***Spotted: Identifying the drivers of British electricity spot prices.***

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## Overview

Electricity prices are important for the economy, and the “spot” prices formed in day-ahead markets are important both for payments made in those markets and because expected spot prices influence forward contracts. The role of the spot market is to ensure that the supply and demand of electricity is matched in each half-hourly period. In this competitive environment, generators and buyers place offers and bids one day ahead and these are used to establish the market-clearing price Wholesale electricity prices are unpredictable, volatile and essential for all market participants. The major factors driving this volatility are changes in fuel and carbon prices, volatility in the energy demand and unstable renewable generation.

## The aim of this paper is to understand the most crucial drivers of the British electricity spot prices and in particular the pass-through of fuel and carbon prices to the wholesale electricity price. We study the factors driving electricity prices to show why British prices rose by 54% from 2009 to 2018, when power prices in many other European countries were falling (Hirth, 2018).

## Apart from the intrinsic interest of knowing what was responsible for this seemingly unusual experience, we introduce a methodological innovation. The British power sector had large amounts of both gas- and coal-fired generating capacity for most of this period, and relative fuel costs largely determined which type of stations were used more intensively. This means that when the gas price is relatively high, it will tend to affect the electricity prices set at peak times, whereas when the gas price is relatively low (or the carbon price is high) gas prices will have a stronger influence on off-peak prices than coal prices do. We capture this effect by constructing variables not for the variable costs of gas generation and of coal generation, but for whichever plant type is cheaper, and whichever is more expensive. This allows us to automatically capture the effects of fuel switching in a way that regressions with the raw fuel prices would not.

## Methods

The primary purpose of the empirical analysis is to understand what shapes the wholesale price of electricity in UK and how prone is the price to change depending on the fluctuations of particular factors. The focus is placed on the day-ahead market in UK encompassing half-hourly data from years 2009-2018. Our analysis aims at explaining why the average wholesale price had increased from 36 £/MWh in 2009 to 56 £/MWh in 2018. We found this particularly interesting as during that time the renewable generation grew significantly in UK while the demand substantially decreased and there was a general trend of a price decrease in continental Europe.

We propose a new econometric methodology which captures the endogenous switching between coal- and gas-fired power stations. In particular, we create variables for fuel costs that switch between the costs of gas- and coal- fired power based on the type that is cheaper. These CheapFuel and CostlyFuel variables incorporate the cost of carbon and thermal efficiency as well as the price of fuel. The work is still in progress but we plan to allow the way in which these fuel prices interact with the level of demand to reflect the relative capacity of gas and coal plants. In other words, if demand is below the available capacity of the lower-cost type of plant, we would expect the cheaper fuel to drive power prices, whereas the more expensive fuel would affect prices mostly once demand was above this level. All this alteration constitutes a methodological innovation that will help us to better capture the impact on price once we define the merit order stack (as shown in the diagram below).

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## Results

Preliminary results show that our approach gives sensible coefficients for the impact of fuel and carbon costs, and of demand and renewable generation, on the price of electricity in the British spot market. Without resort to time or other dummy variables, we are able to explain nearly half of the variation in half-hourly power prices over a multi-year period. Once we have refined our estimates, we will be able to estimate how prices have responded to the various changes to the British electricity sector over the last decade – more renewable generation, a reduction in electricity demand, and a significant increase in carbon prices.

## Conclusions

The aim of this paper it to understand what caused the changes in price, taking into consideration various impact factors and linking the results to the merit order theory as well as new UK Carbon regulations that took place in the researched period. Profound understanding of such dependencies is essential for authorities that implement regulations especially for predicting the results of policies such as how the electricity generators react to economic events like increase of fuel and carbon prices.

## References

Hirth, Lion. "What caused the drop in European electricity prices? A factor decomposition analysis." The Energy Journal 39.1 (2018).