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Correct Tick Value and other important problems in long term development of Weather Derivatives Market in Poland

WRMA Conference – 1-3 June 2009, Miami, FL

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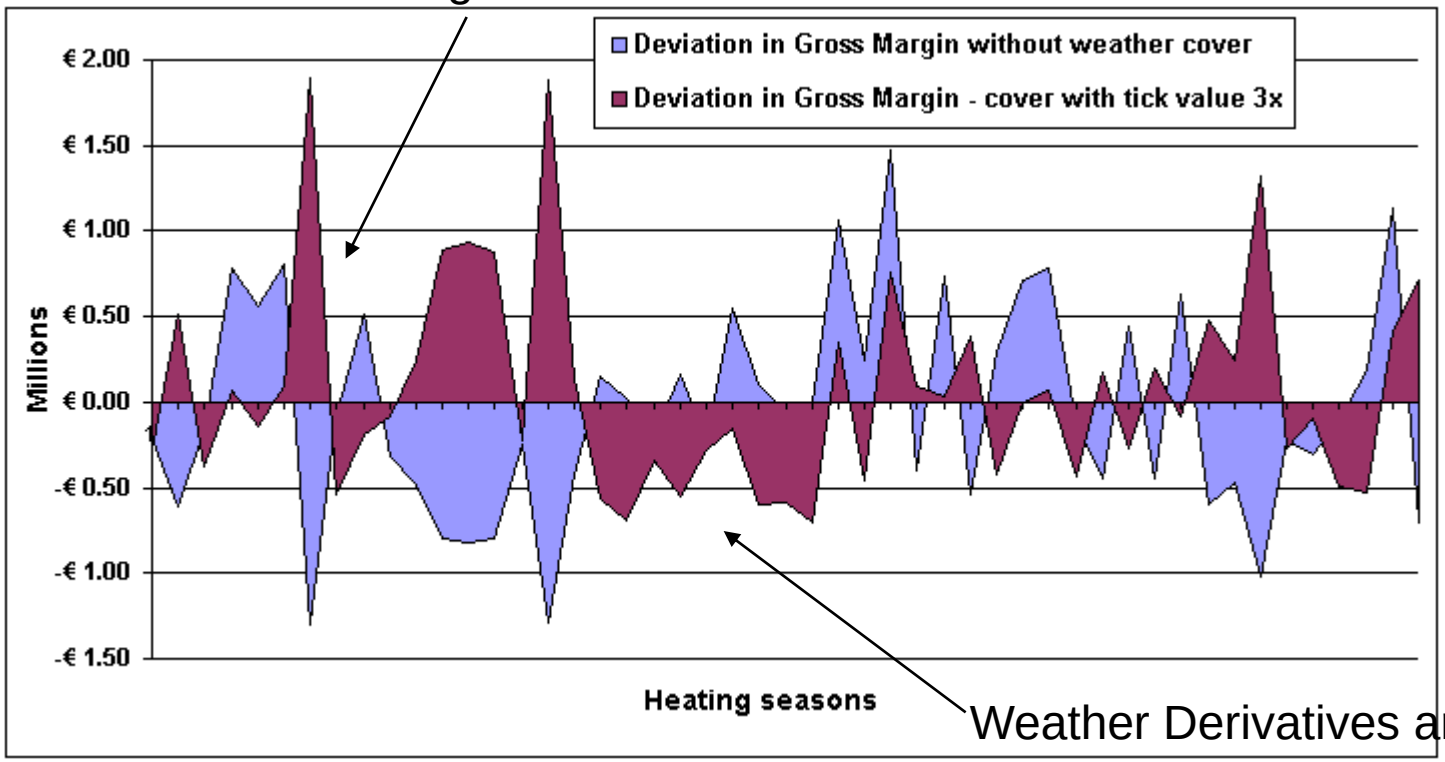
Agenda

1. Impact of tick value on hedging efficiency,
2. Methods of Weather Risk Measurement,
3. Empirical Research
4. Results
5. Conclusions
6. Other problems in application weather derivatives
7. References

Impact of tick value on hedging efficiency

Scenario 1: When tick value is bigger than it should be…

Weather Derivatives
are great !!!

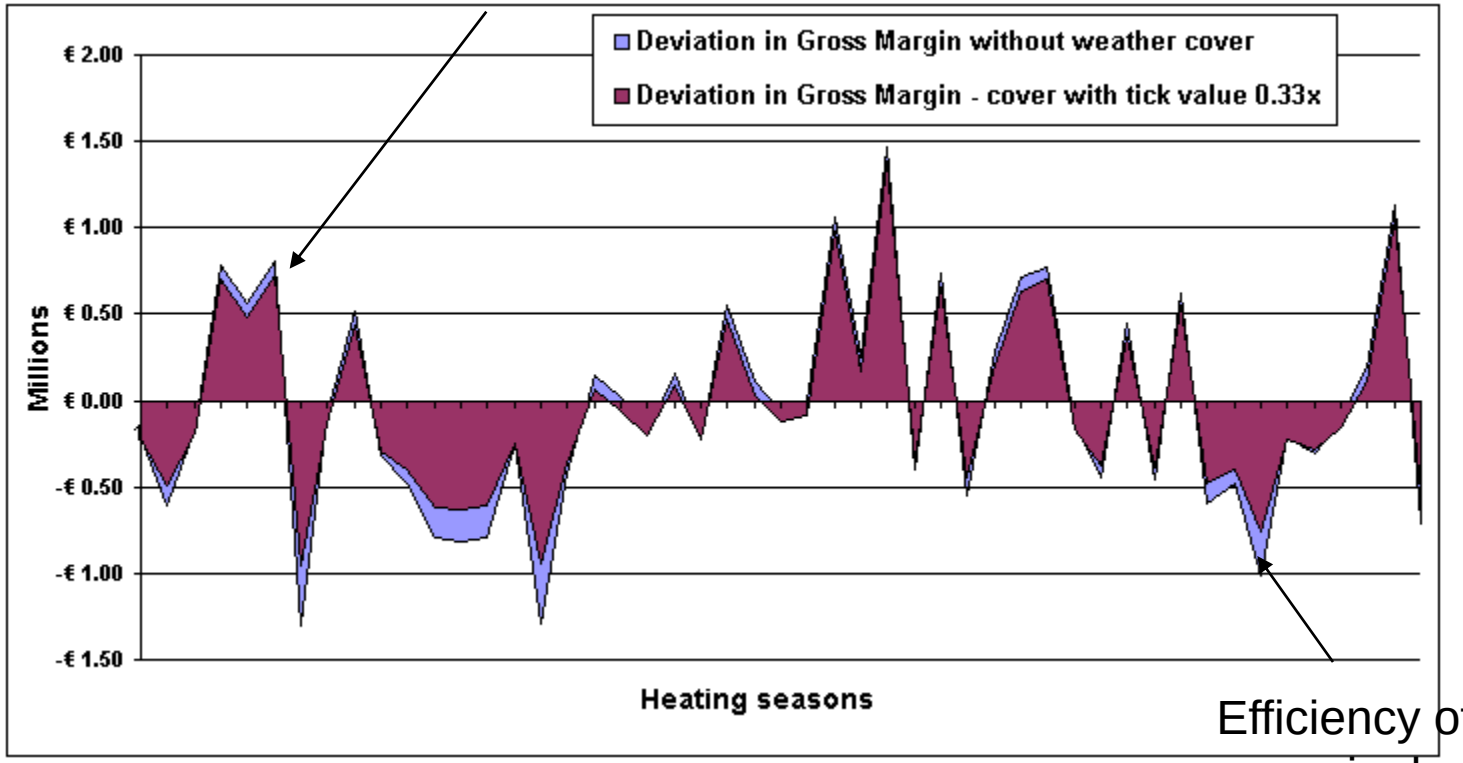


Weather Derivatives are very
expensive !!

Impact of tick value on hedging efficiency

Scenario 2: When tick value is lower than it should be…

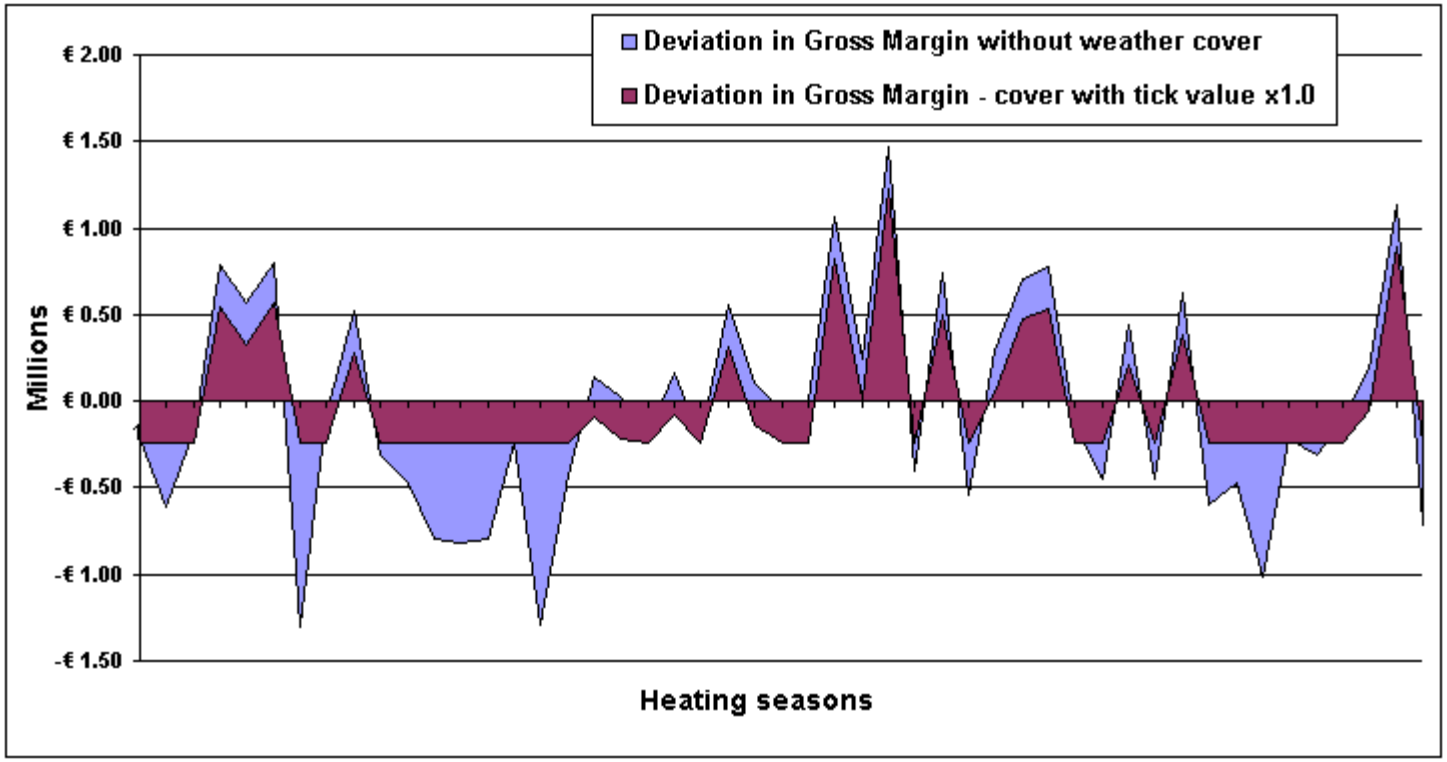
Weather Derivatives are very cheap !!



Efficiency of Weather cover is doubtful !!!

Impact of tick value on hedging efficiency

Scenario 3: When tick value is as it should be…



Methods of Weather Risk Measurement

Methods*:

- **Best/Worst approach**
  - Clemmons and Radulski (2002),

- **Margin coefficient**
  - Forrest (2002),

- **Multivariate Linear Regression**
  - Clemmons and Radulski (2002),

- **Multivariate Linear Regression with dummy variables**
  - Greene (1993),

*Methods fully described in Pres (2009)

Empirical Research

Data & Methodology Description

Data

a) monthly time series of residential natural gas consumption and yearly time series of number of customers in the state of Illinois (U.S.) for the period January 1989–October 2007

b) daily time series of maximum and minimum temperatures, average wind speeds, and total daily precipitation for the Chicago station (WMO 72530) for a similar period as above

Methodology

a) Two periods (1.1989-12.1998 and 1.1999-10.2007)

b) Tick value for next period – mentioned above 4 methods,

c) Weather indices used in building weather cover (HDD[65], CWSI[kts], CPI[inch]),

d) Expected value for given weather index – 10 years average,

Results

Table 2. Selected statistics referring to empirical deviation from the monthly plan with analyzed weather covers and without.

Name of statistics	Without Weather Cover	Best/Worst	Margin coefficients	Multivariate Linear regression	Multivariate Linear regression with dummy variables
Maximum negative deviation [cf]	-8 131.31	-6 525.53	-4 378.84	-4 852.74	-4 894.66
Maximum positive deviation [cf]	6 016.88	4 097.97	2 626.64	2 205.40	2 294.77
Average deviation [cf]	2 288.00	1 644.55	1 406.49	1 261.56	1 177.69
Maximum deviation [%]	40.76%	95.44%	57.76%	44.48%	37.51%
Average deviation [%]	10.41%	13.40%	10.24%	6.80%	6.13%

Results

Table 3. Empirical reduction of maximum deviation from monthly plan with analyzed weather covers.

Name of statistics	Maximum Deviation Without Weather Cover [cf]	Reduction of maximum deviation from plan [cf] - Δ of volatility			
		Best/Worst	Margin coefficients	Multivariate Linear regression	Multivariate Linear regression with dummy variables
January	8131.31	**-4178.38**	-3752.47	-3278.58	-3236.65
February	4917.02	-2356.71	-2648.02	-2795.1	**-2802.61**
March	4877.57	-1745.51	-1442.47	-1761.67	**-1847.5**
April	3636.42	-554.94	-1676.63	**-1997.29**	-1957.51
September	944.65	120.02	831.05	**101.39**	208.52
October	2713.43	3812.1	252.27	327.61	**-548.57**
November	5964.23	-4318.98	**-4372.69**	-4050.13	-3905.14
December	6016.88	-2651.02	**-3098.2**	-2739.23	-2817.15
Total reduction in maximum deviation	37201.51	-11873.41	-15907.17	-16192.99	-16906.61

Values in **bold** reflect method in given month when reduction was best

Results

Table 4. Empirical reduction of average deviation from monthly plan with analyzed weather covers.

Name of statistics	Average Deviation Without Weather Cover [cf]	Reduction of average deviation from plan [cf] - Δ of volatility			
		Best/Worst	Margin coefficients	Multivariate Linear regression	Multivariate Linear regression with dummy variables
January	2875.04	**-1901.38**	-1896.57	-1728.82	-1592.63
February	1570.36	-819.97	-823.94	-951.04	**-976.77**
March	1592.41	-851.92	-680.97	-908.72	**-953.82**
April	1107.85	-292.75	-677.54	**-747.39**	-637.21
September	228.4	77.12	288.58	44.09	**33.75**
October	820.92	1301.66	71.65	13.11	**-350.18**
November	1960.83	-1507.63	**-1580.87**	-1562.8	-1498.35
December	2156.92	-1241.63	**-1364.41**	-1463.48	-1424.91
Total reduction in average deviation	12312.74	-5236.51	-6664.07	-7305.06	-7400.11

Values in **bold** reflect method in given month when reduction was best

Conclusions

- *It is very important to use precisely estimated tick value – it will guarantee (long term) that premium won't be extremely high (including regular margins for brokers) and payout won't be extremely low (including regular stochastic deviations)*
- *We found that the most accurate approach is the multivariate linear regression model with dummy variables, model without dummy variables is slightly worse…*
- *Basically, the Best/Worst approach should not be used in practice at all – it can be used just in educational purposes,*
- *The general efficiency of weather-derivatives hedging could not be drawn from this study, because many factors were omitted (other stations in Illinois, monthly number of customers, breaks, renovations, ect.)*

Other problems in application…

1. Our weather exposure (tick value)?
2. It is a game, once below, next time above
3. Weather derivatives (weather insurance) are expensive and sometimes doesn’t work,
4. Do we have quanto exposure?
5. Weather insurance or weather derivatives (ratings),
6. Energy Regulatory Office

References

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- Greene, H. (1993) Econometric Analysis, New York: Macmilan
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