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Investigating the plunge in German electricity futures prices

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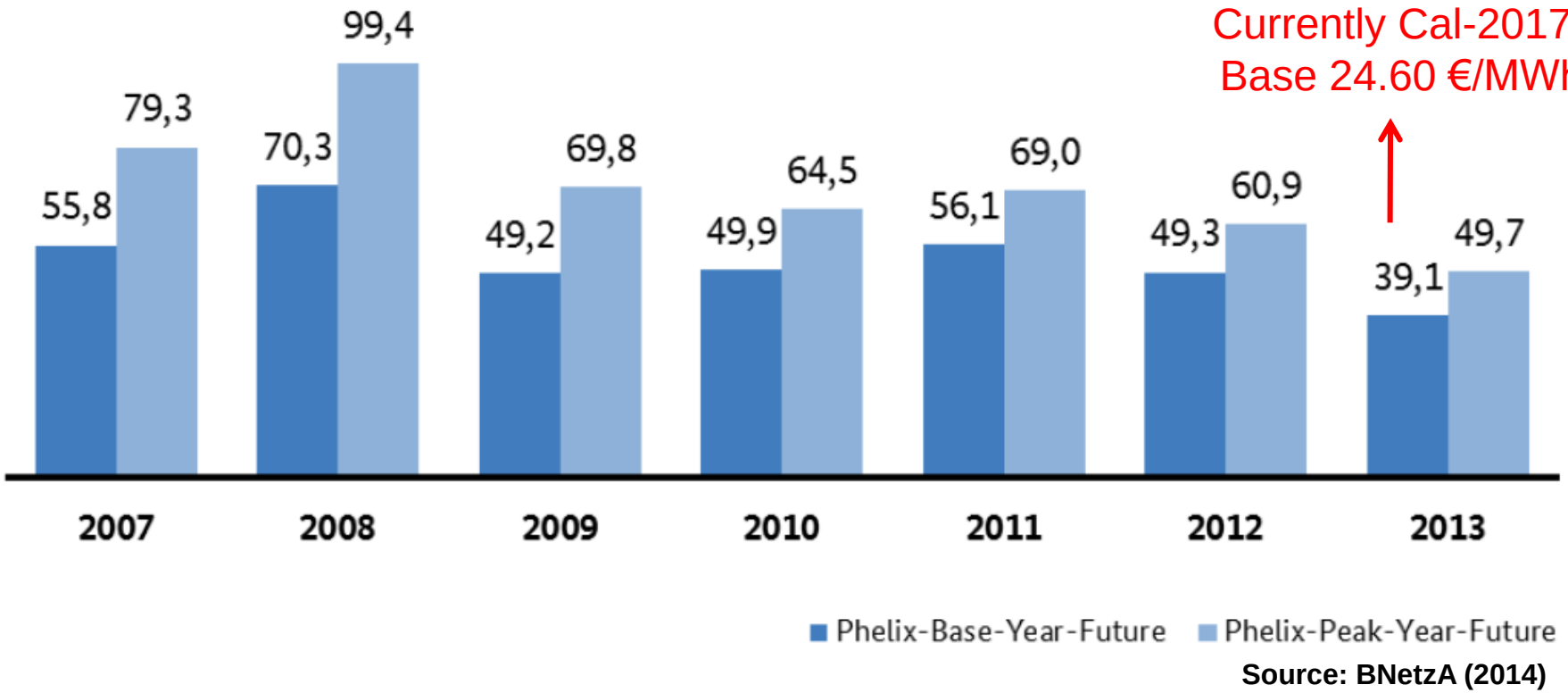
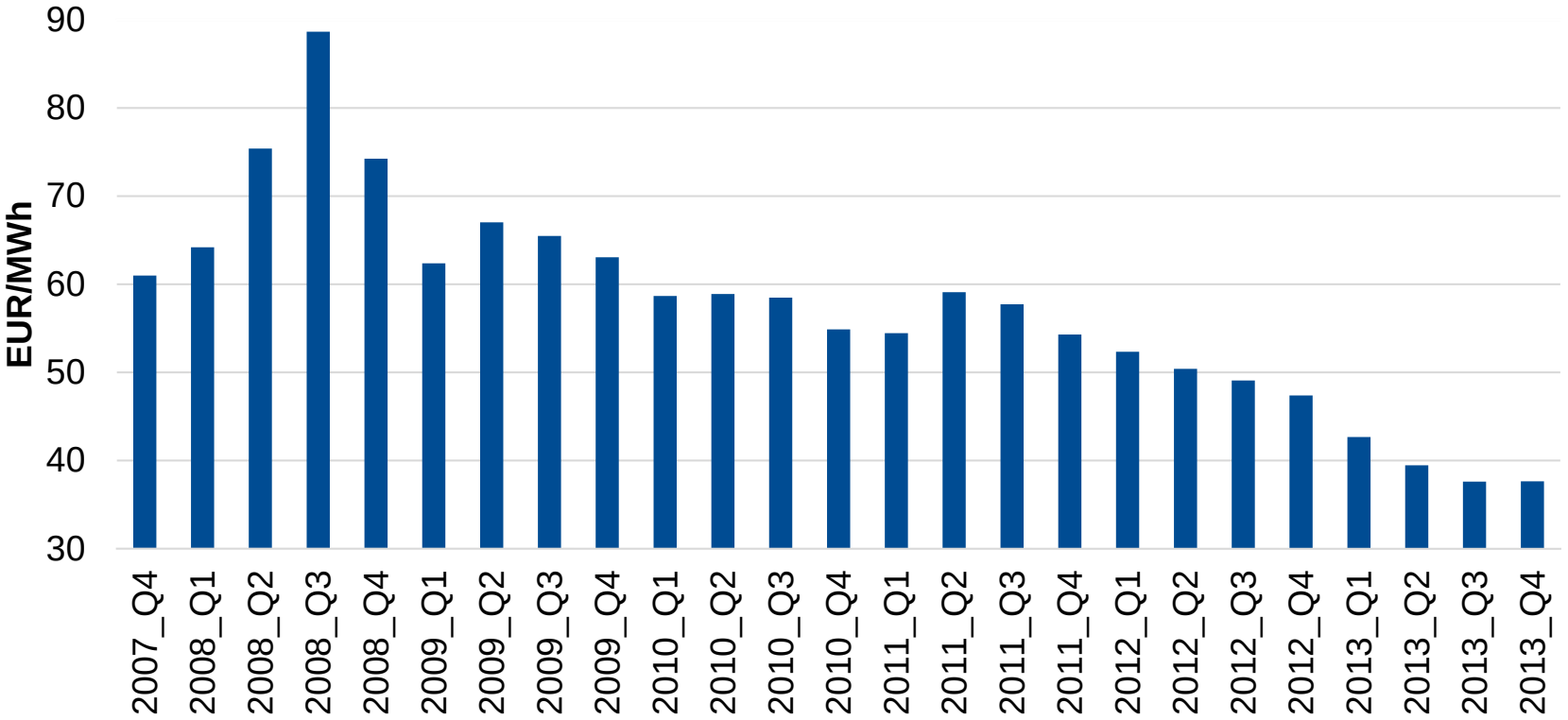
Motivation: German wholesale power prices have dropped



Source: BNetzA (2014)

→ Power prices declined by up to 40 %
→ Apparently only brief impact of nuclear policy reversal after Fukushima

Second look: a steep decline in the value of the Cal-14 future



→ How did expectations change between 2007 and 2013?
→ Is this development driven by the increase in renewable generation?

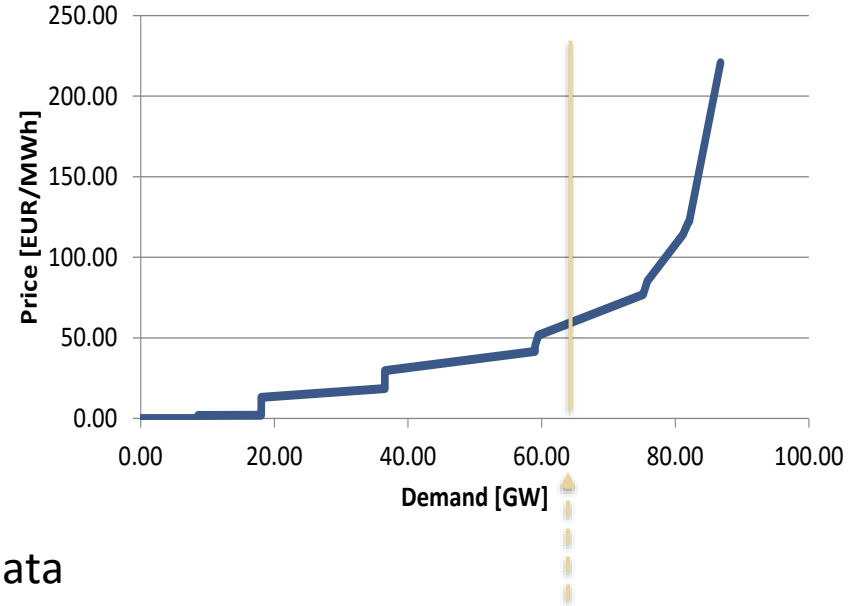
Question: What has happened in the meantime - Sustainable development or speculation?

Goal: Reconstruction of Q4 2007 and Q4 2013 prices for Cal-14

- Use of a parsimonious fundamental model
- Determine 2007 and 2013 expectations for fundamentals' values in 2014
- Decomposition of price impacts due to changes in
  - Renewable penetration
  - Conventional capacities
  - Fuel prices
  - CO2 prices
  - Demand

Parsimonious fundamental model for electricity prices

- Computation of expected prices in an **equilibrium model**
  - Intersection of supply and demand yields prices
- **Supply** side
  - Based on marginal costs of production
  - Piecewise linear supply stack
    - Based on min. and max. efficiency per technology class
  - Correction for CHP must-run, partly temperature dependent production



- **Demand** side
  - Hourly demand profile scaled with annual data
  - Subtraction of renewable profiles (wind and solar) yields residual demand
- Exports/Imports determined endogenously
  - Regression-based estimates: demand, RES infeed, baseload plant availability

Reconstruction of the inputs (expectations to validate the model)

- Demand
  - Extrapolation of demand growth of preceding three years
- Renewables
  - Mid-term forecasts of grid operators
- Conventional capacities
  - BMU Leitstudie 2007, manually adjusted for nuclear phase-out
- Fuel and CO2 prices
  - Myopic expectations beyond the far end of the forward curve

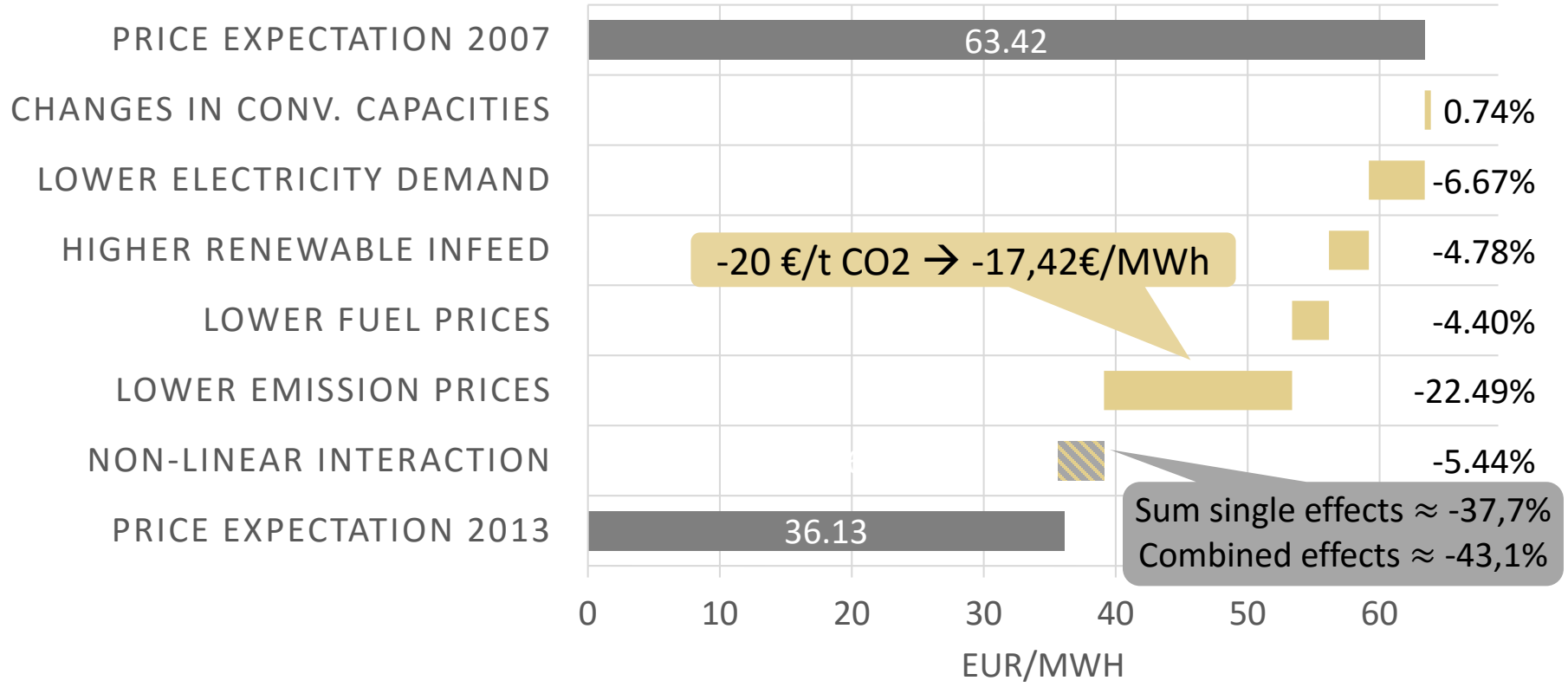
Information basis:		Q4 2007	Q4 2013
Expectation for:		2014	2014
Load	TWh	643,8	603,7
Solar	TWh	5,93	36,60
Wind	TWh	53,92	56,28
Cap	GW	120,6	117,1
Coal	EUR/MWh	10,19	8,70
Gas	EUR/MWh	27,31	29,37
CO2	EUR/t	24,92	4,90

Validation of parsimonious model

Information basis	Q4 2007	Q4 2013	
Expectations for:	2014	2014	
Phelix Base Future	61.30	37.64	EUR/MWh
Fundamental Model Price	63.42	36.13	EUR/MWh

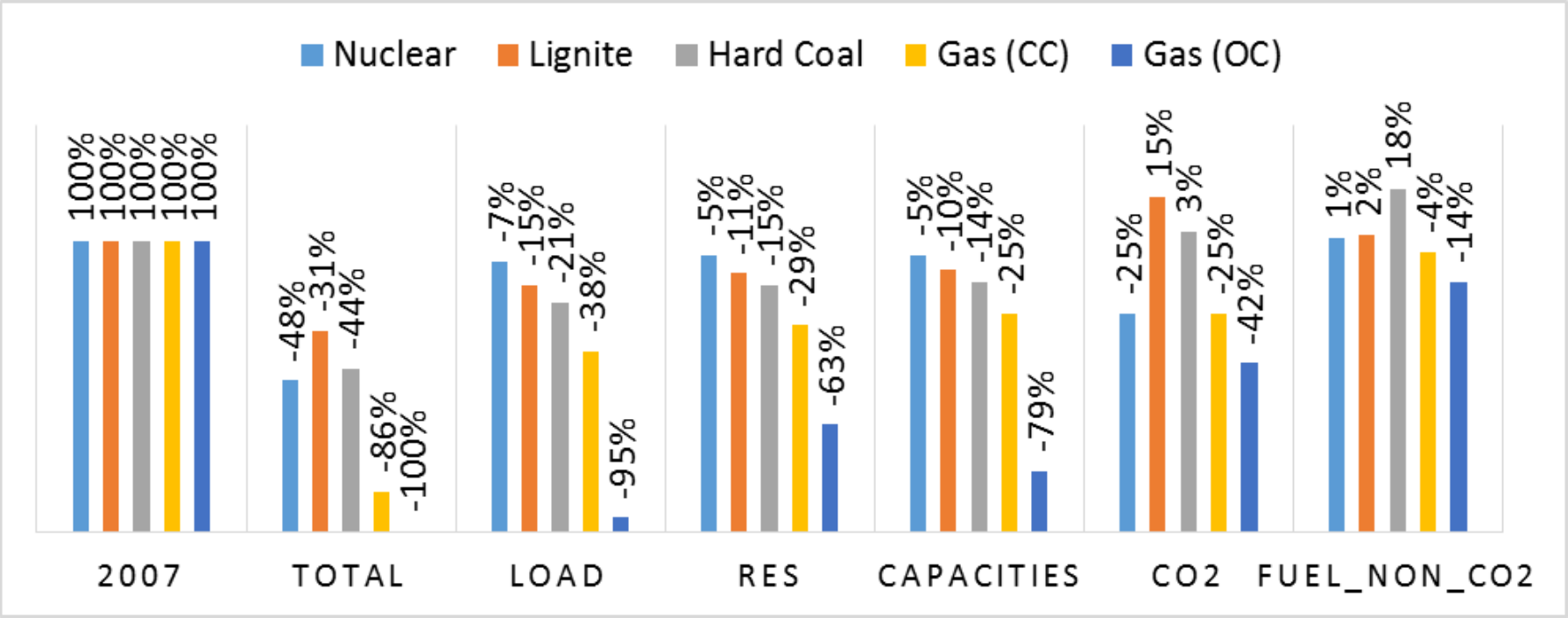
Result: impact of expectation changes on base price

Ceteris paribus approach: individual factor updated from 2007 to 2013 value



Result: operating margins of power plants

- Power plants as strip of European options
- Without technical restrictions & personnel costs
- Impact varies across considered factors:



Conclusion

- The drop in 2007-2013 wholesale electricity prices is driven by fundamentals
  - Model able to capture impact factors and replicate prices
- Analysis of individual factors finds
  - Emission price drop as largest single factor, demand and renewables follow
  - Combined effect of all factors larger than sum of individuals
  - Feedback effect between RES extensions and CO2 price drop?
- Slightly different result for plant operators
  - Load uncertainty large factor, fuel prices impact ambiguous

➢ Source of electricity price drop and loss of plant profitability not equivalent

➢ Falling prices still ongoing, potentially political activities required

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Thank you for your attention

Kallabis T.; Pape C.; Weber C.: The plunge in German electricity futures prices – Analysis using a parsimonious fundamental model - EWL Working Paper 04/2015, Essen 2015

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