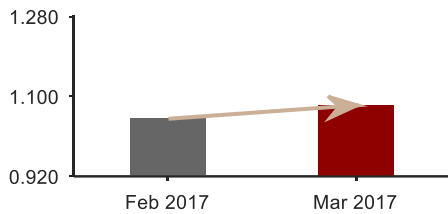
Suggested Action for Procurement

Purchase Limit Month	Suggested Action
March 2017	Buy in February at 1,05€
April 2017	Buy in February at 1,05€
May 2017	Buy in February at 1,05€
June 2017	Buy in February at 1,05€
July 2017	Buy in February at 1,05€
August 2017	Buy in February at 1,05€

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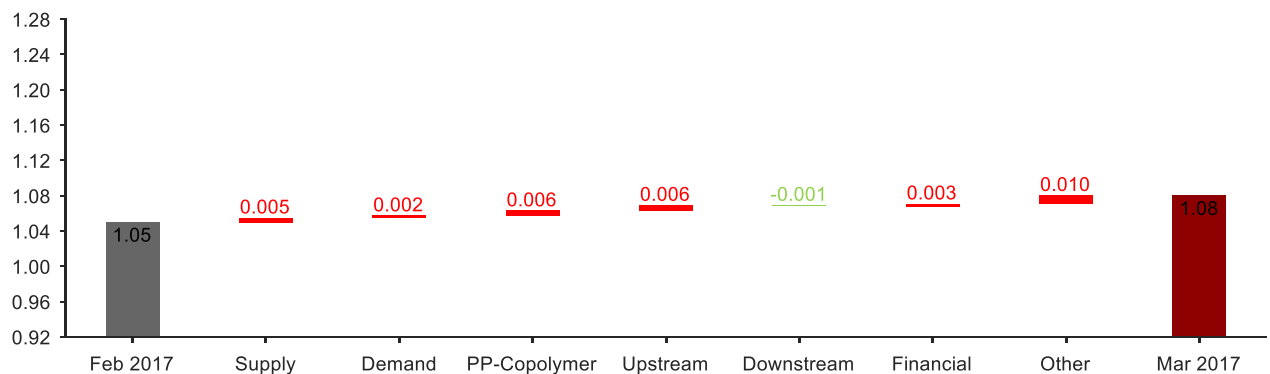
Forecasting the Price of Polypropylene

Impact Analysis: One Month Forecast



Our algorithm forecasts a higher price of PP-Copolymer in one month: it is expectable that the price increases 2,87% from 1,05€ to 1,08€ until the beginning of March.

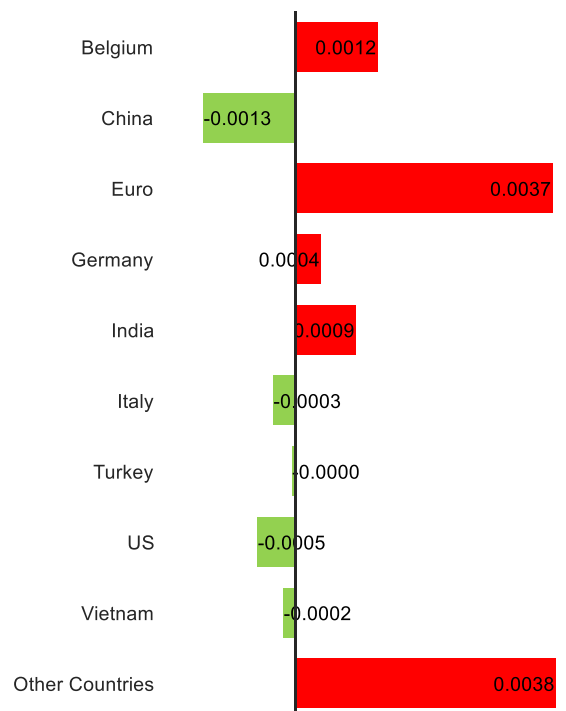
Indices of Factors



Interpretation

- **Decrease of Supply:** Positive pressure of the Supply index
- **Increase of Demand:** Positive pressure of the Demand index
- Positive pressure of the index of PP-Copolymer
- Positive 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
- **Considerably positive pressure of other commodities and other factors**
- Focus on Euro, Singapore, and China

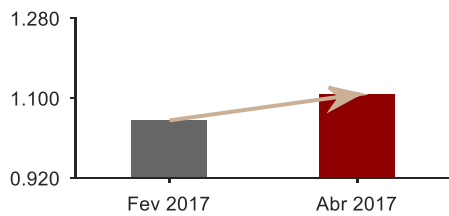
Impact per Country



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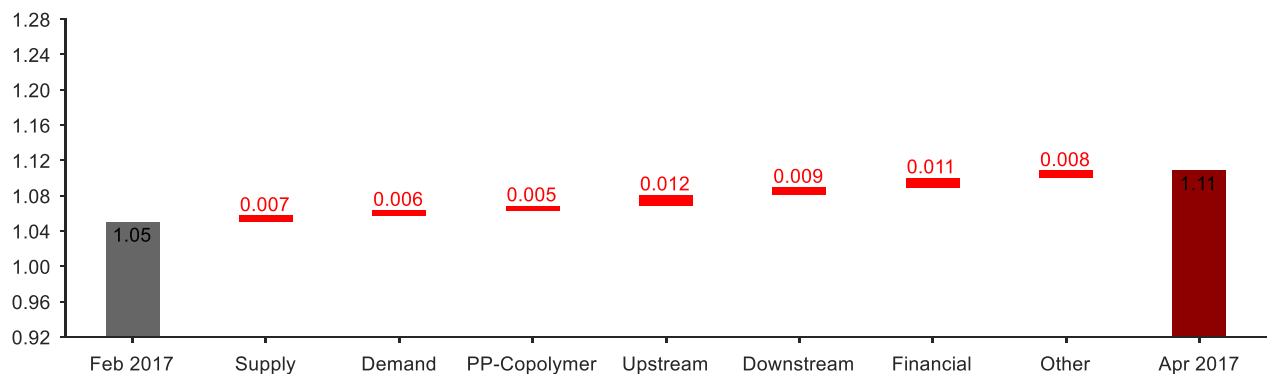
Forecasting the Price of Polypropylene

Impact Analysis: Two Months Forecast



Our algorithm forecasts a higher price of PP-Copolymer in two months: it is expectable that the price increases 5,56% from 1,05€ to 1,11€ until the beginning of April.

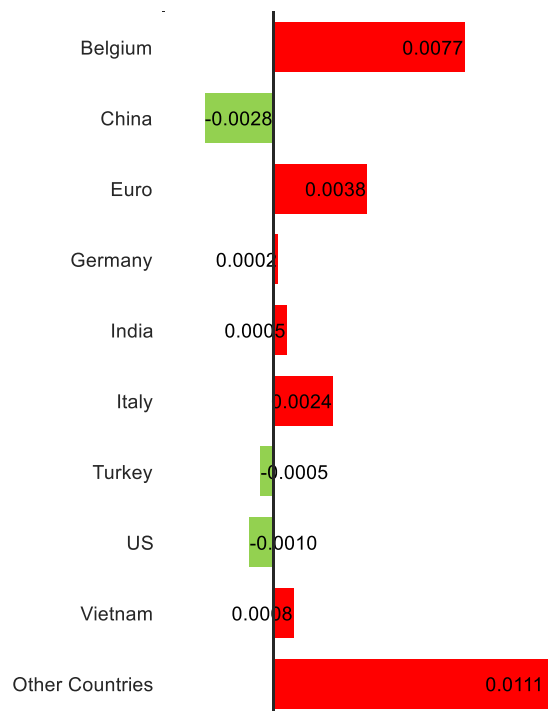
Indices of Factors



Interpretation

- **Decrease of Supply:** Positive pressure of the Supply index
- **Increase of Demand:** Positive pressure of the Demand index
- Positive pressure of the index of PP-Copolymer
- 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
- Positive pressure of other commodities and other factors
- Focus on Belgium, Japan, and France

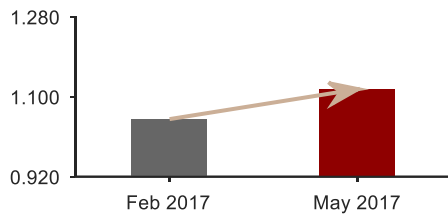
Impact per Country



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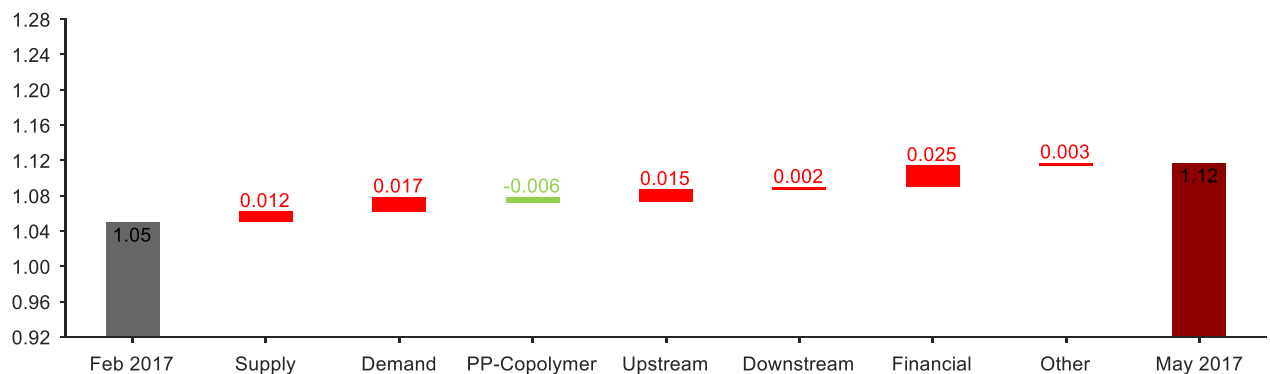
Forecasting the Price of Polypropylene

Impact Analysis: Three Months Forecast



Our algorithm forecasts a higher price of PP-Copolymer in three months: it is expectable that the price increases 6,39% from 1,05€ to 1,12€ until the beginning of May.

Indices of Factors



Interpretation

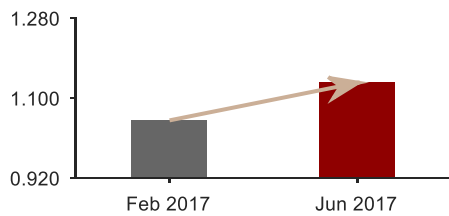
- **Decrease of Supply:** Positive pressure of the Supply index
- **Increase of Demand:** Positive pressure of the Demand index
- Negative pressure of the index of PP-Copolymer
- Positive pressure of the index of variables representing the market upstream
- Slightly positive pressure of the index of variables representing the market downstream
- **Considerably positive pressure of the financial index**
- Positive pressure of other commodities and other factors
- Focus on Japan, Italy, and Euro

Impact per Country



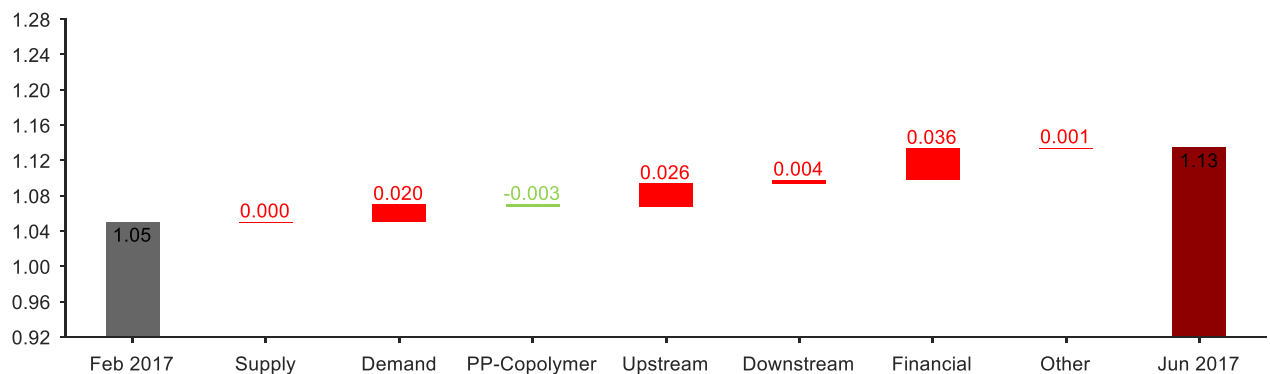
Forecasting the Price of Polypropylene

Impact Analysis: Four Months Forecast



Our algorithm forecasts a higher price of PP-Copolymer in four months: it is expectable that the price increases 8,02% from 1,05€ to 1,13€ until the beginning of June.

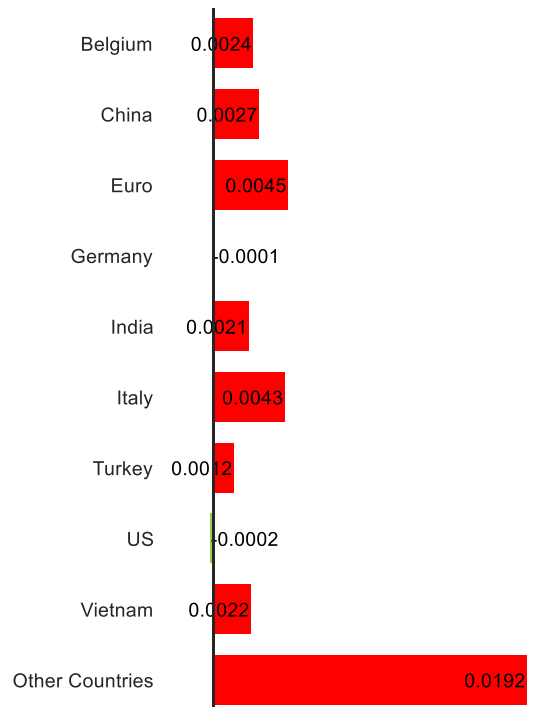
Indices of Factors



Interpretation

- Slight decrease of Supply: Positive pressure of the Supply index
- **Increase of Demand:** Positive pressure of the Demand index
- Slightly negative pressure of the index of PP-Copolymer
- **Considerably positive 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**
- Slightly positive pressure of other commodities and other factors
- Focus on France, Indonesia, and Japan

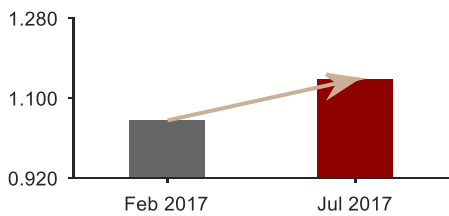
Impact per Country



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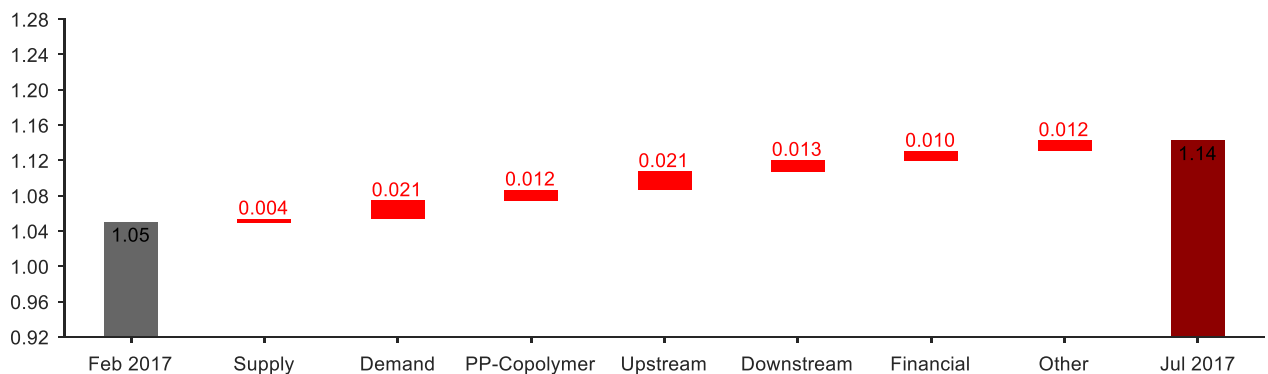
Forecasting the Price of Polypropylene

Impact Analysis: Five Months Forecast



Our algorithm forecasts a higher price of PP-Copolymer in five months: it is expectable that the price increases 8,79% from 1,05€ to 1,14€ 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
- Positive pressure of the index of PP-Copolymer
- 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
- Positive pressure of other commodities and other factors
- Focus on Japan, France, and Indonesia

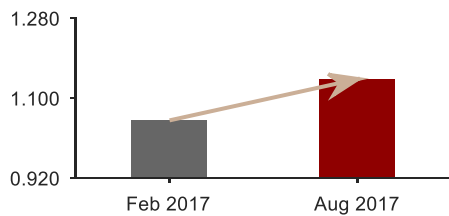
Impact per Country



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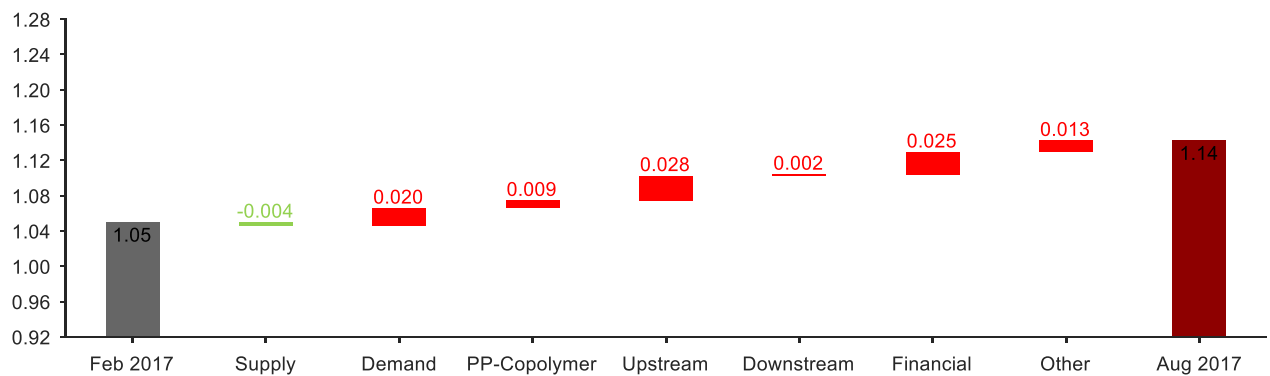
Forecasting the Price of Polypropylene

Impact Analysis: Six Months Forecast



Our algorithm forecasts a higher price of PP-Copolymer in six months: it is expectable that the price increases 8,81% from 1,05€ to 1,14€ until the beginning of August.

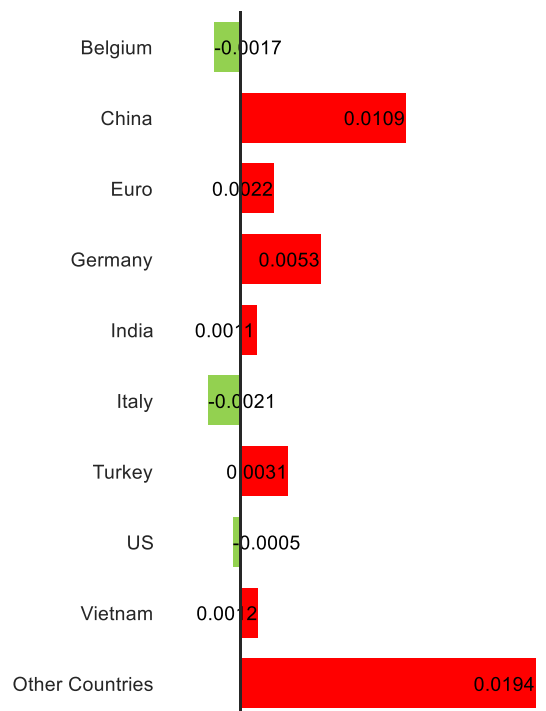
Indices of Factors



Interpretation

- **Increase of Supply:** Negative pressure of the Supply index
- **Increase of Demand:** Positive pressure of the Demand index
- Positive pressure of the index of PP-Copolymer
- **Considerably positive pressure of the index of variables representing the market upstream**
- Slightly positive pressure of the index of variables representing the market downstream
- **Considerably positive pressure of the financial index**
- Positive pressure of other commodities and other factors
- Focus on Japan, China, and France

Impact per Country



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Forecasting the Price of Polypropylene

APPENDIX I – 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;

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

Upstream index: composed of variables related to Propylene, Oil, Natural Gas and Naphtha. 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 Propylene should (in linear, general, and *ceteris paribus* terms) generate an increase in the price of Polypropylene;

Forecasting the Price of Polypropylene

APPENDIX – Technical Explanation of the Impact Analysis

Downstream index: composed of variables related to 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 Polypropylene;

Financial Variables Index: composed of financial market variables. It includes the share price of companies that produce Polypropylene. It also includes financial indices related to this sector. For example, a positive change in the share price of a Polypropylene producer 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 Polypropylene;

Other Variables Index: composed of variables related to other polymers and other commodities, such as Ethylene and Benzene. 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 Polypropylene, and thus, of the price of Polypropylene.

Country Indices

Country Indices 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 polypropylene.

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.