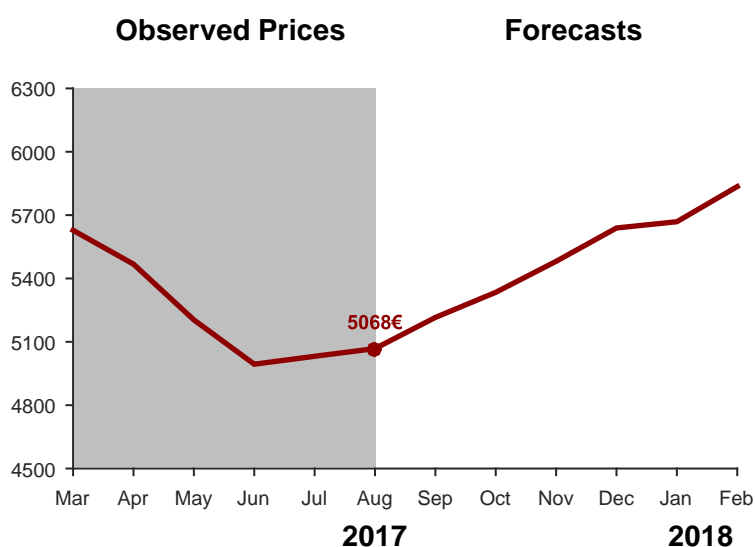


# Forecasting the Price of Copper

<b>Commodity</b>	Copper (London Metal Exchange)
<b>Forecast Period</b>	September 2017 – February 2018
<b>Currency</b>	€
<b>Unit</b>	Metric Tonne
<b>Observations</b>	Monthly forecasts of the monthly average price



## Forecasts



Month/Year	Forecast	Prob. of Raise
Sep. 2017	5215€	82 %
Oct. 2017	5334€	75 %
Nov. 2017	5481€	68 %
Dec. 2017	5639€	68 %
Jan. 2018	5669€	62 %
Feb. 2018	5835€	59 %

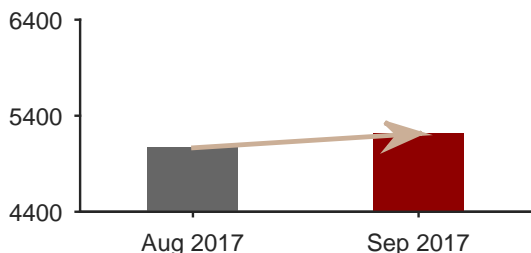
## Suggested Action for Procurement

Purchase Limit Month	Suggested Action
September 2017	Buy in August at 5068€
October 2017	Buy in August at 5068€
November 2017	Buy in August at 5068€
December 2017	Buy in August at 5068€
January 2018	Buy in August at 5068€
February 2018	Buy in August at 5068€

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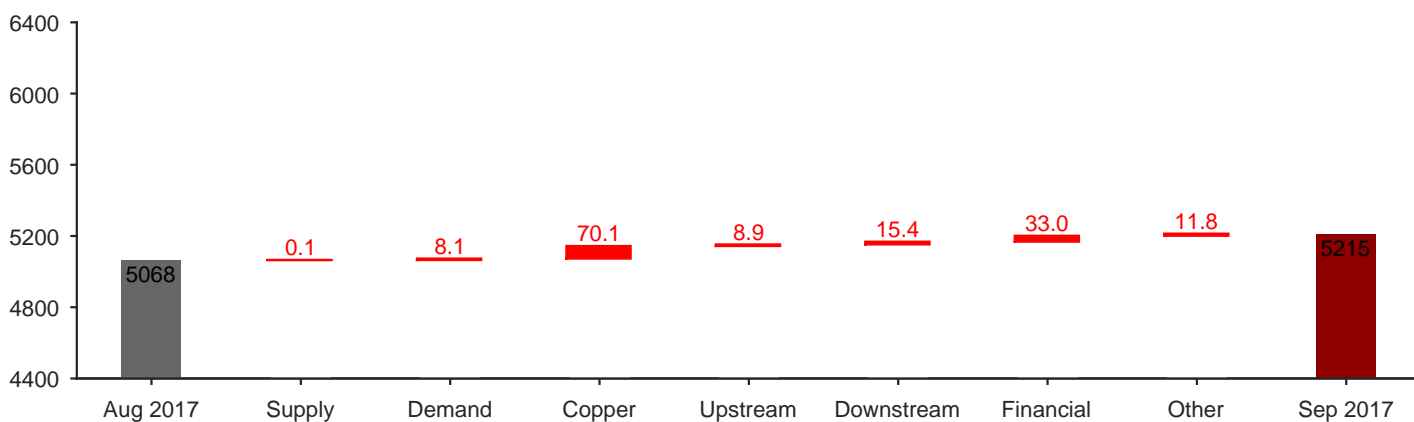
# Forecasting the Price of Copper

## Impact Analysis: One Month Forecast



Our algorithm forecasts a higher price of Copper in one month: it is expectable that the price increases 2.90% from 5068€ to 5215€ until the beginning of September.

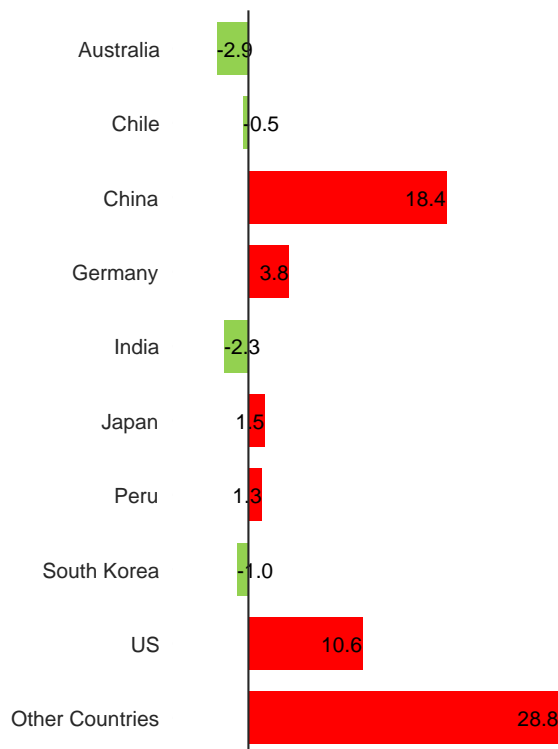
## Indices of Factors



### Interpretation

- Slight 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 Copper**
- 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 China, US, and Russia

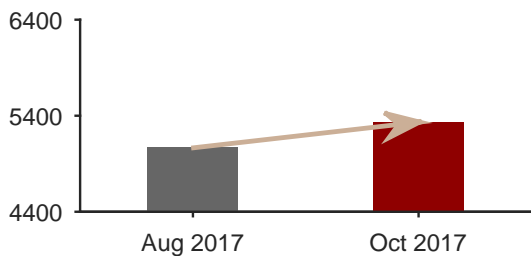
### Impact per Country



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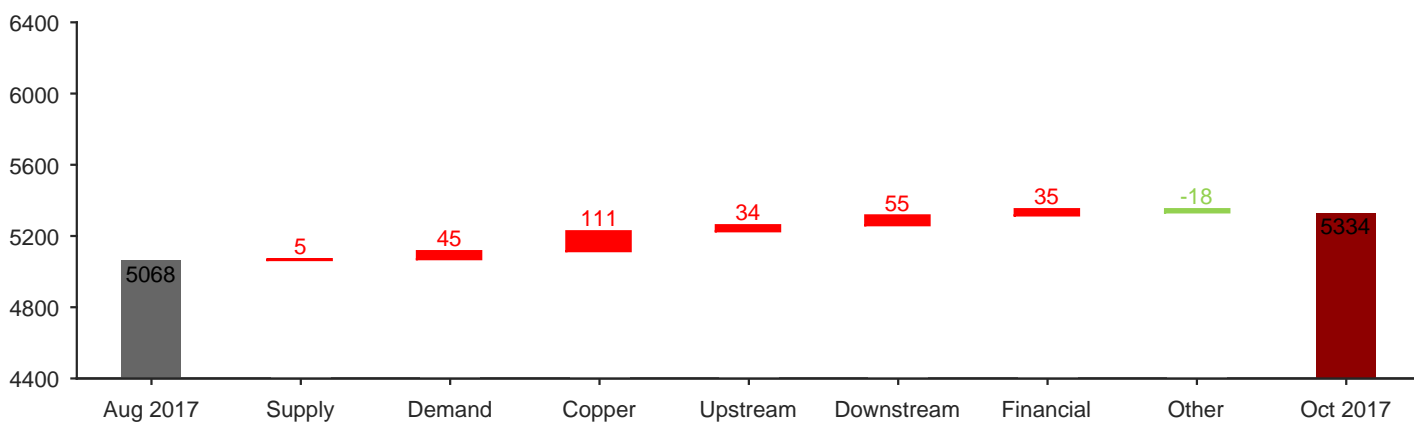
# Forecasting the Price of Copper

## Impact Analysis: Two Months Forecast



Our algorithm forecasts a higher price of Copper in two months: it is expectable that the price increases 5.25% from 5068€ to 5334€ until the beginning of October.

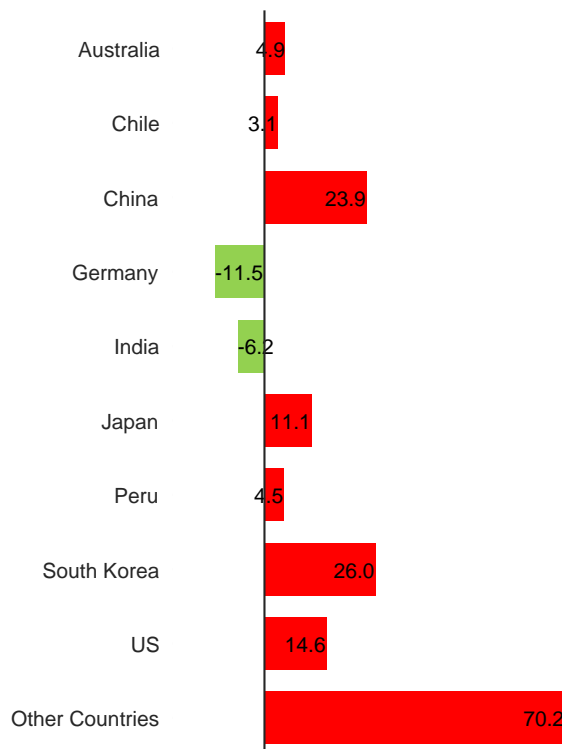
## Indices of Factors



### Interpretation

- Slight 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 Copper**
- 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 Finland, South Korea, and China

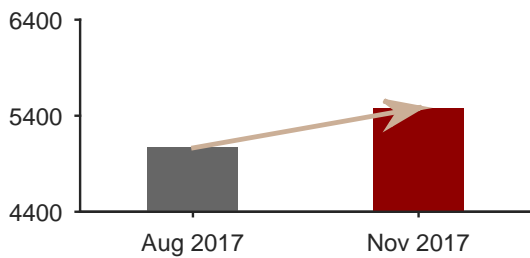
### Impact per Country



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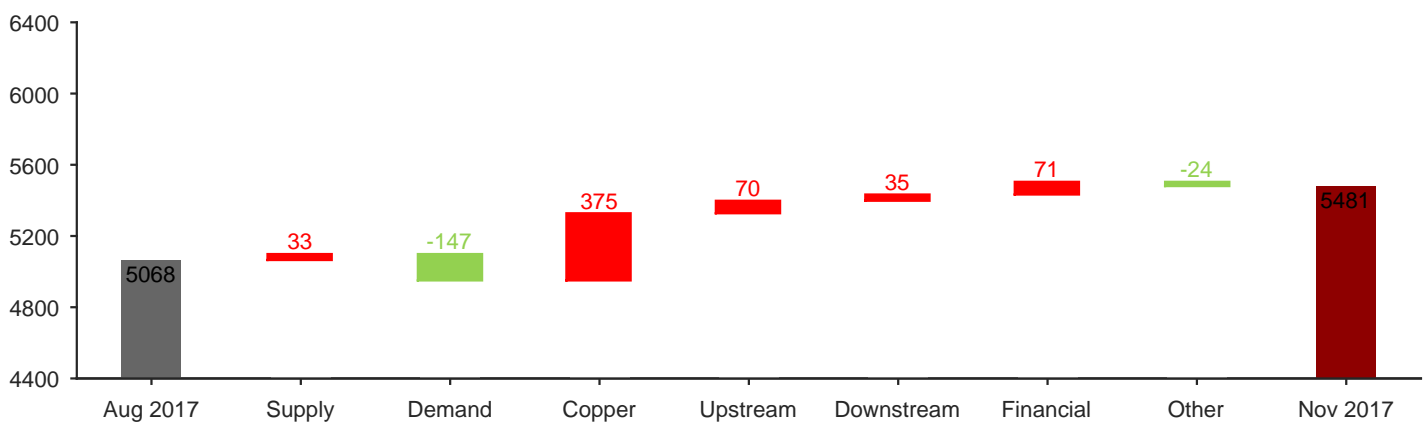
# Forecasting the Price of Copper

## Impact Analysis: Three Months Forecast



Our algorithm forecasts a higher price of Copper in three months: it is expectable that the price increases 8.15% from 5068€ to 5481€ until the beginning of November.

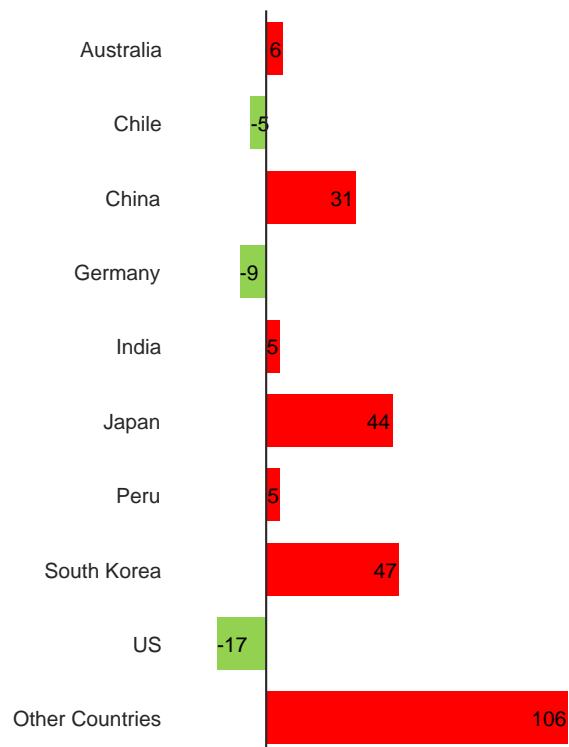
## Indices of Factors



### Interpretation

- **Decrease of Supply:** Positive pressure of the Supply index
- **Considerable decrease of Demand:** Negative pressure of the Demand index
- **Considerably positive pressure of the index of Copper**
- 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
- Slightly negative pressure of other commodities and other factors
- Focus on Finland, South Korea, and Russia

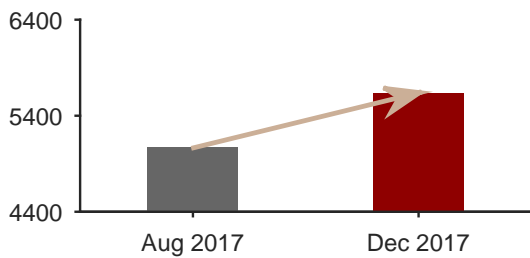
### Impact per Country



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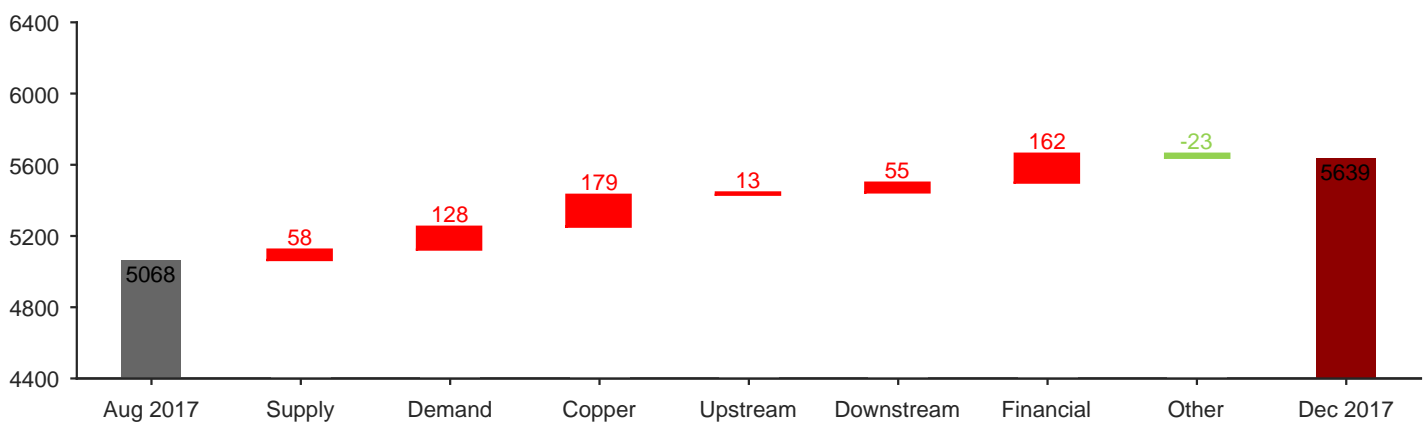
# Forecasting the Price of Copper

## Impact Analysis: Four Months Forecast



Our algorithm forecasts a higher price of Copper in four months: it is expectable that the price increases 11.26% from 5068€ to 5639€ until the beginning of December.

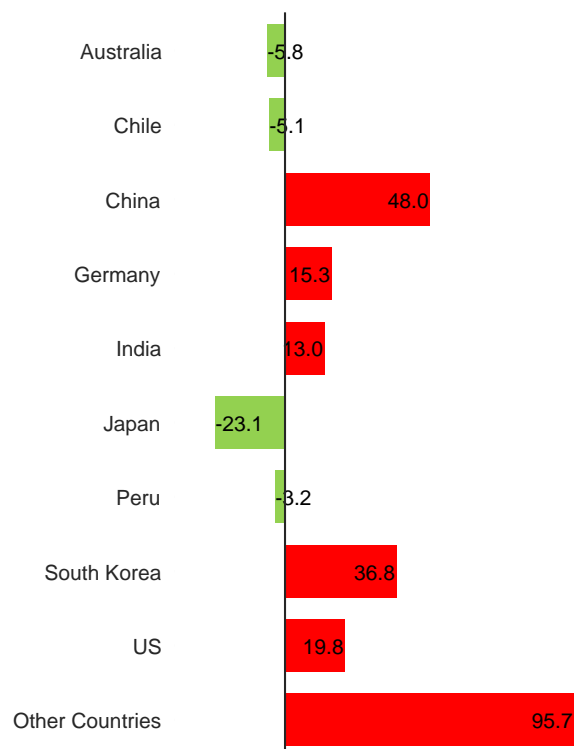
## Indices of Factors



### Interpretation

- **Decrease of Supply:** Positive pressure of the Supply index
- **Considerable increase of Demand:** Positive pressure of the Demand index
- **Considerably positive pressure of the index of Copper**
- Slightly 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**
- Negative pressure of other commodities and other factors
- Focus on Finland, Russia, and China

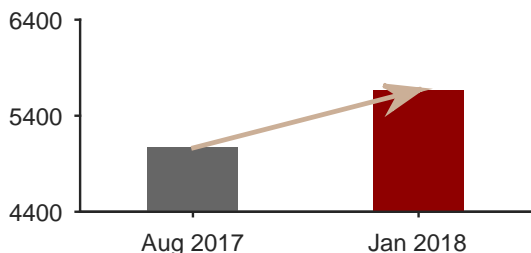
### Impact per Country



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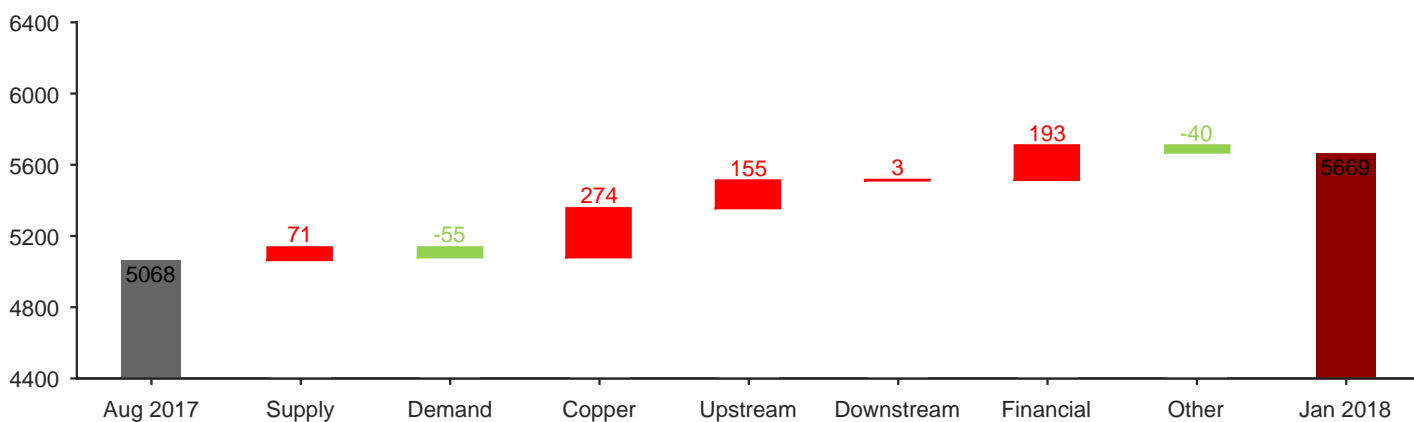
# Forecasting the Price of Copper

## Impact Analysis: Five Months Forecast



Our algorithm forecasts a higher price of Copper in five months: it is expectable that the price increases 11.85% from 5068€ to 5669€ until the beginning of January.

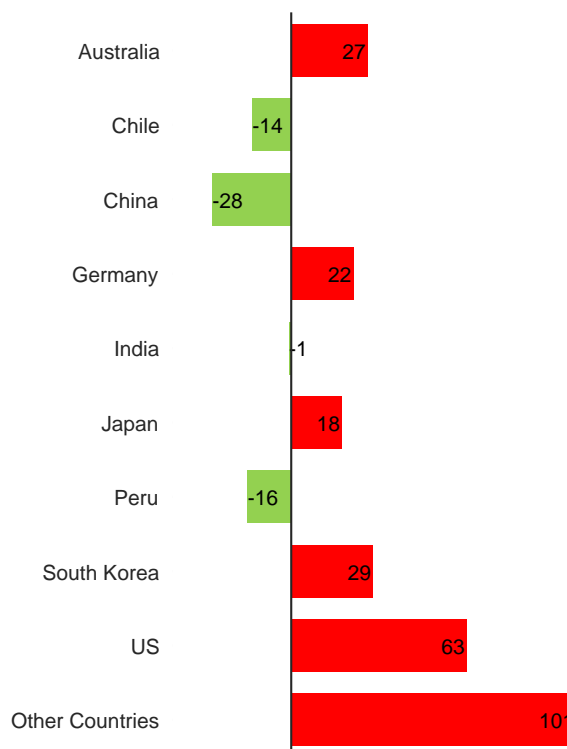
## Indices of Factors



### Interpretation

- **Decrease of Supply:** Positive pressure of the Supply index
- **Decrease of Demand:** Negative pressure of the Demand index
- **Considerably positive pressure of the index of Copper**
- **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**
- Negative pressure of other commodities and other factors
- Focus on US, Finland, and Mexico

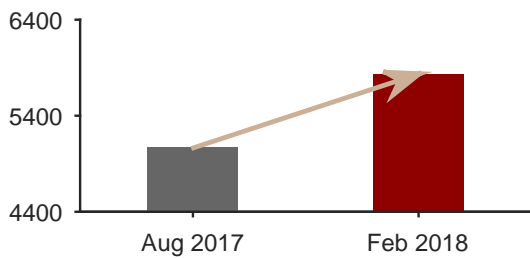
### Impact per Country



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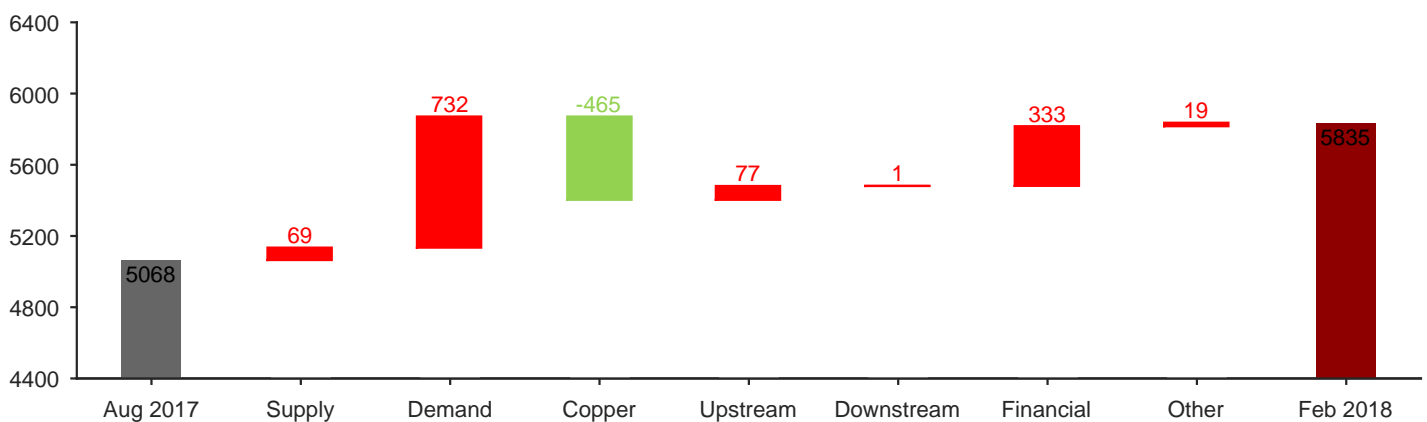
# Forecasting the Price of Copper

## Impact Analysis: Six Months Forecast



Our algorithm forecasts a higher price of Copper in six months: it is expectable that the price increases 15.13% from 5068€ to 5835€ until the beginning of February.

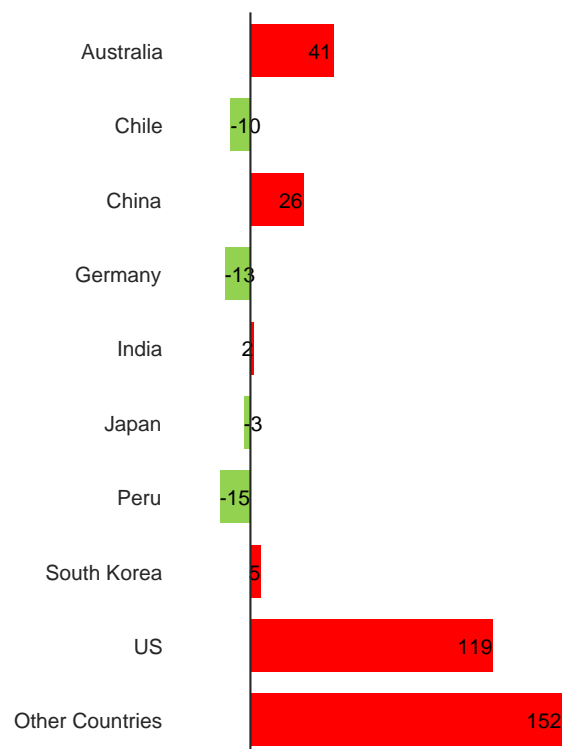
## Indices of Factors



### Interpretation

- **Decrease of Supply:** Positive pressure of the Supply index
- **Considerable increase of Demand:** Positive pressure of the Demand index
- **Considerably negative pressure of the index of Copper**
- 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**
- Slightly positive pressure of other commodities and other factors
- Focus on Finland, US, and Russia

### Impact per Country



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# Forecasting the Price of Copper

## 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;

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

**Upstream index**: composed of variables related to Coal and Copper Ore. 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 Coal should (in linear, general, and ceteris paribus terms) generate an increase in the price of Copper;



# Forecasting the Price of Copper

## APPENDIX – Technical Explanation of the Impact Analysis (II)

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

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

**Other Variables Index:** composed of variables related to other metals (Aluminium and Zinc) and Oil. 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 Copper, and thus, of the price of Copper.

## 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 Copper.

## 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.