

MODELLING THE VOLATILITY OF ELECTRICITY SPOT PRICE IN BRAZIL

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Agenda

1. Goal
2. Spot Price in Brazilian Electricity Sector – PLD
3. Volatility and its causes
4. Conclusions

Goal

- The main goal of this paper is to model the volatility of the electricity spot price in Brazil.

Brazilian Electricity Market

- One of the largest of the world
- Installed Capacity = 110 GW
- Hydro-thermal, mainly hydro.
- Institutions well defined
- Large investments in Renewable sources
- Two different markets: Regulated and Free Market.
- 4 regional markets

Brazilian Electricity Market

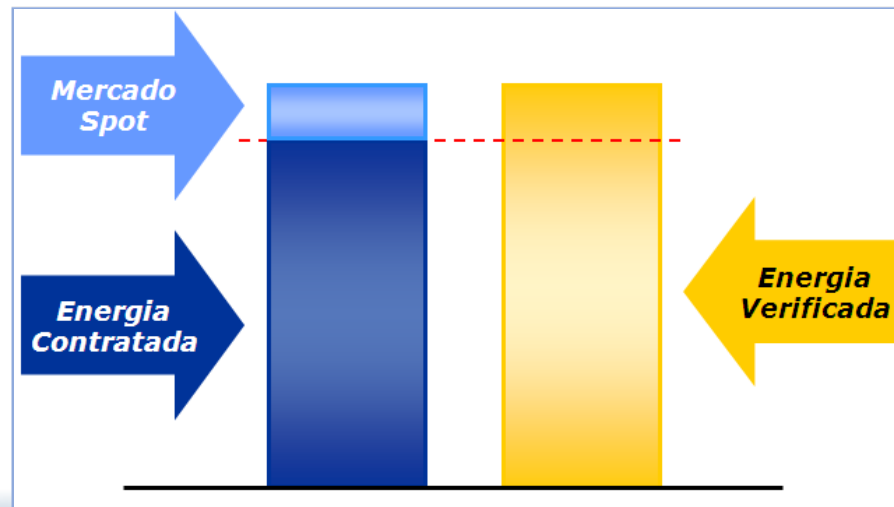
- Market for differences
- Differences settled based on PLD, which is the Settlement Price of Differences
- Minimum and maximum PLD
- Market rules and procedures

Brazilian Electricity Market

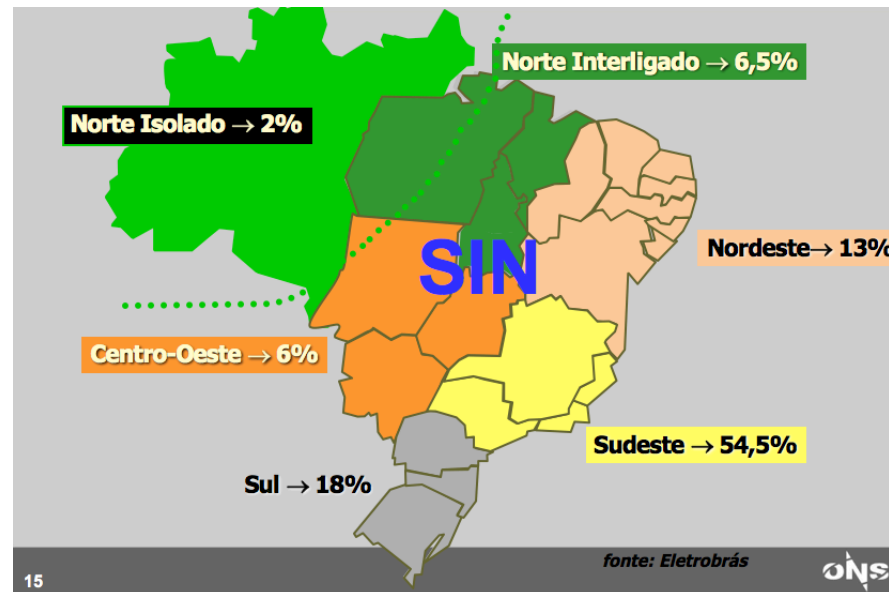
- The difference between contracts of energy and generations – energy market traded short-term or Spot market – is priced at PLD (price of settlement of differences).
- PLD is established in weekly basis.

Brazilian Electricity Market

- The difference between the contracted and verified values – energy market traded short-term or Spot market – is priced at PLD (price of settlement of differences).



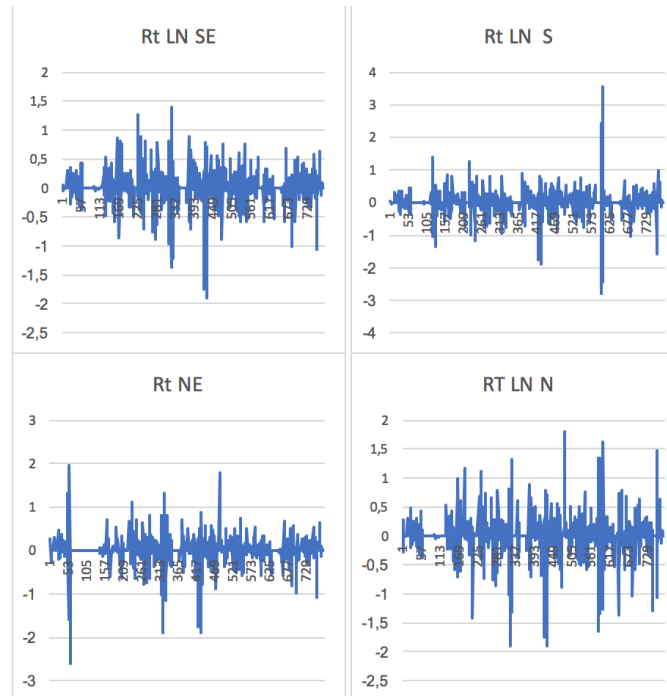
Brazilian Electricity Market



Methods

- Prices from the four markets (SE, S, NE and N)
- 780 observations
- Took off inflation effects
- NL Prices
- Calculated returns
- Estimate Garch Model
- Estimate Granger effects

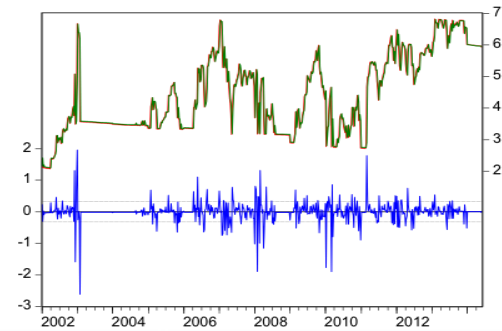
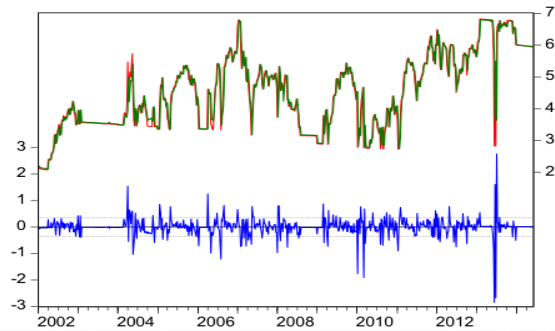
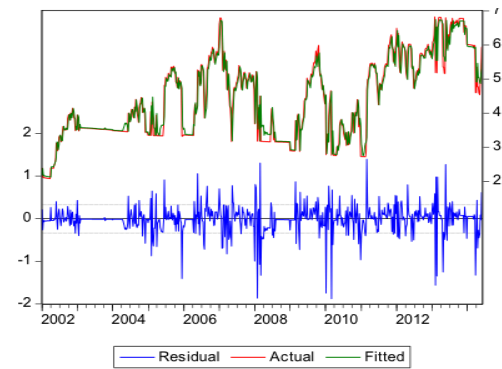
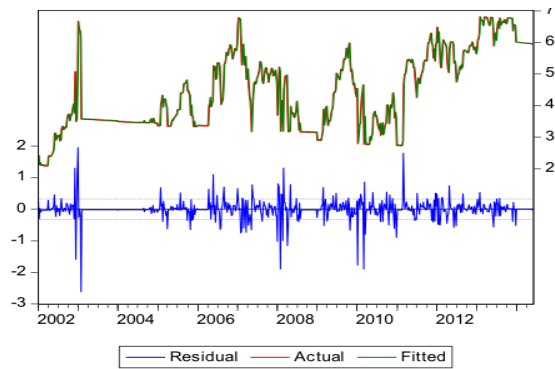
Return NLPrices



Garch Models

- SE
 - $GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*GARCH(-1)$
- S
 - $GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)$
- NE
 - $GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*GARCH(-1)$
- N
 - $GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*GARCH(-1)$

Garch Models



Causes of volatility

- Federal Constitution (1988) has presented environmental concerns.
- Since then, no large reservoirs were built.
- Reservoirs in the past acted as a hedge in dry seasons.
- Since then hydro plants are of run-of-river type.

SPOT PRICE - PLD

- PLD is not a result from demand and supply.
- PLD reflects the forecast of the quantity of water available in reservoirs for the next week.
- $PLD = \min(\text{future cost} + \text{immediate cost})$ of use water.

But, demand is increasing. So what's the solution?

- Dispatch cheap thermal plants during all year.
- This would increase the price, but the volatility would be softened.
- Price should be determined by demand x supply