Interdependencies between Swiss electricity prices and the neighbouring energy markets

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Overview

The European market coupling is intensified targeting a single European energy market, also called as "the Energy Union". Therefore, new market mechanisms, such as "implicit auctioning" (see Jullien et al., 2012), are introduced as well as new interconnectors between different countries are constructed (see ENTSOE, 2010). These developments lead to a stronger integration and interdependencies between the neighbouring electricity markets. The Swiss electricity market is placed between three big energy markets, i.e. the German, French and Italian market, so that changes in the electricity system of these neighbouring countries can have a strong impact on the Swiss electricity prices and energy investments.

This study analyses the electricity price development in Switzerland in detail. At first, the relationship between prices in Switzerland and its neighbouring countries (Germany, France and Italy) is analysed. Afterwards the focus is set on the effects of fundamental price drivers of the neighbouring energy markets, such as load, renewable power generation and power plant capacity. Finally, a regression model is developed to explain the impact of each fundamental driver on the Swiss price.

Methods

A descriptive analysis of different factors and relationship is carried out to determine the main developments of Swiss electricity prices. Correlation coefficients between Swiss and the electricity prices of neighbouring countries are calculated to determine the interdependencies between countries. Thereby, the dependencies are determined for different seasons and time of the day, as these dependencies significantly differ for each month and season of the year. For instance, in summer the Swiss price has a similar structure as the German electricity price (correlation coefficient ρ= 0.88 between 2011 and 2014). During winter, the effect of German prices is smaller (ρ =0.76), while the correlation with the Italian price rises from 0.55 to 0.68 in winter.

However, not only the prices of the neighbouring countries are analysed with the Swiss prices, also the fundamental drivers of electricity prices from the different neighbours, such as load, renewable power generation and cross-border trade, are considered within the correlation analysis. Finally, a linear regression model based on domestic and foreign energy parameters is developed to explain the influence on Swiss electricity prices and the sector in total. The initial regression model is then extended with autoregressive elements to gain a better fit between explanatory variables and the dependent variable, i.e. electricity price.

Selected results

The results for the correlation coefficient ρ show that there is a strong dependency between the German, French and Swiss electricity prices, especially in summer months (ρ*=0.88* between Germany and Switzerland, ρ*=0.86* between France and Switzerland), so that they can be identified as collinear for the summer values. However, in the winter months the high electricity demand in France also has a strong influence on the Swiss electricity prices, as the French load influences the French prices, which in turn can be seen as the opportunity costs for electricity price bids in the Swiss market. Therefore, the Swiss and French electricity prices are also significantly correlated (ρ*=0.71*). Figure 1 shows the development of the different price indices in the last four years.

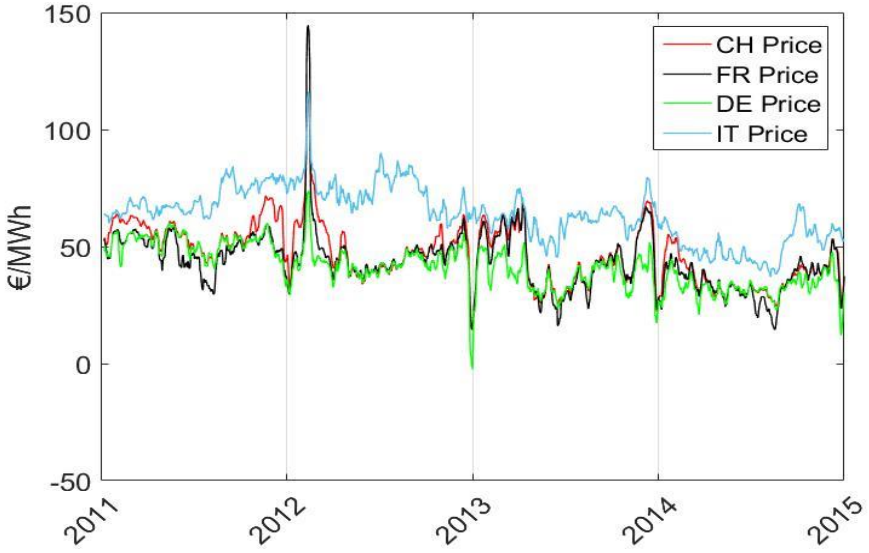

Figure: 7-day moving average day-ahead spot prices

Analyzing the fundamental drivers, e.g. the ones from abroad, it can be noted that the French and Italian load in specific hours or in the winter have an influence on Swiss prices, while the renewable power generation in Germany is another relevant driver for Swiss electricity prices. A linear regression model, based on these fundamentals and extended by autoregressive component that considers the Swiss prices with a lag of 24 hours or a week, performs very well and delivers a high mean absolute error (MAE = 4.51 €/MWh) for an in-sample analysis of the period 2011 to 2015. Figure 2 illustrates the original curve and the simulated curve applying the regression model for hour 13 of the day.

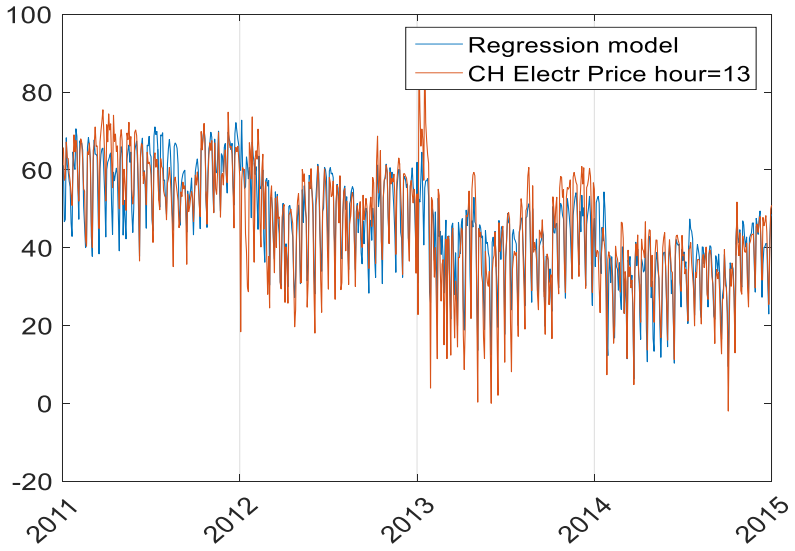

Figure 2: Simulation of midday Swiss electricity prices for spring/summer periods (April to October) applying a regression model with autoregressive components

Conclusions and Outlook

The analysis of price correlations and the regression model incorporating foreign fundamentals for Swiss electricity prices indicate a strong relationship between the neighboring electricity markets and highlight the dependency of Swiss prices on the developments within the electricity sector of the

large neighboring markets Germany, France and Italy. Especially the demand in France and Italy and the power supply from renewable sources in Germany have an impact on the Swiss electricity prices.

However, these analyses have to be deepened considering more fundamental drivers of electricity prices and by distinguishing the time horizon of the historical data which are used to calculate the different statistical coefficients.

References

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