

Convergence of Wholesale Electricity Spot Prices in Europe?

Presentation

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AGENDA

1. The Aim
2. State of the Literature / Methods
3. The Data
4. Results
5. Conclusion and Outlook



The Aim

Comparing the Polish Wholesale Prices with those of West European Markets

- Testing for Long Run Price Convergence
- Finding Underlying Factors



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State of the Literature

Testing Price Convergence using Time Series Analysis

- Asche, Gjøølberg, Volker (2003) „Price Relationships in the Petroleum Market: an Analysis of Crude Oil and Refined Product Prices“ in Energy Economics 25 (2003) 289–301 **=> Cointegration**
- Cuddington, Wang (2004) „Assessing the Integration of U.S. Natural Gas Spot Markets: Evidence from Daily Price Data“ in Georgetown University Working Paper **=> AR**
- Videbeck (2004) “Economic Market Segmentation of an Electricity Pool” in Victoria University of Wellington Working Paper **=> Factor Analysis**
- Jerko, Mjelde, Bessler (2004) „Dynamic Interactions in the Western United States Electricity Spot Markets“ in Modelling Prices in Competitive Electricity Markets (ed. Brunn) **=> Structural VAR acyclic graphs**
- Worthington, Higgs (2003), „Transmission of Prices and Price Volatility in Australian Electricity Spot Markets: A multivariate GARCH analysis“, forthcoming Energy Economics **=> GARCH**

No literature thus far on East European wholesale markets

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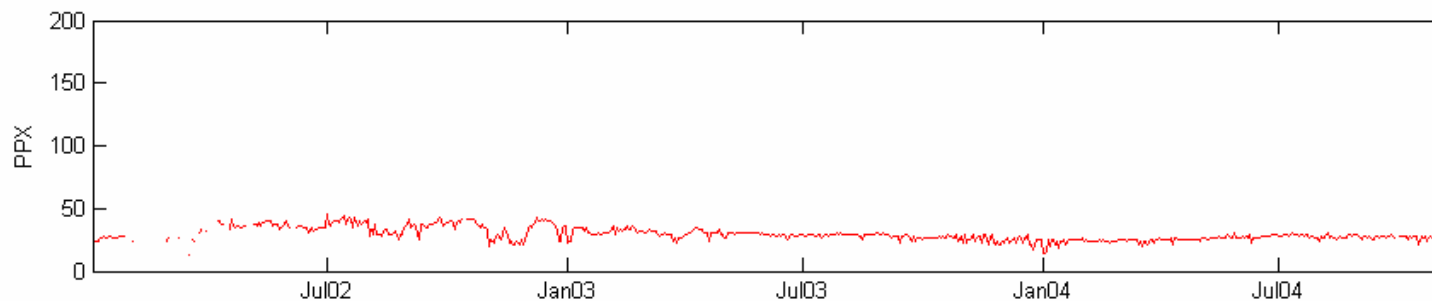
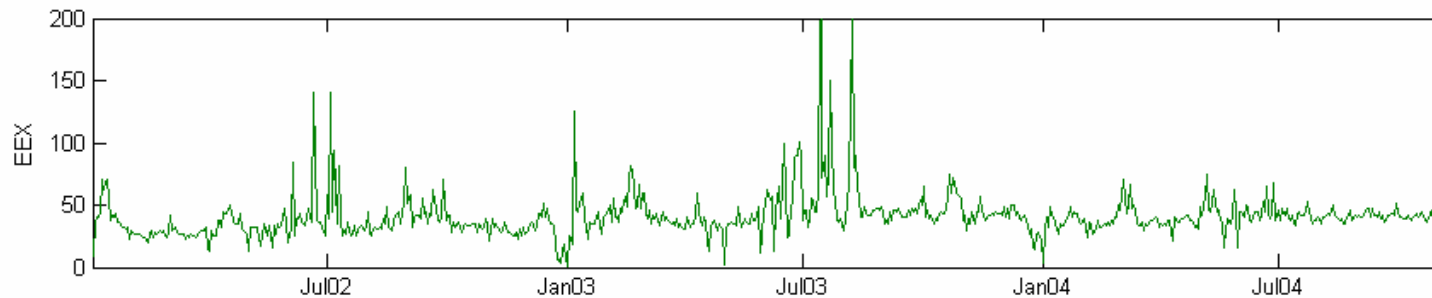
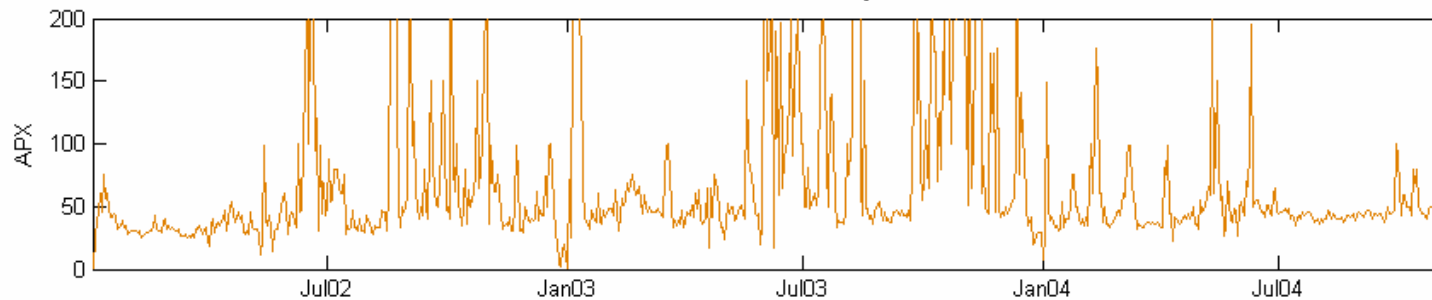
The Data

Hourly Spot Market Prices and Volumes for

- four power exchanges:
 - Amsterdam (APX)
 - Leipzig (EEX)
 - Paris (PNX)
 - and Warsaw (PPX)
- May 2002 – November 2004

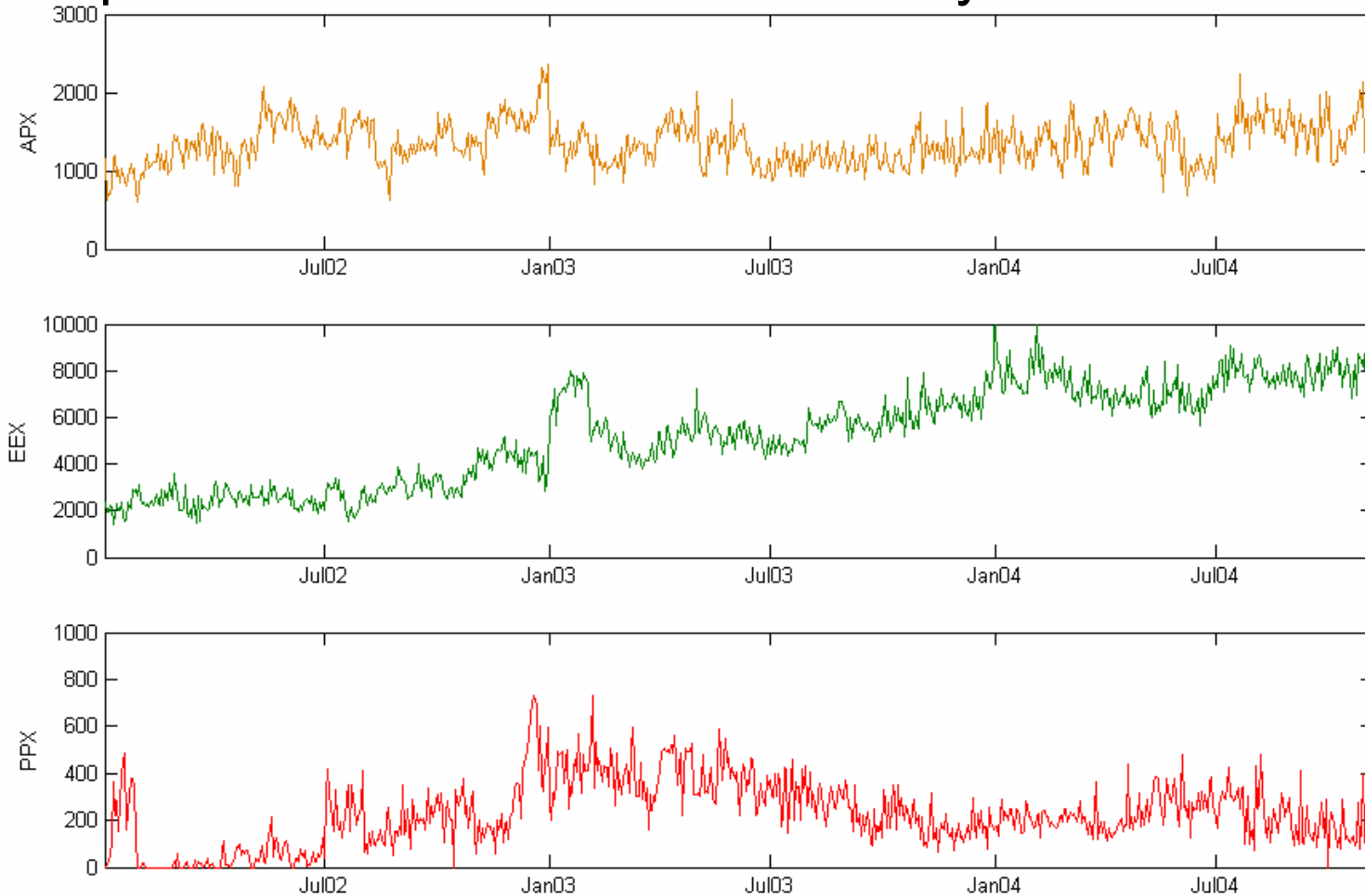
3.1 Prices

Spot Market Prices for Electricity in the 11th hour in EUR/MWh



3.2 Volumes

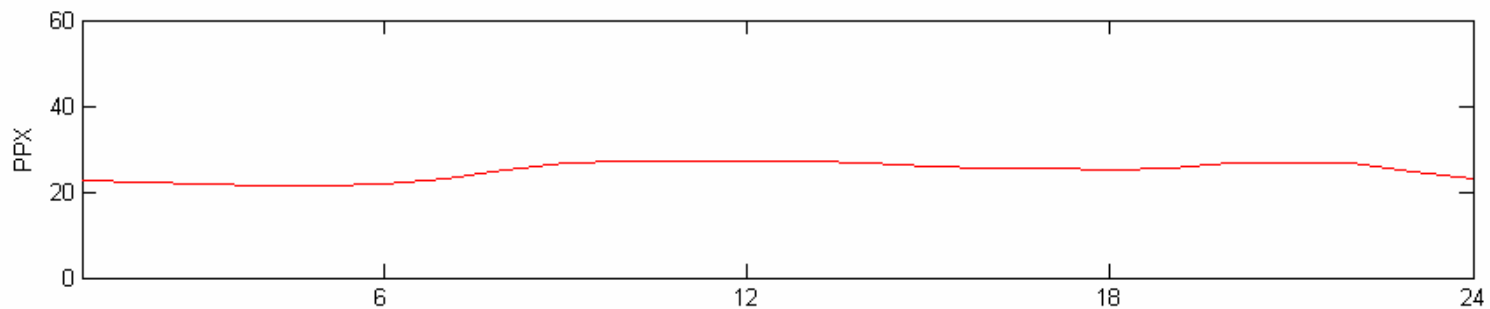
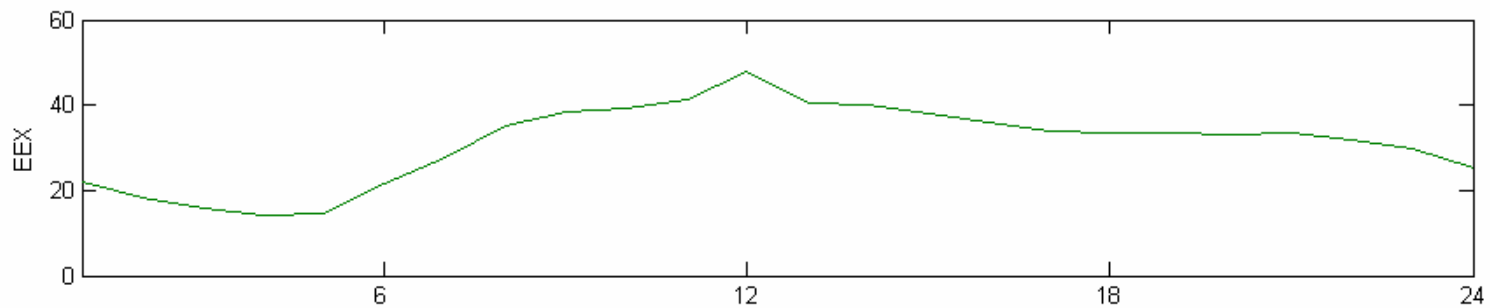
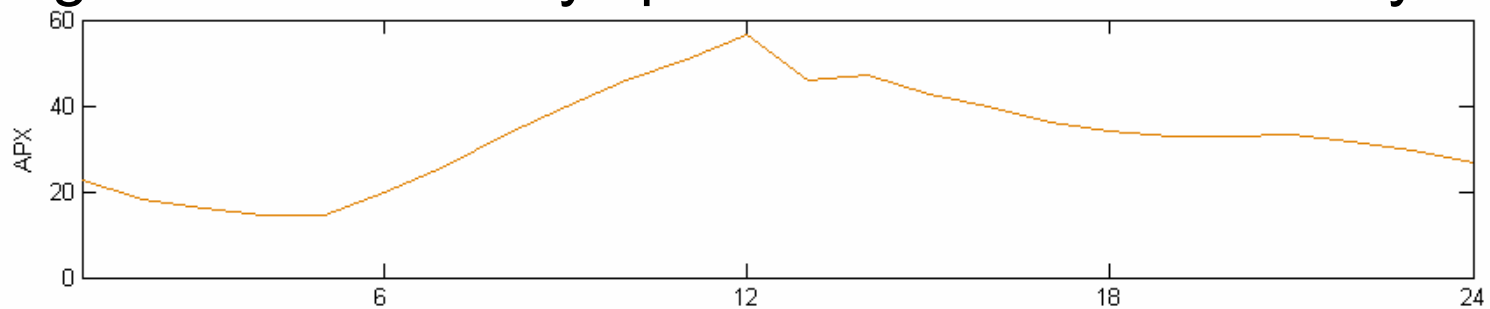
Spot Market Volumes for Electricity in the 11th hour in MWh





3.3 Daily Price Profiles

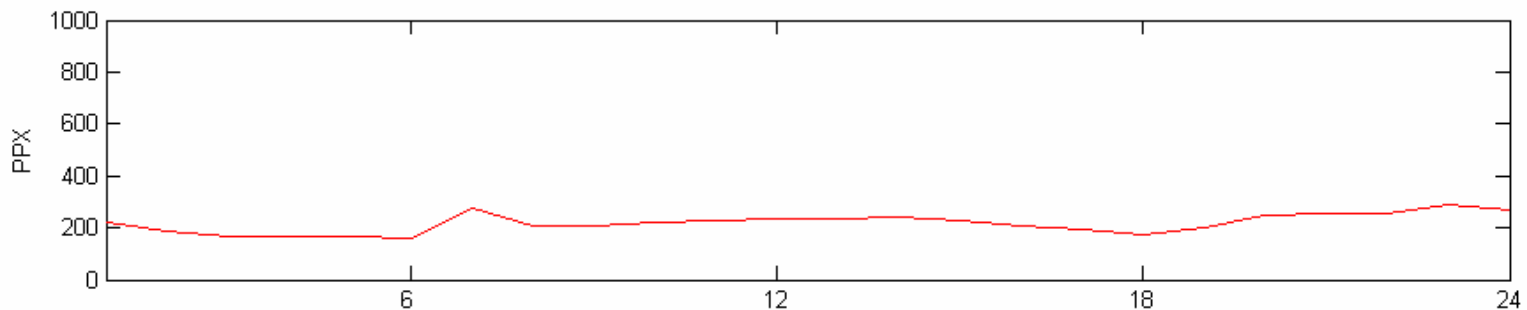
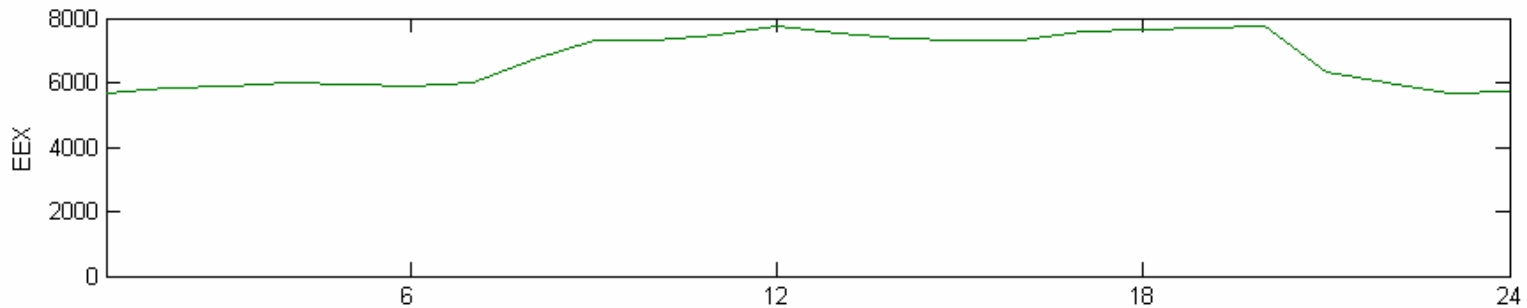
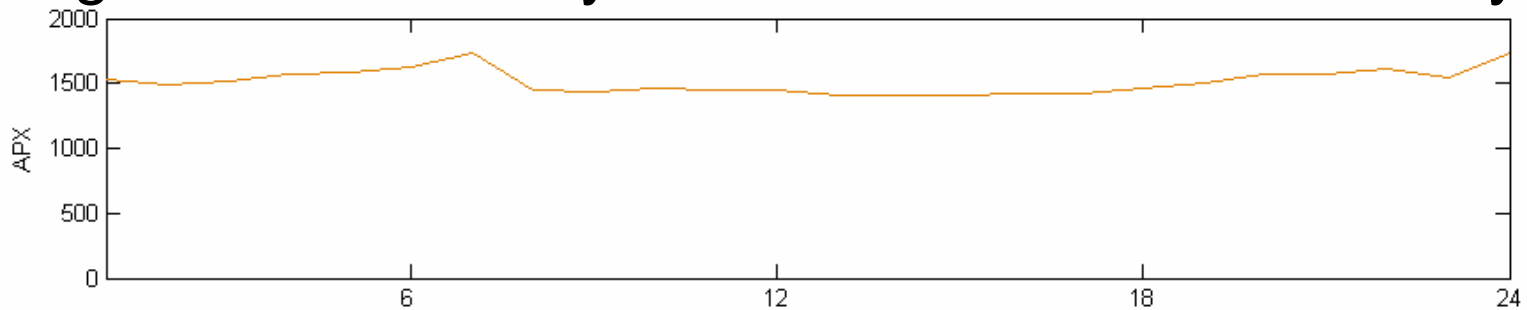
Averages of the workdays prices of the Summer half year 2004





3.3 Daily Volume Profiles

Averages of the workdays Volumes of the Summer half year 2000



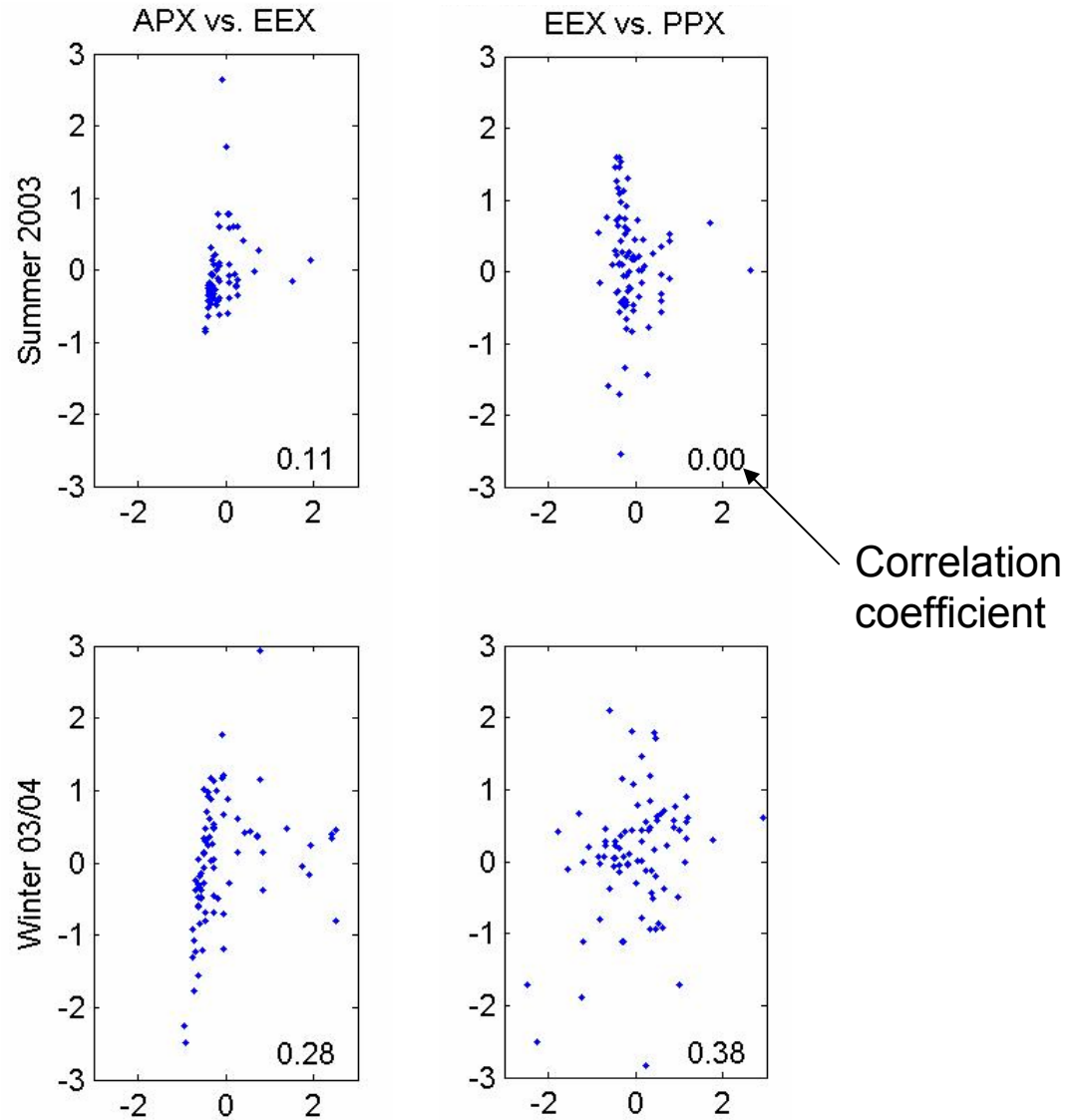


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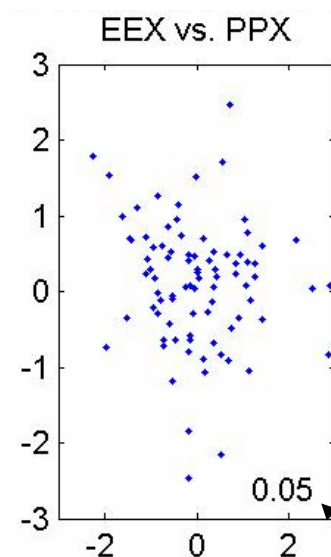
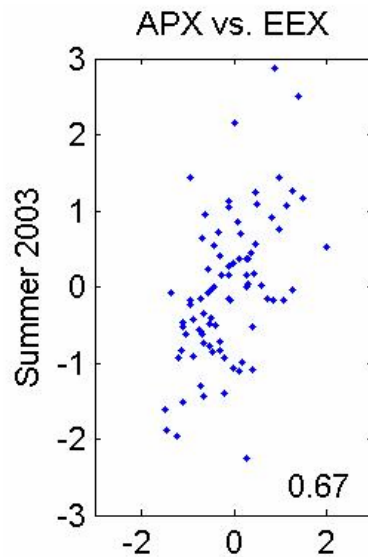
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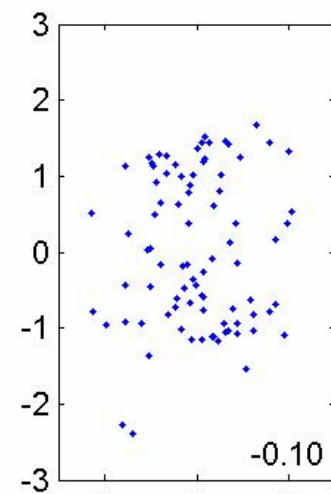
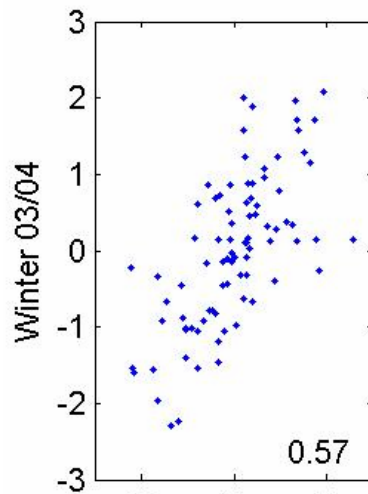
4.1 Correlation of 11h Price Series



4.1 Correlation of 23h Price Series

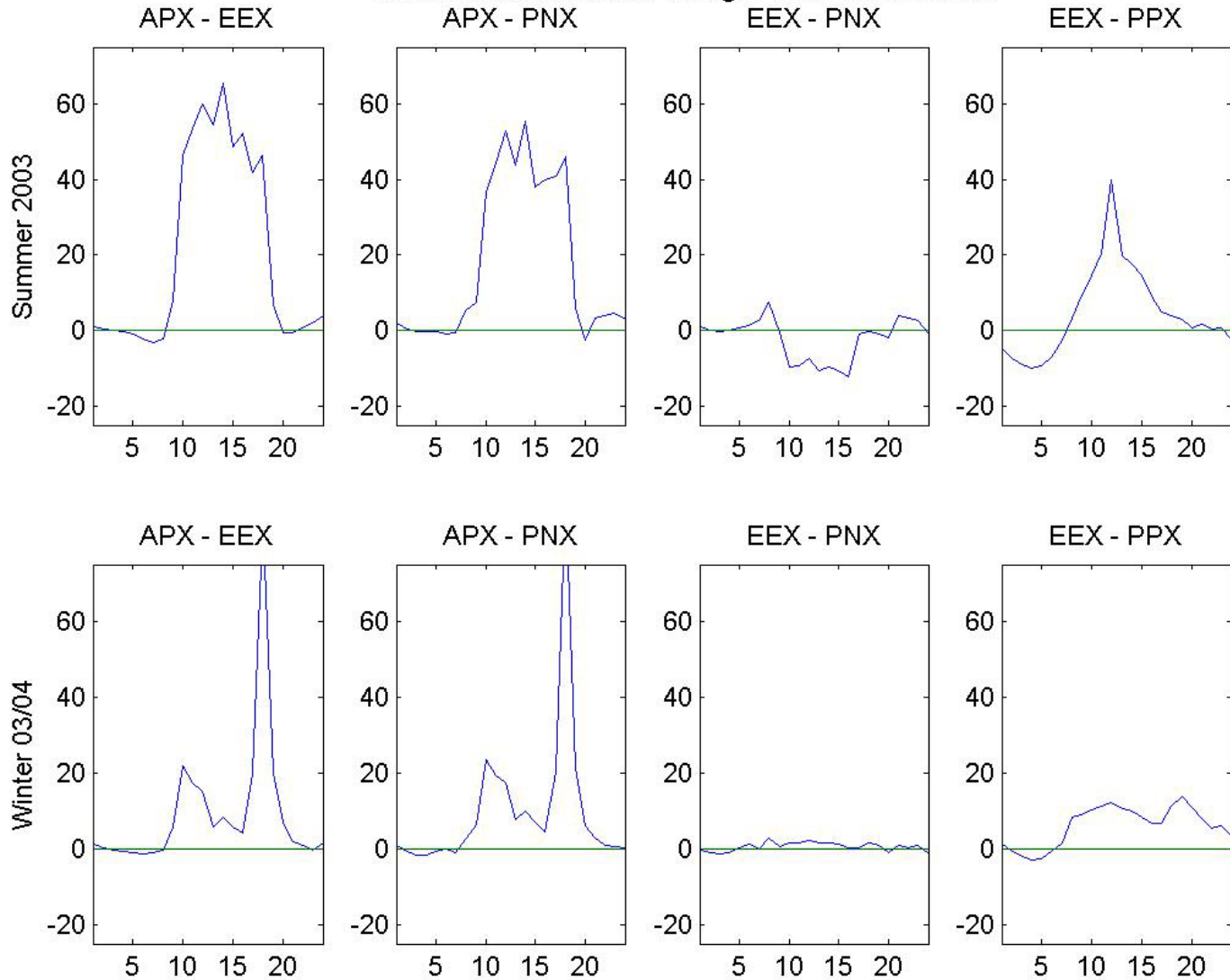


Correlation
coefficient



4.2 Mean Price

Difference of Seasonal Average Prices in EUR/MWh





4.3 Common Factor in the Time Series 1

Given:

($n \times 4$) matrix of Standardized Weekdays Electricity Spot Market Prices in APX, EEX, PNX and PPX from May02 to Nov04

Calculation:

Principle Component Analysis (Single Value Decomposition of the Correlation Matrix)

The Factors:

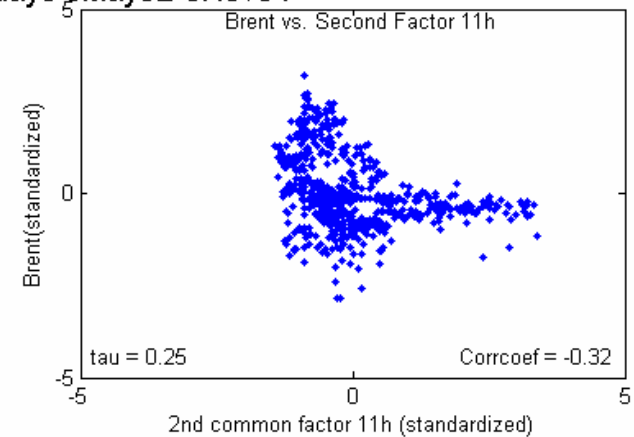
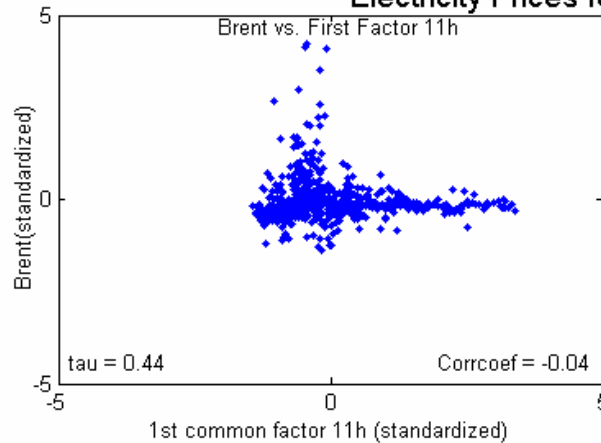
11h	Corr. w. APX	Corr. w. EEX	Corr. w. PNX	Corr. w. PPX	Tau
1 st Factor	0.79	0.63	0.86	0.04	0.44
2 nd Factor	-0.05	0.09	-0.06	0.99	0.25

23h	Corr. w. APX	Corr. w. EEX	Corr. w. PNX	Corr. w. PPX	Tau
1 st Factor	0.88	0.89	0.87	-0.74	0.72
2 nd Factor	-0.10	-0.26	-0.20	-0.67	0.14

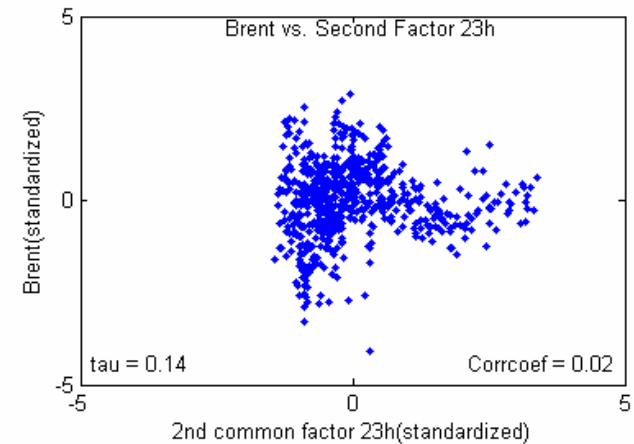
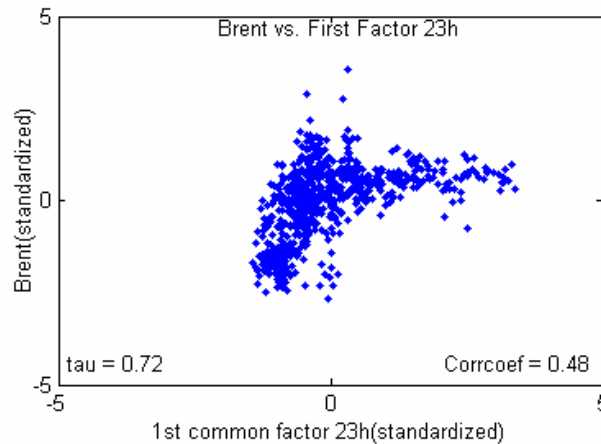
4.3 Common Factor in the Time Series 2

Scatterplots of Standardized Brent-Prices vs. the 1st and 2nd Common Factor of 11h and 23h Electricity Prices for Weekdays 8May02-8Nov04

11h



23h





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Conclusion and Outlook

- Polish Wholesale Prices are higher than West European at off-peak, lower in peak
- First Common Factor explaining most of the Wholesale Market Price Variance is not at all or even negatively correlated with POLPX-Prices
- The Polish wholesale market is the least integrated of European markets
- The Oil Price seems to be correlated with APX, EEX, PNX off-peak prices
- **Next Step:** Bring together price data and network characteristics