

economics_{for}
energy

Renewable generation and electricity prices in the German and Austrian market

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Why this study?

- Importance of understanding consequences of increased renewable production (price effect)
 - RE as a key to decarbonise (IPCC, IEA)
 - Subsidies, support systems
- First study for DE / AT based on market data (only simulations so far)
 - DE / AT region has high RE capacity
 - Relevance for entire EU (EU-wide consequences?)

The model

Dependent variable:

Day-ahead **electricity price** at EEX (AT & DE) by:

Explanatory variables:

- **Vertical system load** (eq. quantity, demand) Forecast
- **RE generation** (wind + solar) Forecast
- Day-ahead **natural gas Price**
- Electricity **Export/Import** balance (10 countries)
- **Dummies** (daily, monthly, holidays)

$$\Delta \mathbf{Pe}_t = \beta_0 + \beta_1 \Delta \mathbf{Load}_t + \beta_2 \Delta \mathbf{RE}_t + \beta_3 \Delta \mathbf{Pg}_t + \beta_4 \Delta \mathbf{ExIm}_t + \epsilon_t$$

The model

- Daily averages
- First differences (Δ)
- Period: July 1st 2010 – March 31st 2012
- Various data sources

$$\Delta Pe_t = \beta_0 + \beta_1 \Delta Load_t + \beta_2 \Delta RE_t + \beta_3 \Delta Pg_t + \beta_4 \Delta ExIm_t + \epsilon_t$$

Results

		Dependent variable: $\Delta P_{elec, t}$	
		Model 3	
$\Delta Load_t$	coeff.		0,000163
	(s.d.)		(0,00032)
ΔRE_t	coeff.		-0,001022
	(s.d.)		(0,000094)
$\Delta ExIm_t$	coeff.		-0,000326
	(s.d.)		(0,00032)
$\Delta P_{gas, t}$	coeff.		1,0931
	(s.d.)		(0,357)
daily dummies			yes
monthly dummies			yes
holiday dummy			yes
observations			640
Adjusted R-squared			0,729
D-W			2,568

RE, P_{gas} significant

Electricity Prices fall by **1 €/MWh** for each GWh of renewable production

about 2% at average prices of 49,26 €/MWh

smaller than other studies DK, E

Significant coefficients in fat print ($p < 0,01$); standard deviations in parenthesis & grey (N-W standard errors).

Results









How robust is the result? → model variations

- Divide dataset: First and last year
- Divide dataset: High and low load days (upper & lower 25%)
- Distinguish between solar and wind (instead of sum RE)
- Weekly averages (instead of daily averages)

Results

	Model 3	<i>1st year</i> Model 3A	<i>2nd year</i> Model 3B	<i>high load</i> Model 3C	<i>low load</i> Model 3D	<i>RE separate</i> Model 3E	<i>weekly</i> Model 3F
$\Delta Load_t$	0,000163 (0,00032)	0,00048 (0,00016)	0,000132 (0,0001)	0,000135 (0,00019)	0,000108 (0,000172)	0,00017 (0,00005)	0,000388 (0,00049)
ΔRE_t	-0,001022 (0,000094)	-0,000927 (0,00014)	-0,000869 0,000106	-0,001202 (0,000162)	-0,001022 (0,000167)		-0,0079 (0,00017)
$\Delta Wind_t$						-0,001028 (0,000094)	
ΔSol_t						-0,00154 (0,000275)	
ΔExl_{mt}	-0,000326 (0,00032)	0,000014 (0,000508)	-0,000797 (0,000393)	0,000245 (0,0004)	-0,000484 (0,000456)	-0,00029 (0,00032)	0,00088 (0,00049)
$\Delta P_{gas\ t}$	1,0931 (0,357)	0,443101 0,45563	1,259 (0,398)	1,624 (0,299)	0,395 (0,698)	1,09 (0,363)	1,625 (0,00024)
daily dummies	yes	yes	yes	yes	yes	yes	no
monthly dummies	yes	yes	yes	yes	yes	yes	yes
holiday dummy	yes	yes	yes	yes	yes	yes	no
observations	640	365	366	160	160	640	90
Adjusted R-squared	0,729	0,7236	0,723	0,703	0,433	0,73	0,702

Results

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Conclusions / Discussion

- Some interesting results regarding the set of coefficients

Exlm relevant for last year only

RE price impact equal for high and low load days

solar effect > wind effect

- **Main Conclusion:** The price effect of RE is robust throughout all variations of the model

Electricity Prices fall by ± 1 €/MWh for each GWh of renewable production

other research: 2€/MWh upwards,

why?

size of market (AT+DE)?

International impacts?



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