

Volatility and risk sharing in European gas markets

Work in progress

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Introduction

- There has been a substantial debate with respect to the market structure for natural gas in Europe after deregulation commenced
 - Long-term oil linked contracts at the continent
 - UK autarky in the mid 1990s
 - Interconnector from 1998: Arbitrage?

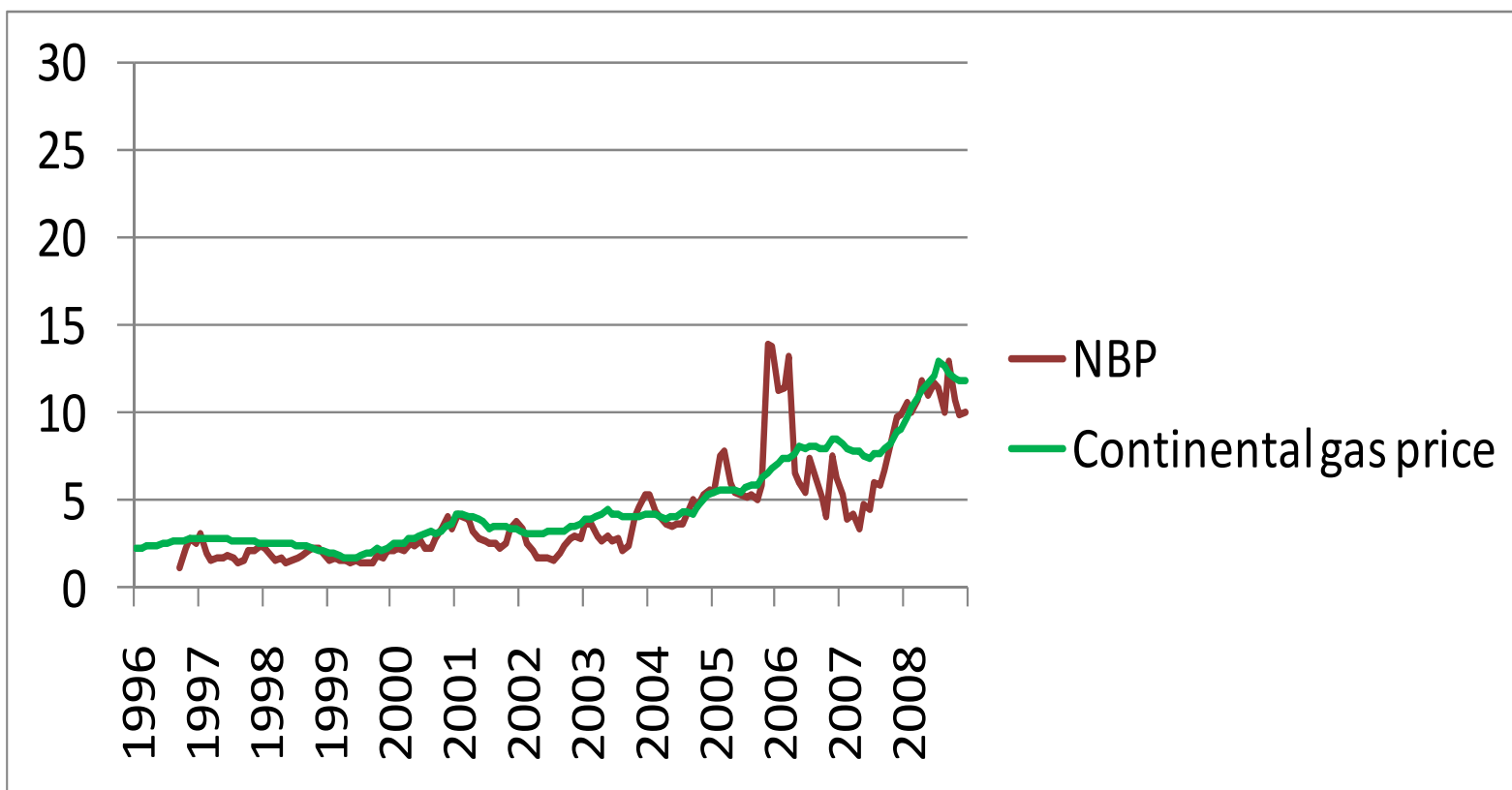
- New spot trading places at the continent
 - Zeebrugge, TTF

- Recently there are clear indications of peak load pricing for gas in the UK
 - Implies that capacity is an issue and the Interconnector does not have capacity to mitigate this
 - Limits arbitrage opportunities
 - As expected given the US experience

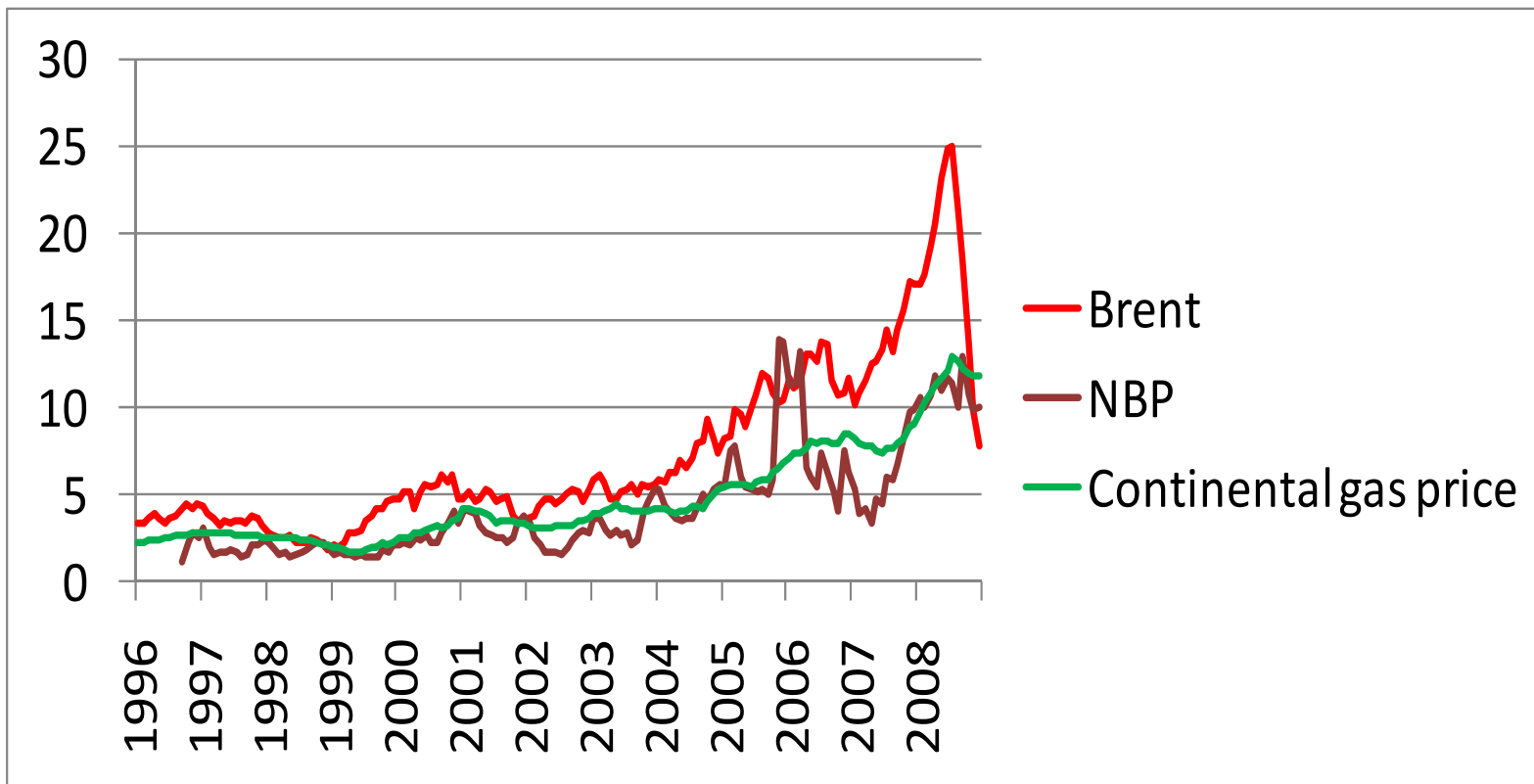
Introduction

- Deregulation and speculation is expected to reduce price volatility in a competitive market
- Increased competition is (normally) expected to increase volatility
- When deregulation increase competition and introduce speculation, the effect is an empirical question, depending on what dominates (Slade)
- Market integration in the European market
 - Asche, Osmundsen and Tveteras, Asche, Osmundsen and Sandsmark, Silverstovs et al, Panagiotidis and Rutledge
- Volatility spillovers?
- Volatility for gas has has primarily been studied in the US
 - Pindyck, Mu
- Volatility spillover is so far only studied by Ewing et al, again in the US

Contract and spot gas prices

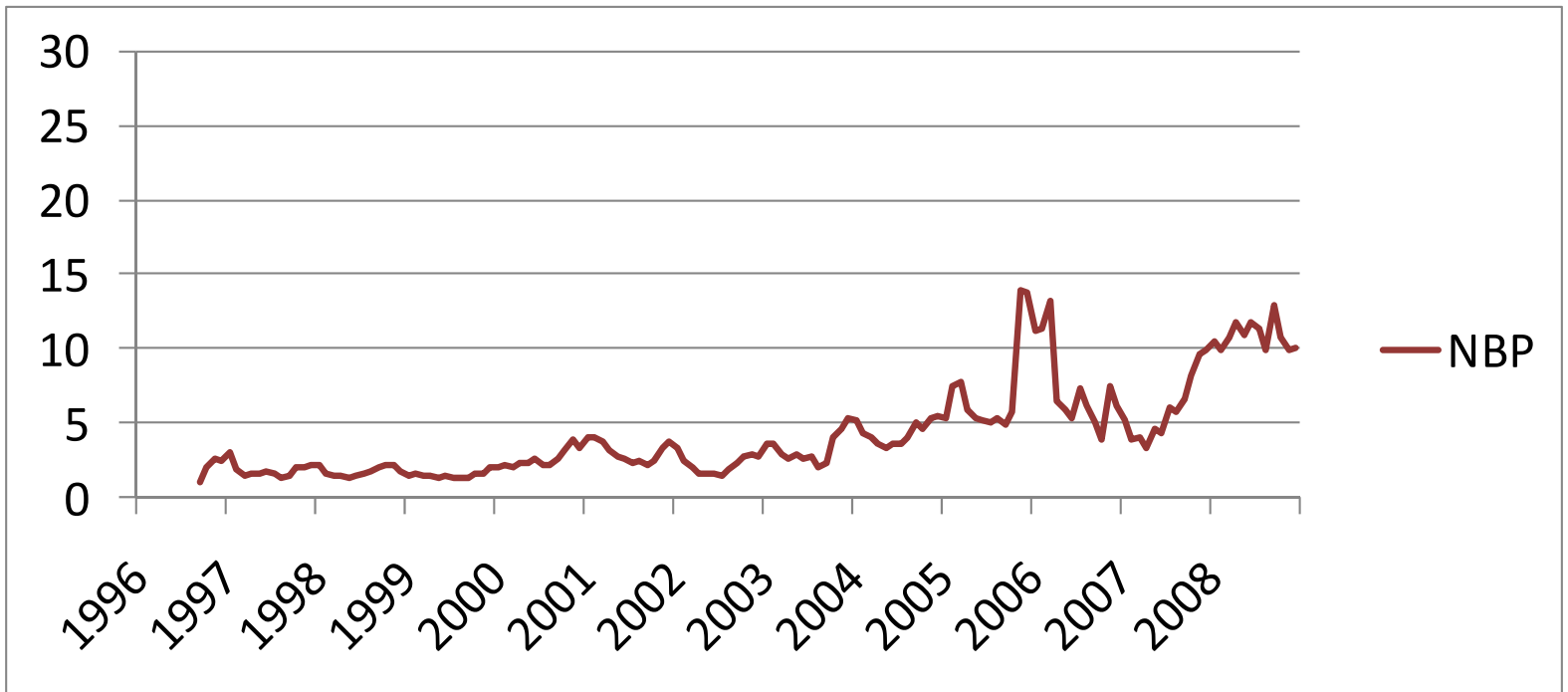


Contract and spot gas prices



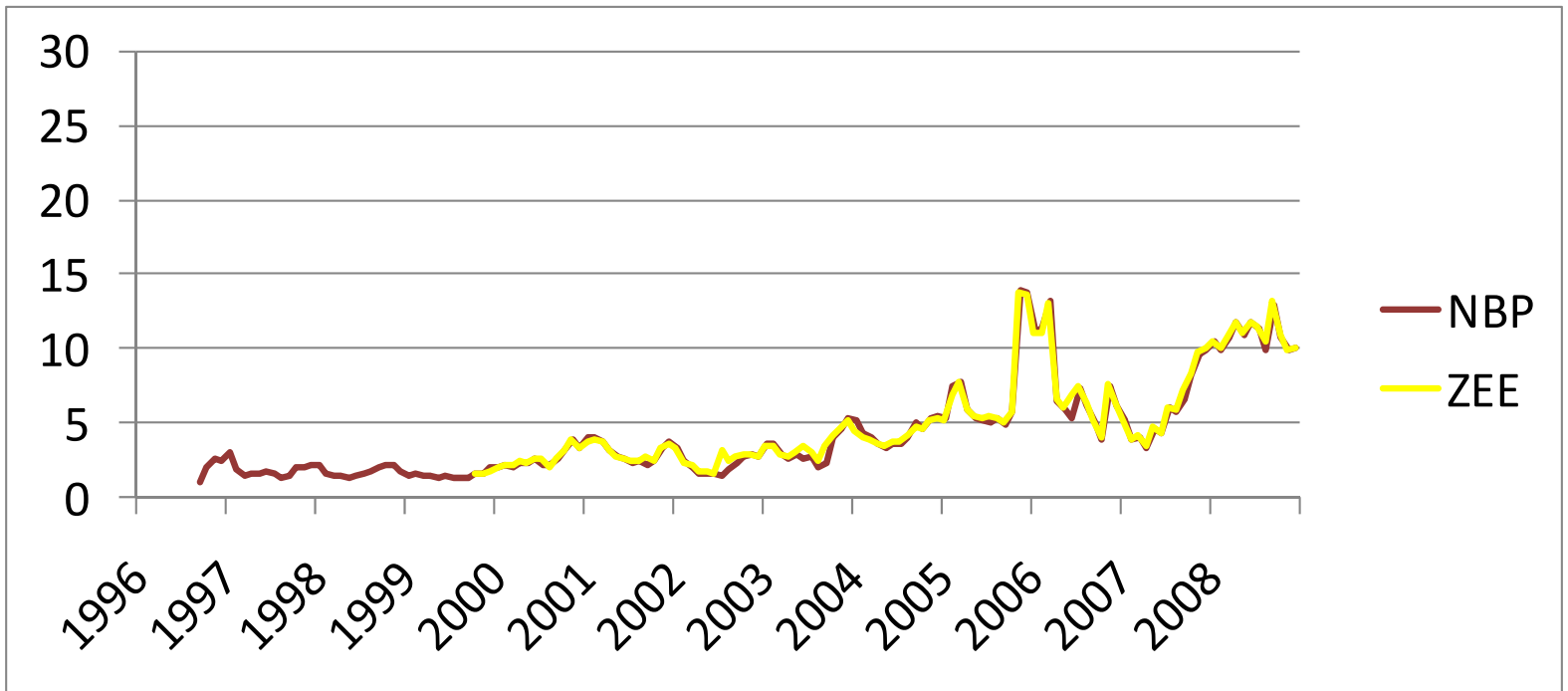


Contract and spot gas prices



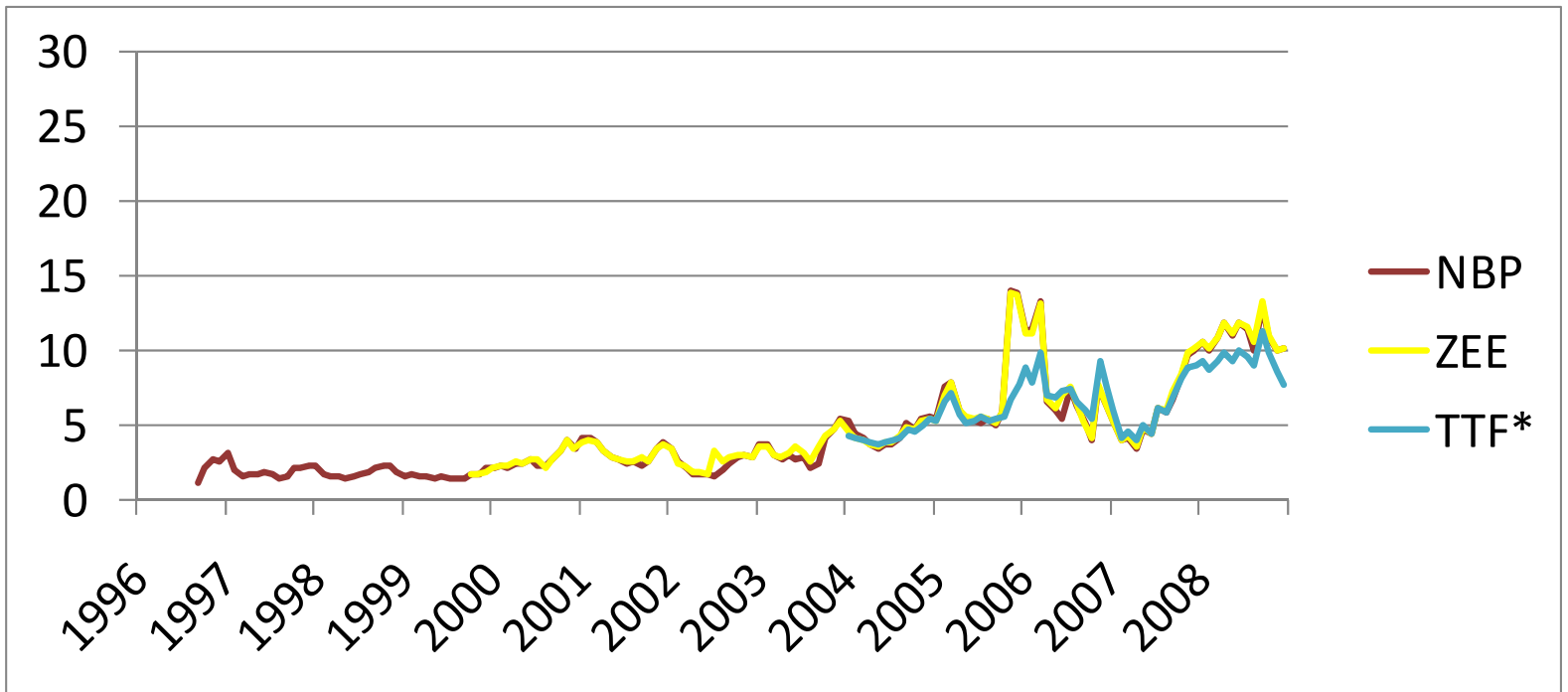


Contract and spot gas prices





Contract and spot gas prices



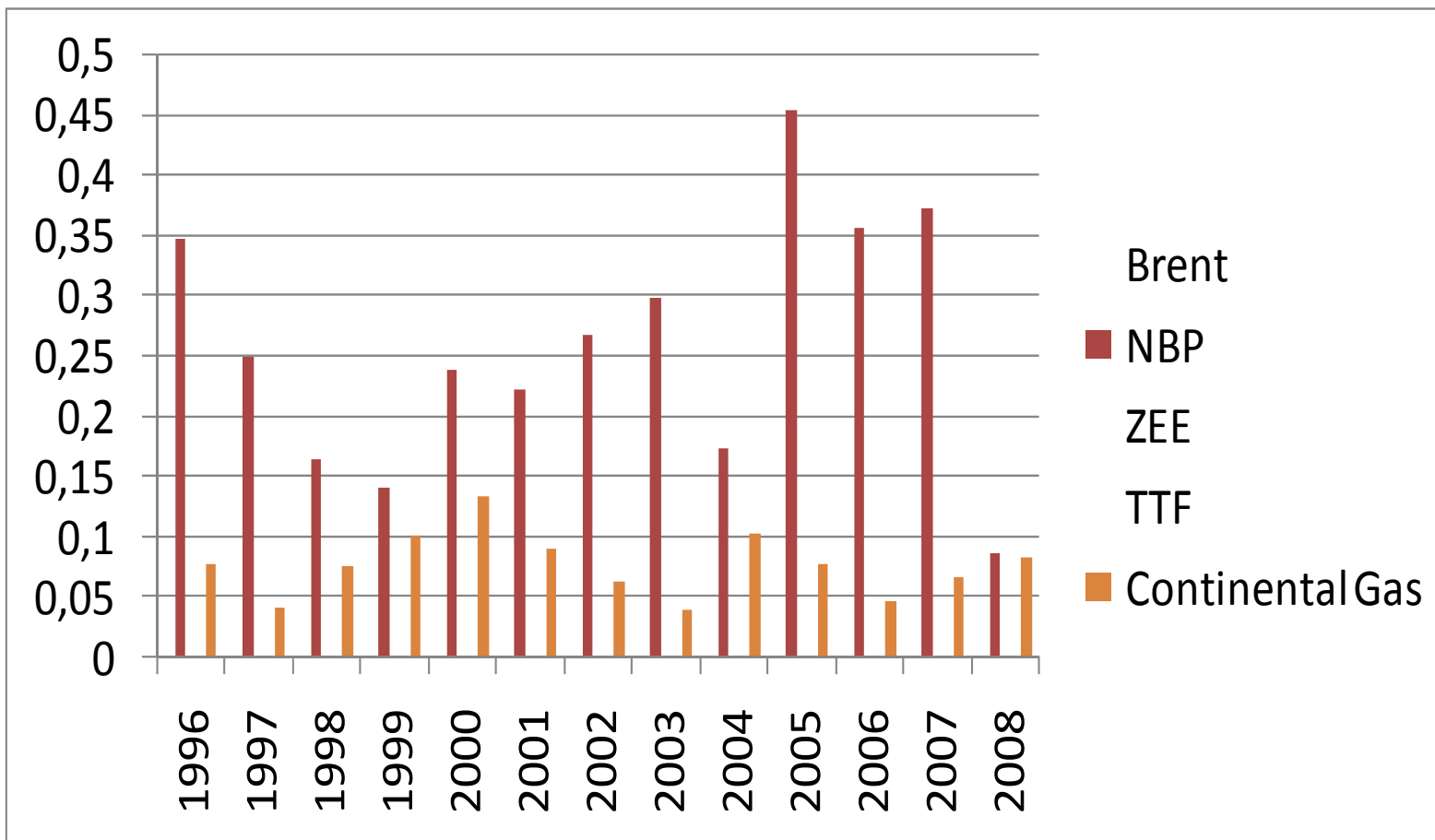
Volatility is lower in oil and contract prices

- Coeficients of Variation

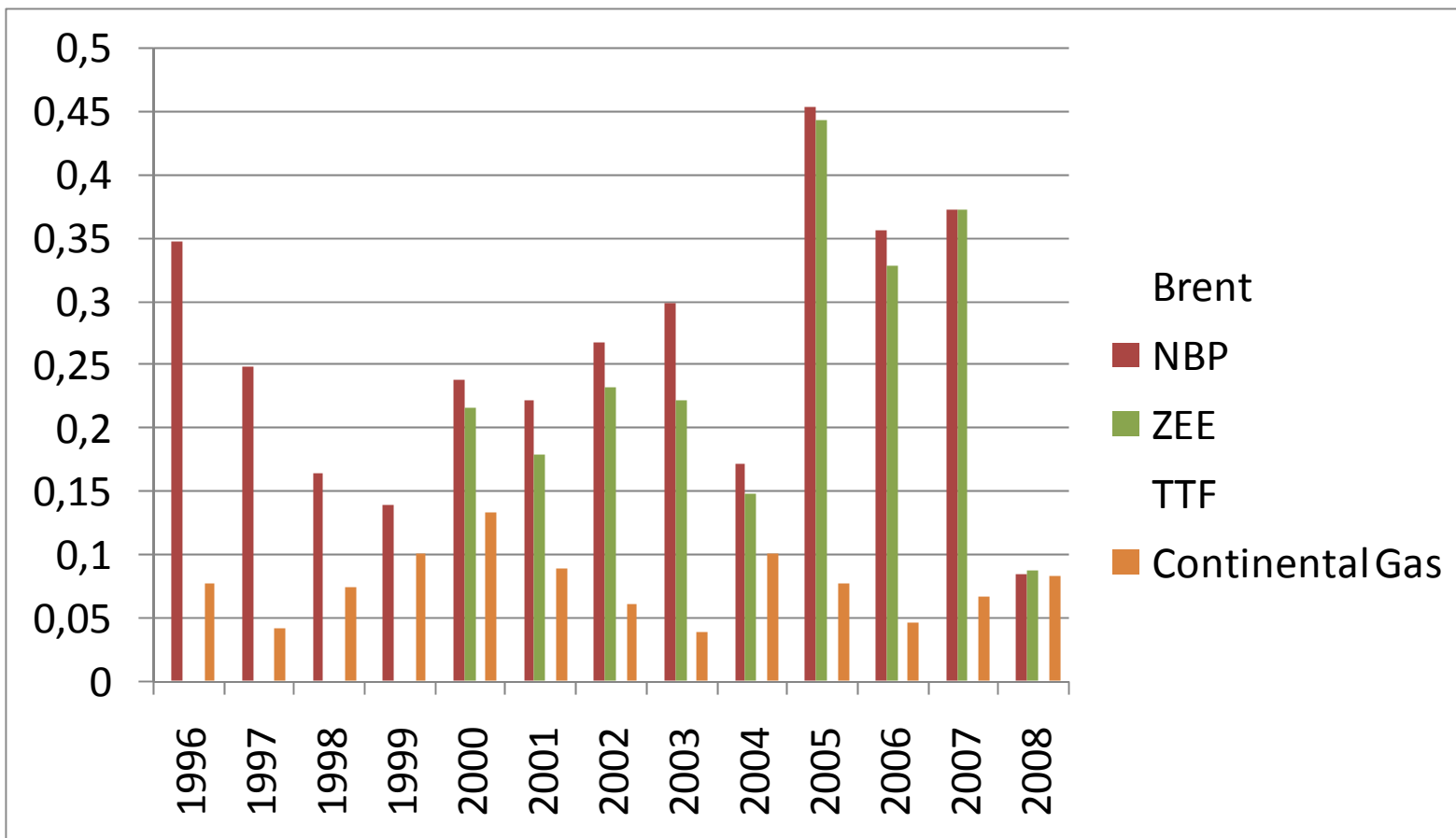
Brent	NBP	ZEE	TTF	Continental Gas
0,14	0,26	0,27	0,19	0,07

- There are different levels in volatility
 - NBP and Zebrugge is very similar
 - TTF has lower volatility
 - Oil prices are still less volatile
 - Contract gas is least volatile

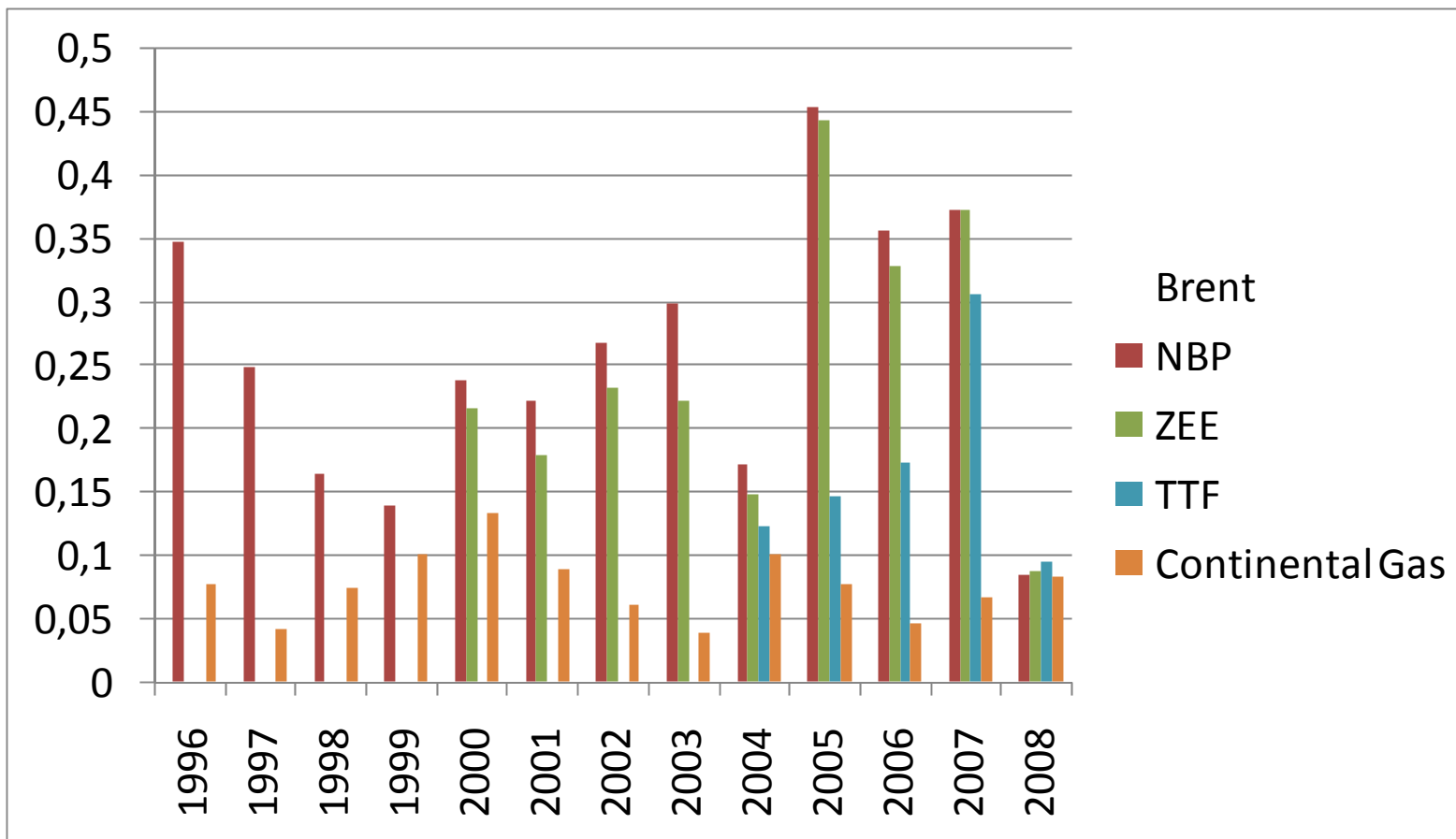
Annual CVs



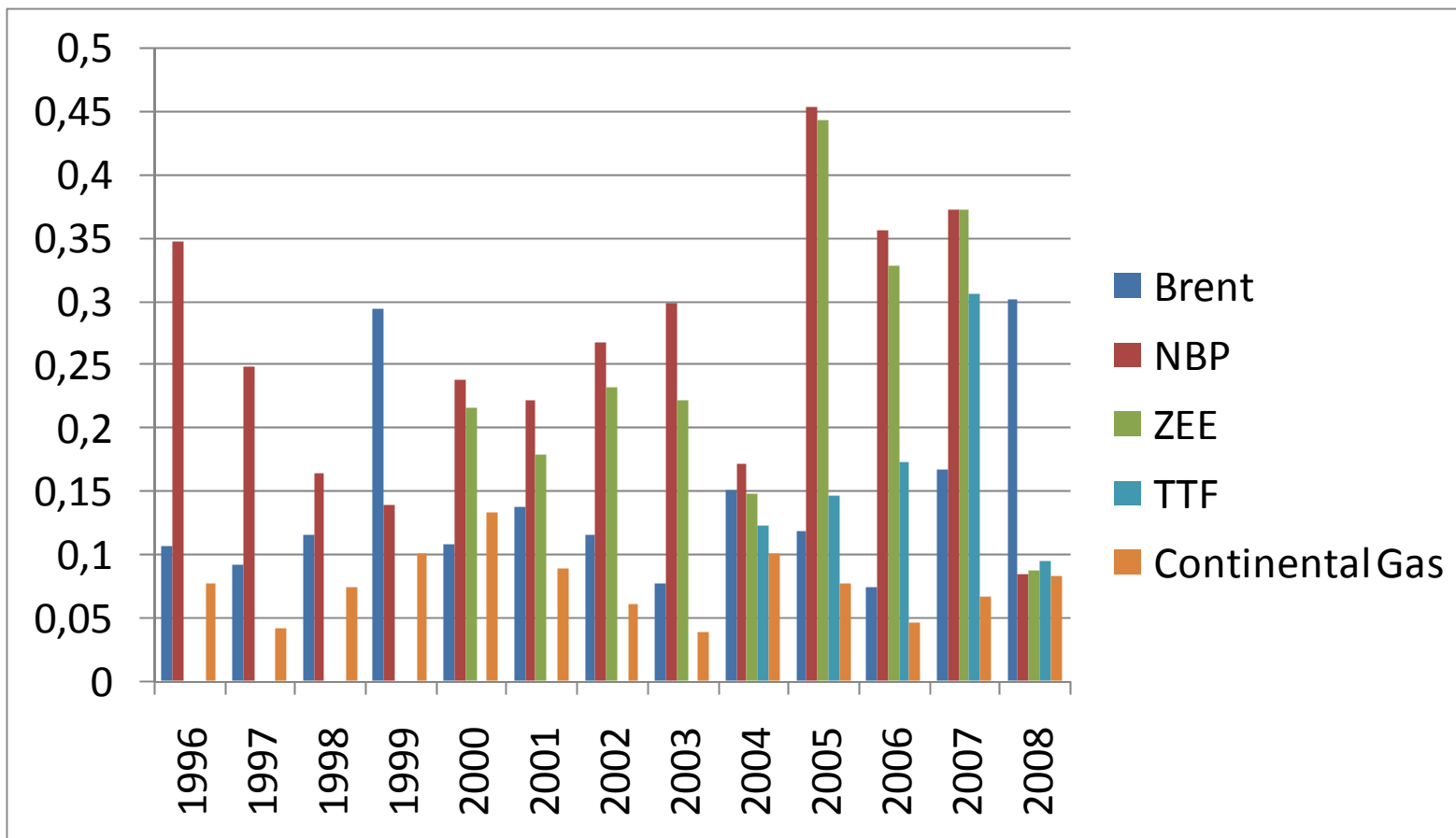
Annual CVs



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Annual CVs





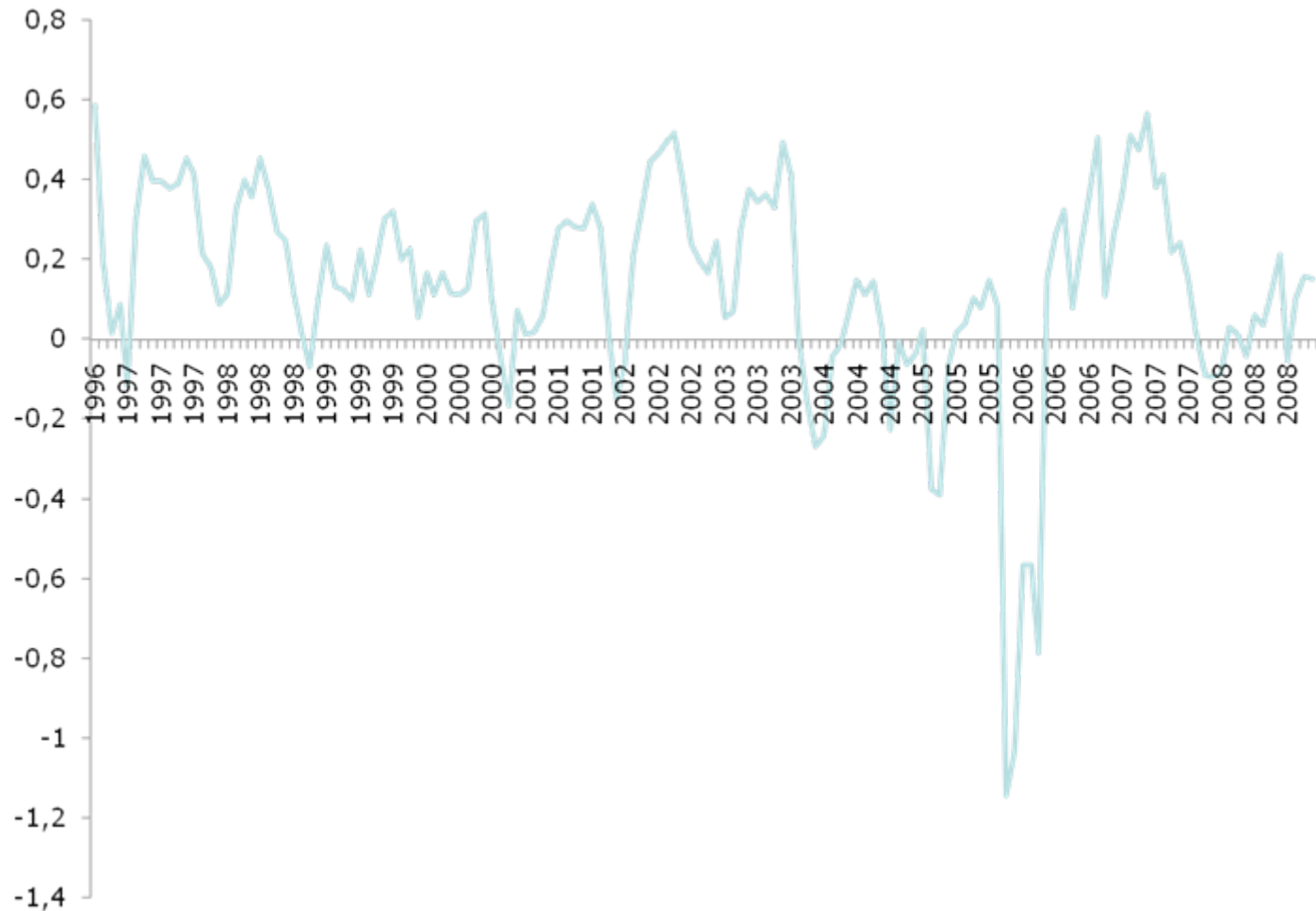
Data

- We focus on contract gas price and NBP due to limited length of the other gas price series
- Monthly prices from September 1996 – December 2008
- All prices are nonstationary
- We use first differences of logs



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Contract vs. NBP price – spreads in percent



Multivariate GARCH specification

- GARCH(1,1) with BEKK parameterization of the residuals

$$\Delta y_t = \mu + u_t$$

$$u_t \sim N(0, H_t)$$

$$H_t = C'C + A' \varepsilon_{t-1} \varepsilon'_{t-1} A + B'H_{t-1}B$$

- To test for a structural break, we estimate the model for two periods, 1996-2003 and 2004-2008
- With a p -value < 0.001 the null is clearly rejected

Parameter estimates

Parameter	1996-2003		Parameter	2004-2008	
	Estimate	<i>p</i> -value		Estimate	<i>p</i> -value
Mean			Mean		
μ_{NBP}	0.0009	0.5966	μ_{NBP}	0.0031	0.3884
μ_{Cont}	0.0002	0.7487	μ_{Cont}	0.0007	0.3584
Covariance structure			Covariance structure		
$c_{NBP,NBP}$	0.0233**	0.0000	$c_{NBP,NBP}$	0.0323**	0.0028
$c_{Cont,NBP}$	-0.0019	0.4028	$c_{Cont,NBP}$	0.0133**	0.0000
$c_{Cont,Cont}$	0.0030	0.1873	$c_{Cont,Cont}$	0.0000	0.9994
$a_{NBP,NBP}$	0.5427**	0.0000	$a_{NBP,NBP}$	0.4507**	0.0000
$a_{NBP,Cont}$	-0.0019	0.8010	$a_{NBP,Cont}$	-0.0101	0.1279
$a_{Cont,NBP}$	-0.0287	0.8574	$a_{Cont,NBP}$	0.6780**	0.0091
$a_{Cont,Cont}$	0.1886**	0.0046	$a_{Cont,Cont}$	0.0867	0.1103
$b_{NBP,NBP}$	0.8329**	0.0000	$b_{NBP,NBP}$	0.8209**	0.0000
$b_{NBP,Cont}$	0.0029	0.5371	$b_{NBP,Cont}$	0.0114*	0.026
$b_{Cont,NBP}$	0.0473	0.5878	$b_{Cont,NBP}$	-1.4541**	0.0009
$b_{Cont,Cont}$	0.9733**	0.0000	$b_{Cont,Cont}$	0.7906**	0.0000

Results

- The results indicates that there is a structural break in the volatility transmission between the two markets
- Before 2004 there was no spillover
- Now volatility in NBP prices influence continental prices
 - The effect is unidirectional
- An effect of deregulation and spot trading at the continent?



Concluding remarks

- Continental contract gas prices have significantly lower volatility than other gas prices in Europe, as well as the oil price
 - Volatility is highest in the UK and at Zeebrugge
- Deregulations seems to increase volatility, but reduce price
 - Evidence of market power being exploited before deregulation
 - Despite lower prices on average, deregulated markets can experience longer periods with higher prices



Concluding remarks

- There has been a structural break in volatility spillovers
- Spot markets seem to influence the contract market to a larger degree
- More integrated markets
 - But due to different regulatory structures, the integration seems much slower than in the US