Volatility spillovers in EU electricity markets

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Overview

Electricity markets have experienced considerable changes in the last decades. With increased deregulation, cross boarder trade and the consolidation of pricing mechanisms, markets have become more integrated. In the literature there has been many articles investigating the price relationships between markets and the development of price volatility. However, few have studied volatility spillover effect between electricity markets. In this paper we investigate and estimate the level of price volatility spillover effects between 4 major European exchanges, EEX in Germany, Powernext in France, BPX in Belgium and APX in the Netherlands for the period 2007-2016. In our initial analysis we identify Germany and France as power exporting nations while the Netherlands and Belgium are import dependent.

Kommentiert [RED1]: Denne er ikke relevant da vi ikke ser spesielt på fornybar energi vs fossil energi, eller vurderer introduksjon av nye energiformer til et marked.

Methods

In this study we use weighted daily price series gathered from Thomson Reauters which we assume of high quality. To evaluate volatility spillover between markets, we utilize the generalized version of the spillover index developed in Diebold and Yilmaz (2009, 2012), which allow us to identify directional and net volatility spillover, in addition to total volatility spillover. This will help distinguish the main receivers and transmitters of price uncertainty and shocks to the price. Diebold and Yilmaz (2012) utilize a generalized vector autoregressive framework as described by Koop et al. (1996) and Pesaran and Shin (1998). This produces forecast-error variance decompositions which is invariant variable ordering. The method allows us to calculate the total volatility spillover index. Further, we can identify directional spillover received by a market i and spillover transmitted to a market j. Finally, we calculate the net volatility spillover found by subtracting shocks transmitted by shocks received.

Results

Our first observation is a declining volatility spillover between the markets over time. Both in the total volatility index and in individual markets. We notice that 36,3% of market volatility is caused by spillover between exchanges. Table 1 shows that Powernext receives the least from other markets and is responsible for 87,11% of its own variance, and as such is the dominant electricity market. We see that BPX and APX receive around 50% of its volatility effect from external markets.

Table 1 Total directional volatility spillover

Europe (2007 - 2015)		From BPX	From Powernext	From APX	From EEX	Sum (excl. own)
To	BPX	50.03	28.79	13.23	7.95	49.97
	Powernext	5.45	87.11	3.07	4.37	12.89
	APX	19.77	18.87	49.64	11.72	50.36
	EEX	7.60	17.38	7.02	67.99	32.01
Sum (excl. own)		32.82	65.04	23.33	24.04	
Sum (incl. own)		82.85	152.15	72.97	92.03	**36.30 %**

Table 2 shows the net spillover for all markets, i.e. difference between the volatility transmitted by a given market to all others and the volatility received from all other markets. Seemingly, only Powernext is able to give more than it receives as the net spillover is positive (52.15 = 65.04−12.89). The three remaining markets receive more than they transmit.

Table 2 Net directional volatility spillover

BPX	Powernext	APX	EEX
-17.15	52.15	-27.03	-7.97

In Table 3 the difference between giving and receiving is disaggregated to bivariate relations. For instance, the pairwise spillover between BPX and Powernext is −23.34 (= 5.45−28.27). This implies that BPX transmits far less volatility to Powernext than BPX receives from Powernext. This can be expected as Belgium is dependent on power import from France. Considering the absolute value of the pairwise spillover, the highest amount of difference in volatility transfer is between BPX and Powernext. The pairwise spillover between BPX and EEX (−0.35) is the lowest difference, which we suggest is do to no direct cross boarder interconnection between the markets.

Table 3 Pairwise volatility spillover

(BPX,Powernext)	(BPX,APX)	(BPX,EEX)	(Powernext,APX)	(Powernext,EEX)	(APX,EEX)
-23.34	6.54	-0.35	15.8	4.49	-4.7

Conclusions

The results indicate that Powernext is the most influential in terms of transmitting volatility, while the APX and BPX are inclined to receive from external volatility effects. With France and Germany being the largest producers of electricity in Europe, this indicates that that price volatility origins from the more dominant market and is transmittet to minor market. We also notice that markets that are dependent on power imports are more susceptible to receive volatility effects from the exporting markets. In addition, time analysis indicate that our results are time-varying.

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