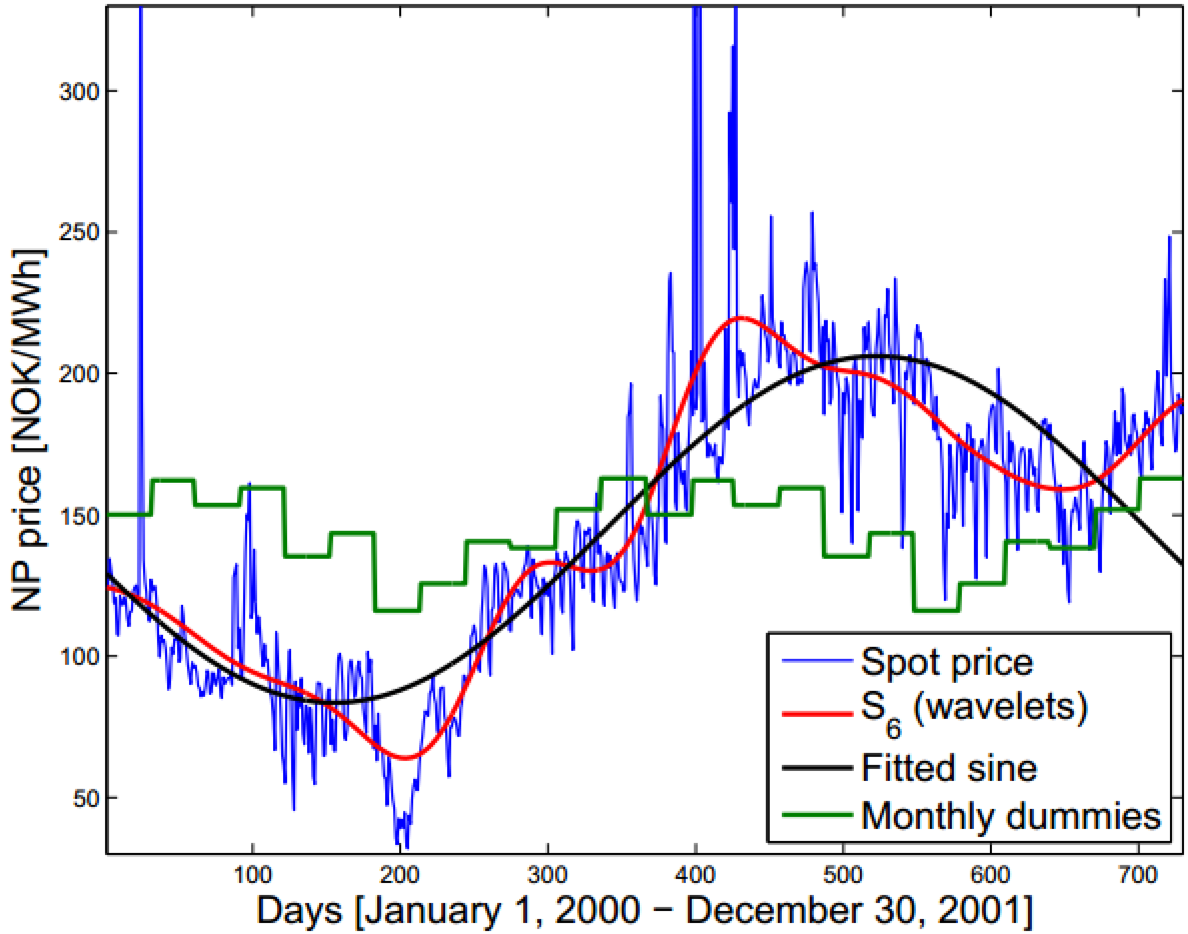
Electricity prices detrending and deseasonalization

with the Hodrick-Prescott filter

Michał Zator
(Joint work with Rafał Weron)
Wrocław University of Technology

Oslo, 12.12.2013

Oslo2013.



- The annual cycle does not show up in the data as clearly as expected
- Long-term trends dominate the regular, seasonal pattern

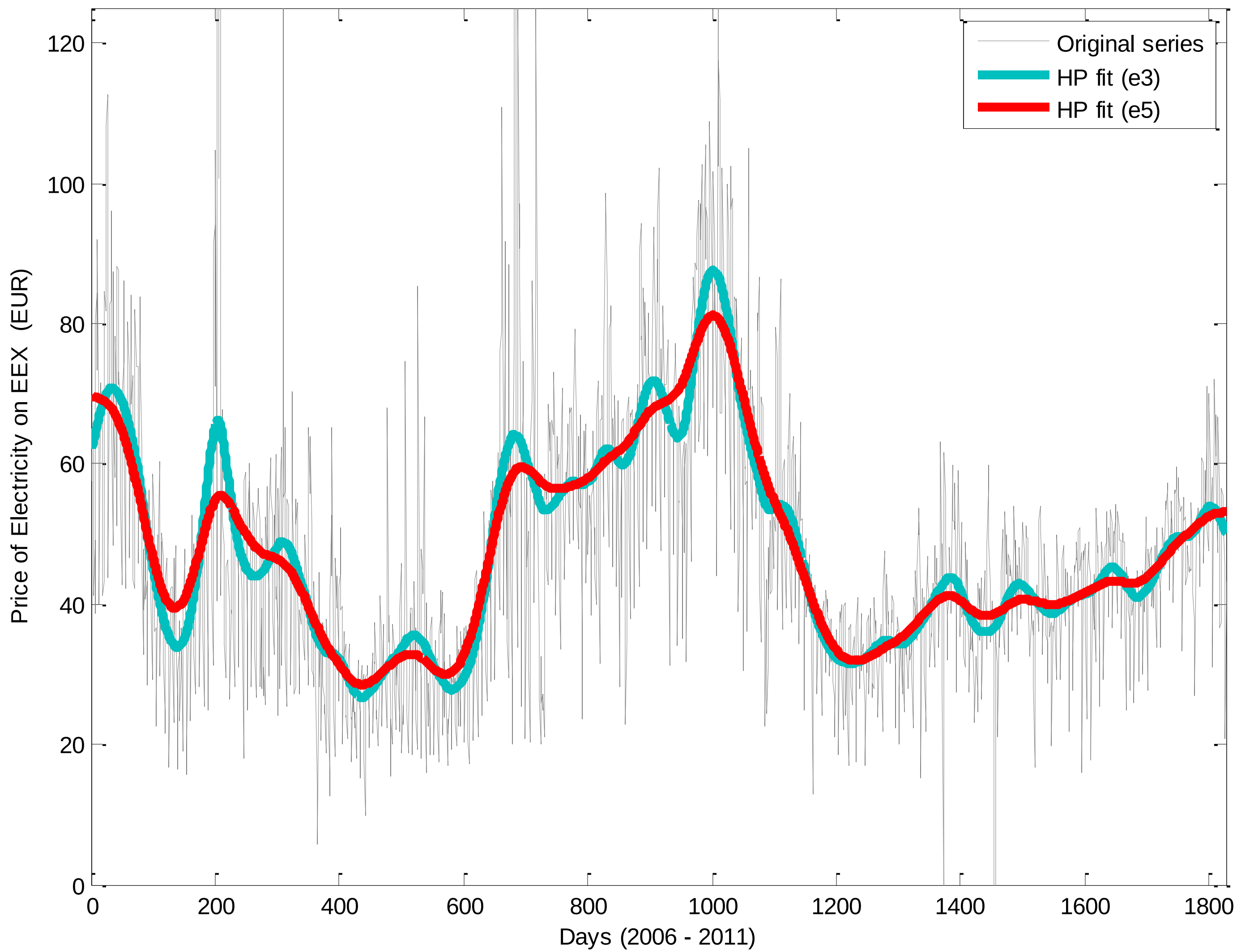
- The entire idea of detrending and deseasonalization is based on the presumption that the price series is the sum of a stochastic component and a more predictable component capturing some regularities (long-term trend and seasonality caused, e.g., by high prices of fossil fuels)
- However, the irregular behavior of this long-term component implies that imposing standard assumptions about seasonality (i.e. yearly, sinusoidal cycle) does not work very well
- We may therefore use a weaker assumption: that the long-term component is smooth

- In the field of growth-cycle decomposition of GDP a similar position was taken by Hodrick and Prescott (1981, 1997)
- They used this technique to account for long-term growth only – since most of macroeconomic data is already seasonally adjusted
- Nonetheless, the technique seems universal

- The idea is to find a long-term component which is (a) close to the original series and (b) smooth
- Measuring and weighting (a) and (b) is done by means of a loss function:

$$\min_{\tau}\left(\sum_{t=1}^{T}(y_t-\tau_t)^2+\lambda\sum_{t=2}^{T-1}\left[(\tau_{t+1}-\tau_t)-(\tau_t-\tau_{t-1})\right]^2\right).$$

  - Where y_t is the original series, τ_t is the long-term component and λ determines the importance of smoothness (higher λ means smoother series)


Original series
HP fit (e3)
HP fit (e5)
Price of Electricity on EEX (EUR)
Days (2006 - 2011)
0
20
40
60
80
100
120
0
200
400
600
800
1000
1200
1400
1600
1800

- One method of checking whether the Hodrick-Prescott filter works well in the context of electricity markets is to do the following:

1. Take original series and extract the long-term seasonal component (LTSC) with one, chosen method (wavelets, sines), subtract the LTSC from the original series to obtain the stochastic component
2. Based on the obtained stochastic component, estimate the parameters of a stochastic model (e.g. MRS)
3. Simulate N=100 stochastic components from the MRS model and add to the LTSC from #1
4. Use the Hodrick-Prescott filter (and other methods, for comparison) for each series generated in #3 and calculate the difference between the HP fit and the LTSC from #1

		Method of identification					
		HP filter (4*10^4)	HP filter (4*10^5)	Wavelet (5)	Wavelet (6)	Wavelet (7)	Sin + EWMA
Original long-term component	Wavelet (5)	0%	45%	19%	84%	163%	184%
	Wavelet (6)	20%	0%	91%	2%	117%	173%
	Wavelet (7)	130%	31%	266%	90%	0%	207%
	Sin + EWMA	27%	0%	101%	30%	36%	116%
	Average	44%	19%	119%	51%	79%	170%

The percentage surplus of the RMSE over the minimum RMSE in each row, for different methods (columns) used for different ways of extracting the original long-term component (rows, refer to #1 of the procedure)

To do:

- ❑ Further testing
- ❑ Optimal choice of the smoothing parameter λ

Thank you!

Michał Zator (michal.zator@pwr.wroc.pl)
Wrocław University of Technology

References:

- R.J. Hodrick, E.C. Prescott (1997) *Postwar U.S. business cycles: An empirical investigation*, Journal of Money, Credit and Banking 29(1), 1-16
- J. Janczura, S. Trück, R. Weron, R. Wolff (2013) *Identifying spikes and seasonal components in electricity spot price data: A guide to robust modeling*, Energy Economics 38, 96-110 (doi:10.1016/j.eneco.2013.03.013)
- J. Nowotarski, J. Tomczyk, R. Weron (2013) *Robust estimation and forecasting of the long-term seasonal component of electricity spot prices*, Energy Economics 39, 13-27 (doi:10.1016/j.eneco.2013.04.004)

Final version published as:

- R. Weron, M. Zator (2015) *A note on using the Hodrick-Prescott filter in electricity markets*, Energy Economics 48, 1-6 (doi:10.1016/j.eneco.2014.11.014)