EUROPEAN CENTRAL BANK

EUROSYSTEM

Consumer liquid fuel prices in an environment of high and volatile oil prices

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The views expressed are those of the presenter and not necessarily those of the ECB

Outline

1. Introduction and background
   - Oil price developments within the context of the ECB's monetary policy analysis
   - Consumer liquid fuel prices – a descriptive cross-country and time series analysis
2. The direct pass-through of oil prices into consumer liquid fuel prices
3. Extensions to basic analysis – changes over time and asymmetry
4. Conclusions and ideas for further work

1. Price Stability

- **Article 105 of the Treaty establishing the European Community:**
  - **"1. The primary objective of the ESCB [Eurosystem] shall be to maintain price stability,**

    without prejudice to the objective of price stability, the ESCB [Eurosystem] shall support the general economic policies in the Community with a view to contributing to the achievement of the objectives of the Community as laid down in Article 2."

- **The ECB has defined price stability "as a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below 2%. Price stability is to be maintained over the medium term"**
  - **The Governing Council aims to maintain inflation rates at levels below, but close to, 2% over the medium term.**

THE ECB'S MONETARY POLICY STRATEGY

Primary objective: price stability

Governing Council

takes monetary policy decisions based on an overall assessment of the risks to price stability

Economic Analysis

Analysis of economic dynamics and shocks

cross-checking

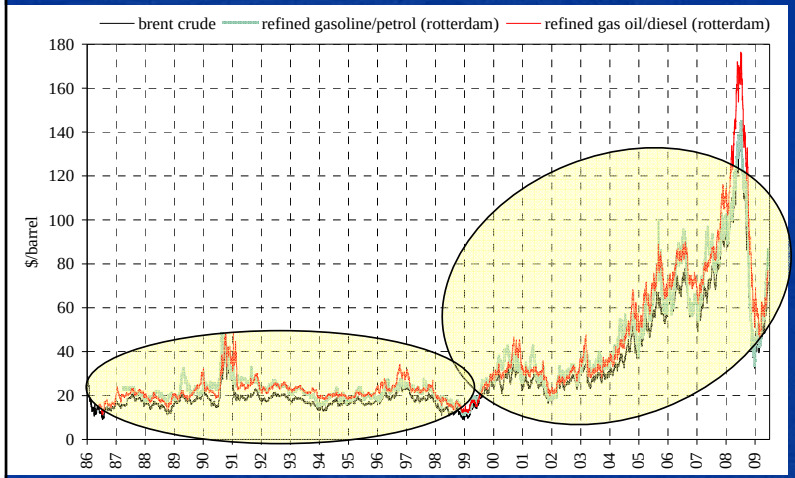
Monetary Analysis

Analysis of monetary trends

Full set of information

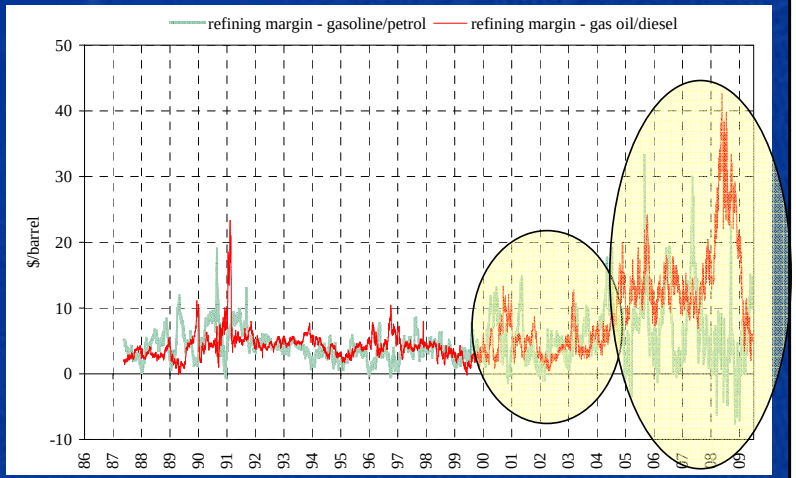
1. Oil price developments since the mid-1980s

Crude and refined oil prices
(USD per barrel)



Source: Reuters and US EIA.

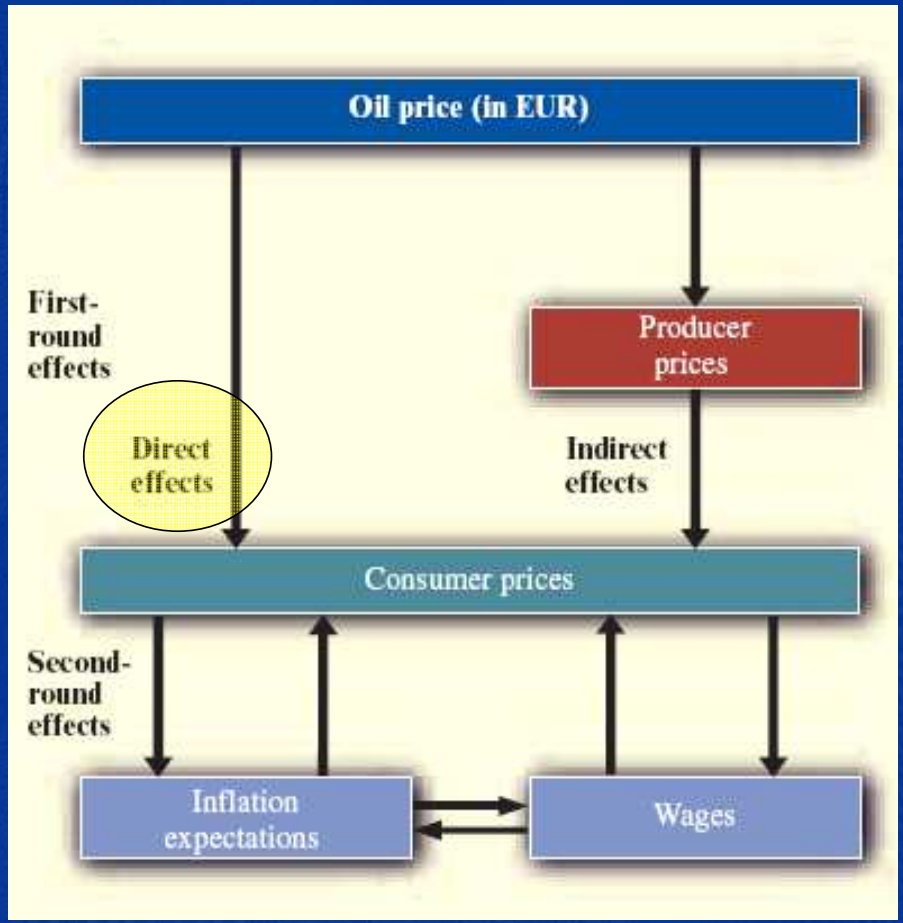
Refining margins
(USD per barrel)



Source: Reuters and US EIA.

1. Main transmission channels of an oil price shock to prices: a stylised overview of oil price pass-through

External activity channel



Domestic activity channel

1. Direct effect – energy is most volatile component of the HICP

Standard deviation of monthly changes in HICP and its main components (1996-2008)

	Non-seasonally adjusted	Seasonally adjusted
Overall HICP	**0.26**	**0.15**
Processed foods (11.9%)*	0.23	0.21
Non-Energy Industrial Goods (30.0%)	0.76	0.09
Services (40.8%)	0.32	0.11
HICP exc. unprocessed foods & energy	***0.27***	***0.08***
Unprocessed foods (7.6%)	0.74	0.47
Energy (9.6%)	*1.43*	*n/a*
Car fuel (4.4%)	*2.34*	*n/a*
Heating fuel (0.8%)	*4.74*	*n/a*
Non-oil energy (4.4%)	*0.63*	*n/a*

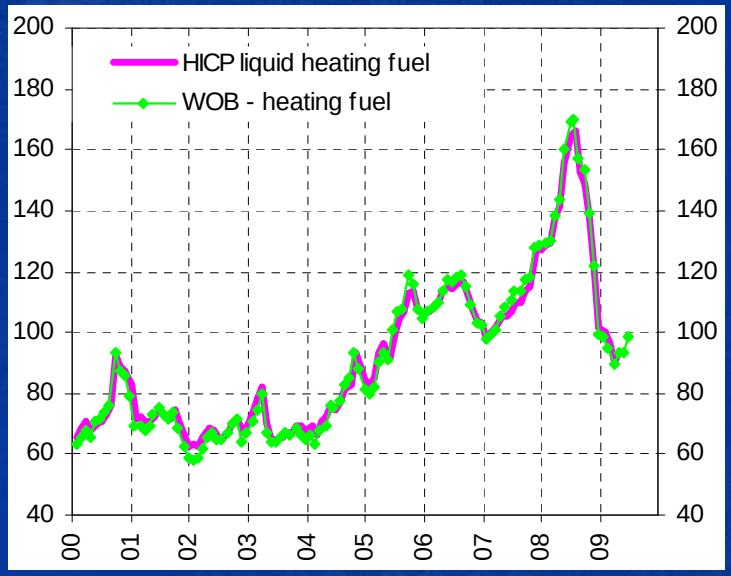
** 2008 weight in overall HICP*
Source: ECB calculations

- **Energy prices most volatile component of overall HICP inflation**
- **Liquid fuels (transport and heating) particularly so**

1. Oil bulletin data and the HICP

Heating fuel

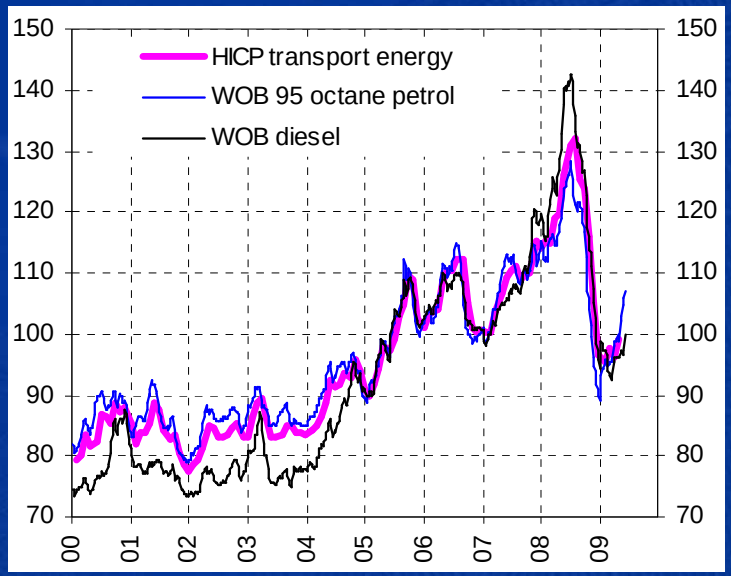
(Index 2005 = 100)



Source: Eurostat and European Commission.

Car fuel

(Index 2005 = 100)

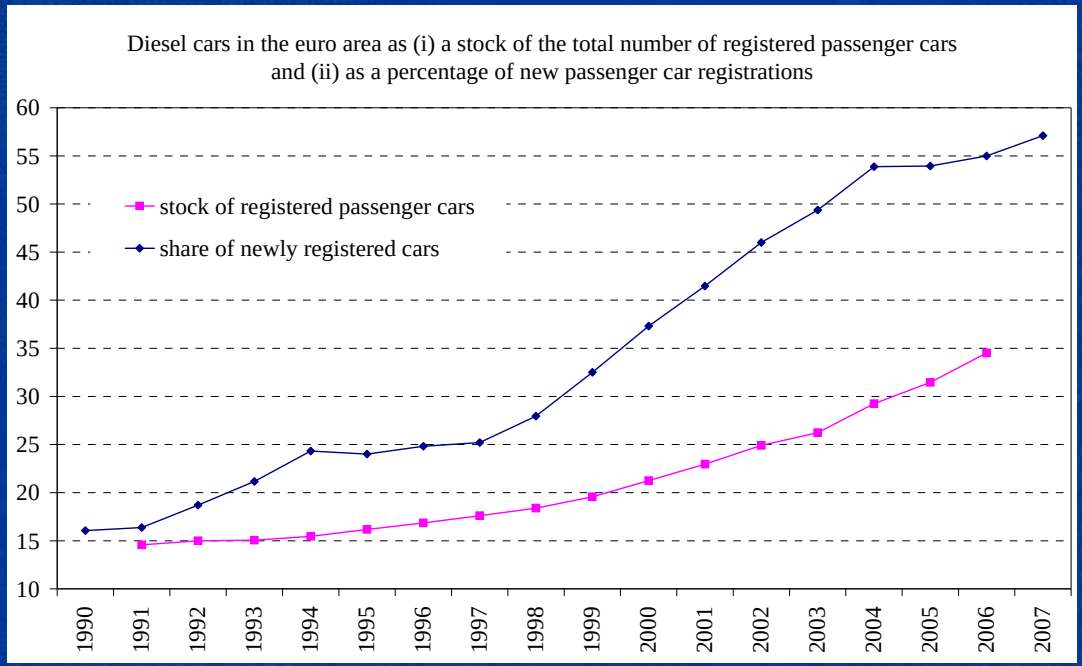


Source: Eurostat and European Commission.

1. Breakdown of car fuel may be relevant

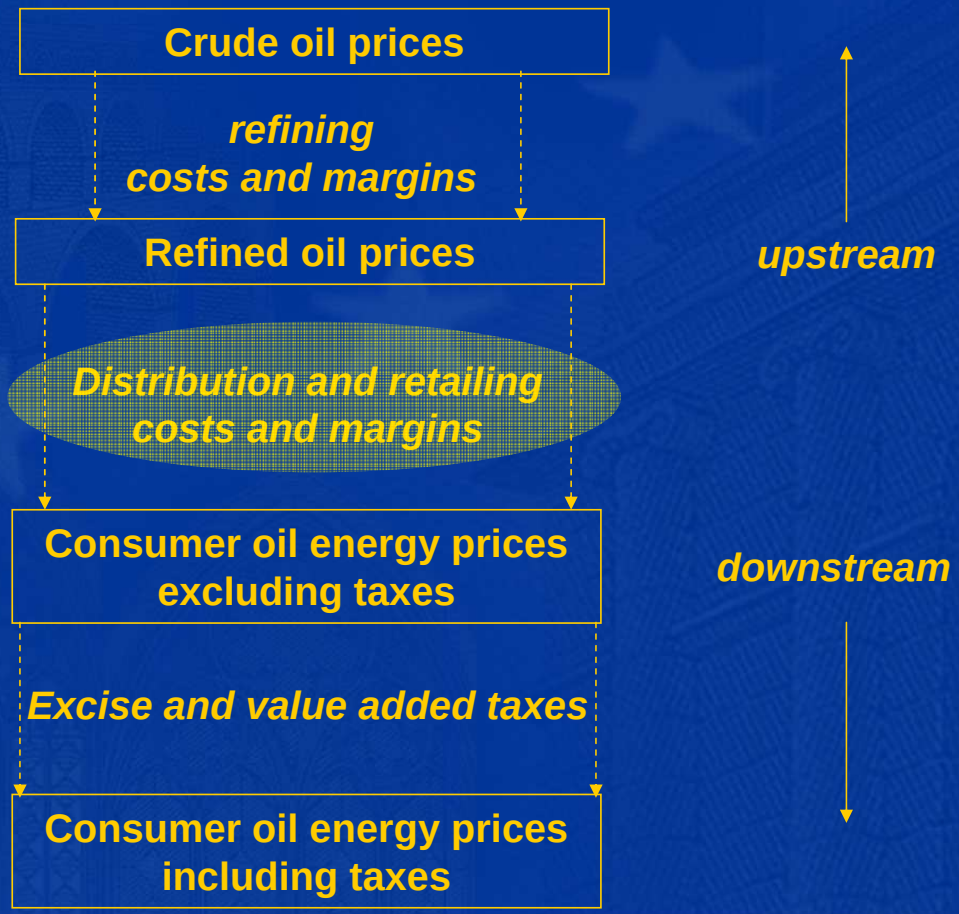
Importance of diesel cars

(percentages ; annual data)

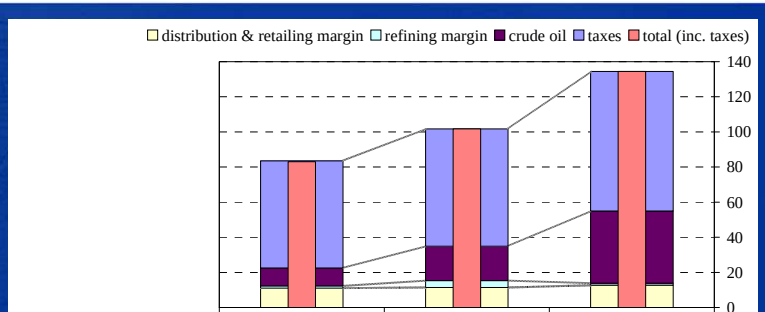


Sources: Eurostat and ACEA

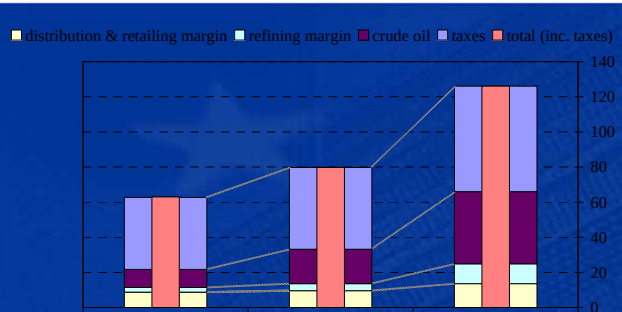
1. Conceptual framework



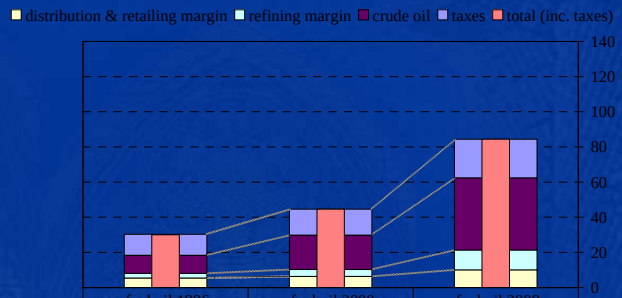
1. What are you paying for? A decomposition of consumer liquid fuel prices – euro area average



	petrol 1996 (€ cent / litre)	petrol 2000 (€ cent / litre)	petrol 2008 (€ cent / litre)
taxes	61	67	79
crude oil	10	20	41
refining margin	1	4	1
distribution & retailing margin	11	11	13
total (inc. taxes)	83	102	134



	diesel 1996 (€ cent / litre)	diesel 2000 (€ cent / litre)	diesel 2008 (€ cent / litre)
taxes	41	47	60
crude oil	10	20	41
refining margin	3	4	11
distribution & retailing margin	9	10	14
total (inc. taxes)	63	80	126



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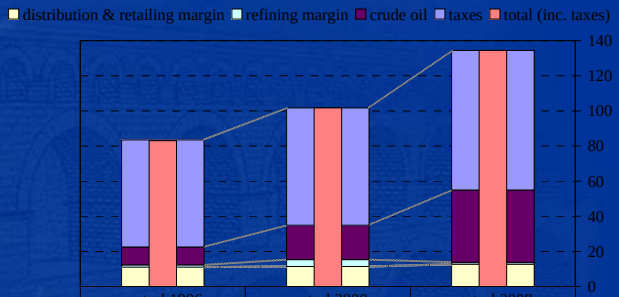

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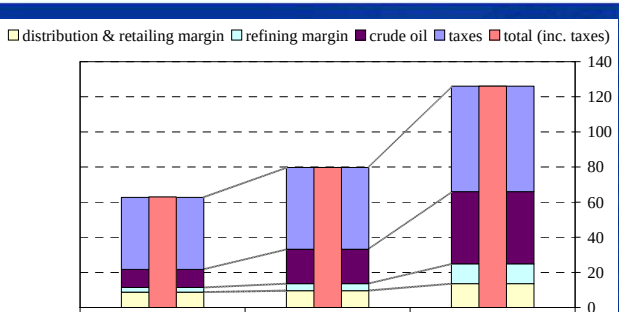

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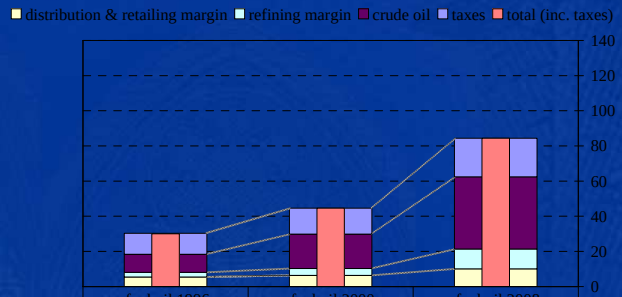

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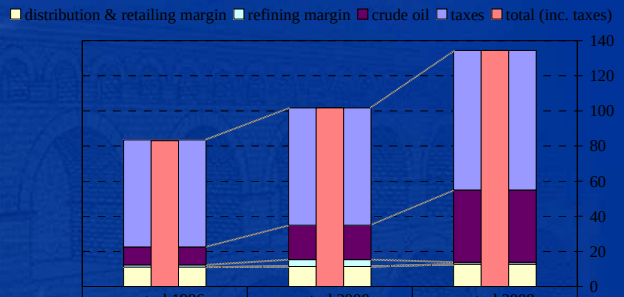

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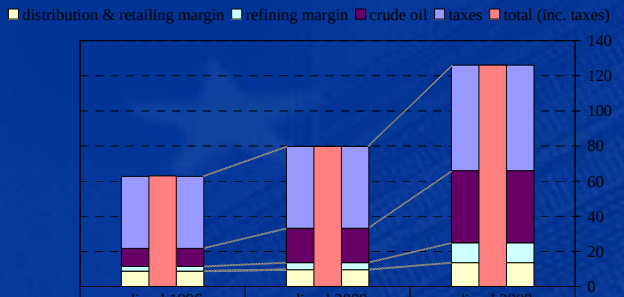

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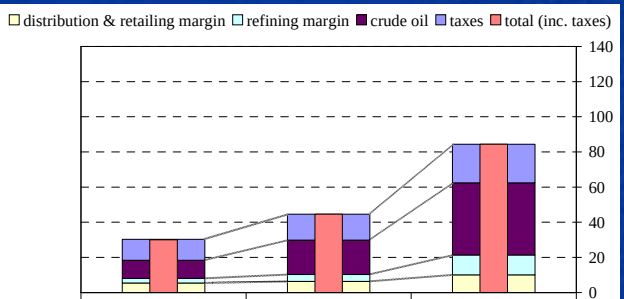

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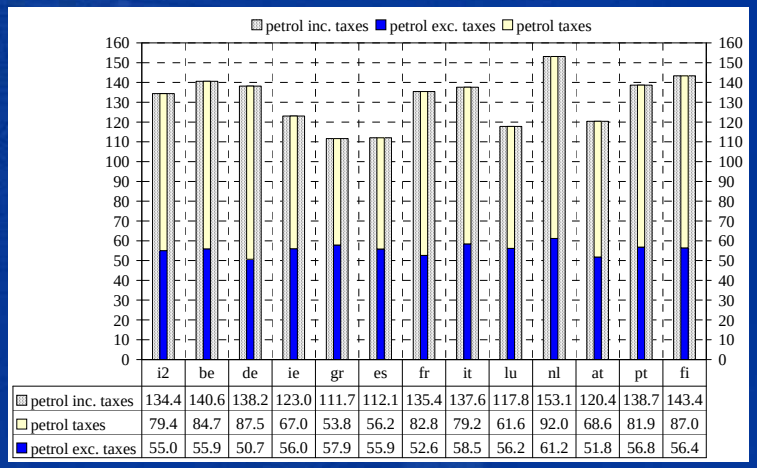
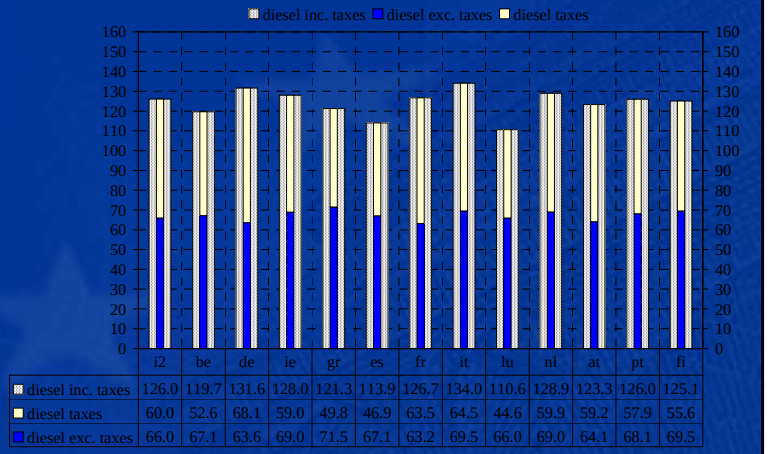
1. Consumer liquid fuel prices across countries

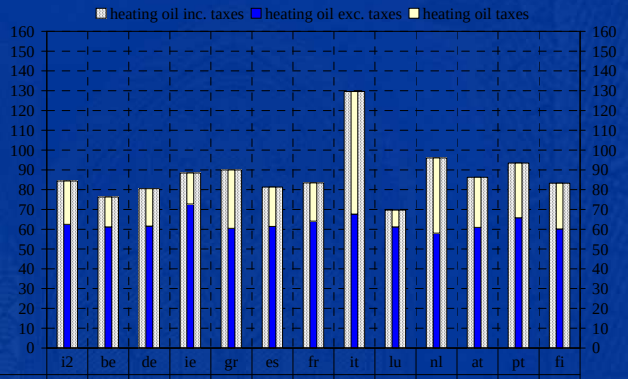
(average in 2008, euro cent per litre)



	i2	be	de	ie	gr	es	fr	it	lu	nl	at	pt	fi
petrol inc. taxes	134.4	140.6	138.2	123.0	111.7	112.1	135.4	137.6	117.8	153.1	120.4	138.7	143.4
petrol taxes	79.4	84.7	87.5	67.0	53.8	56.2	82.8	79.2	61.6	92.0	68.6	81.9	87.0
petrol exc. taxes	55.0	55.9	50.7	56.0	57.9	55.9	52.6	58.5	56.2	61.2	51.8	56.8	56.4



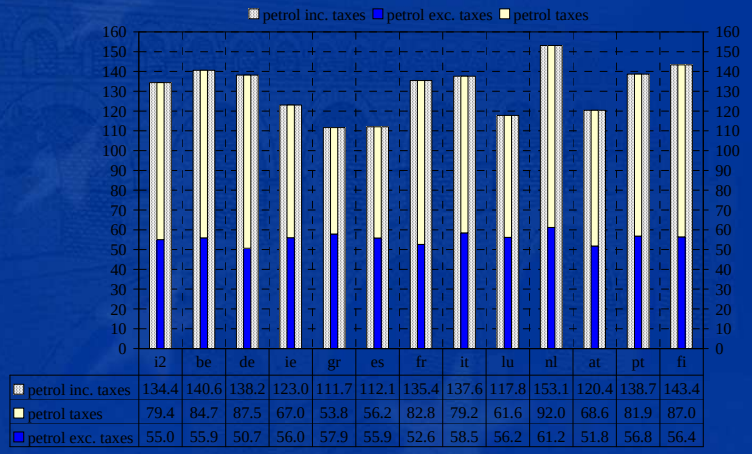
	i2	be	de	ie	gr	es	fr	it	lu	nl	at	pt	fi
diesel inc. taxes	126.0	119.7	131.6	128.0	121.3	113.9	126.7	134.0	110.6	128.9	123.3	126.0	125.1
diesel taxes	60.0	52.6	68.1	59.0	49.8	46.9	63.5	64.5	44.6	59.9	59.2	57.9	55.6
diesel exc. taxes	66.0	67.1	63.6	69.0	71.5	67.1	63.2	69.5	66.0	69.0	64.1	68.1	69.5



	i2	be	de	ie	gr	es	fr	it	lu	nl	at	pt	fi
heating oil inc. taxes	84.3	76.3	80.6	88.5	90.0	81.3	83.5	129.6	69.7	96.0	86.3	93.4	83.2
heating oil taxes	21.9	15.1	19.0	15.7	29.6	19.9	19.3	61.9	8.5	38.0	25.3	27.6	23.1
heating oil exc. taxes	62.5	61.2	61.6	72.7	60.4	61.5	64.1	67.6	61.2	58.1	61.0	65.8	60.1

1. Consumer liquid fuel prices across countries

(average in 2008, euro cent per litre)



	i2	be	de	ie	gr	es	fr	it	lu	nl	at	pt	fi
petrol inc. taxes	134.4	140.6	138.2	123.0	111.7	112.1	135.4	137.6	117.8	153.1	120.4	138.7	143.4
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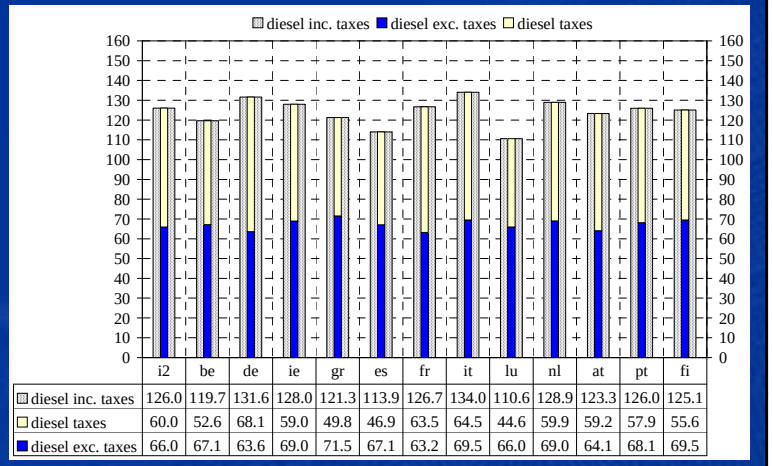

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diesel inc. taxes	126.0	119.7	131.6	128.0	121.3	113.9	126.7	134.0	110.6	128.9	123.3	126.0	125.1
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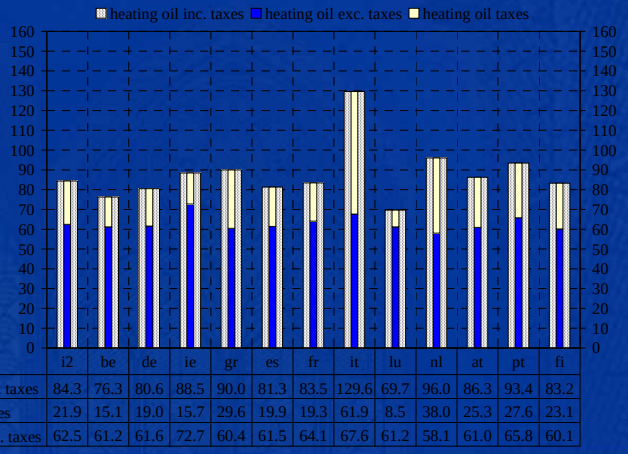

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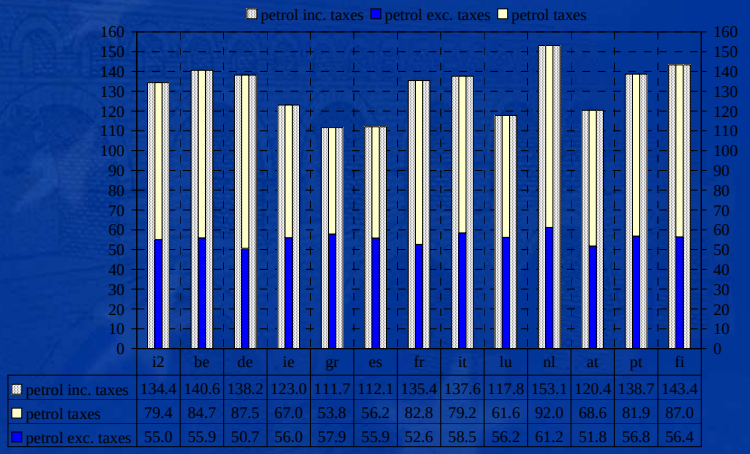
1. Consumer liquid fuel prices across countries

(average in 2008, euro cent per litre)



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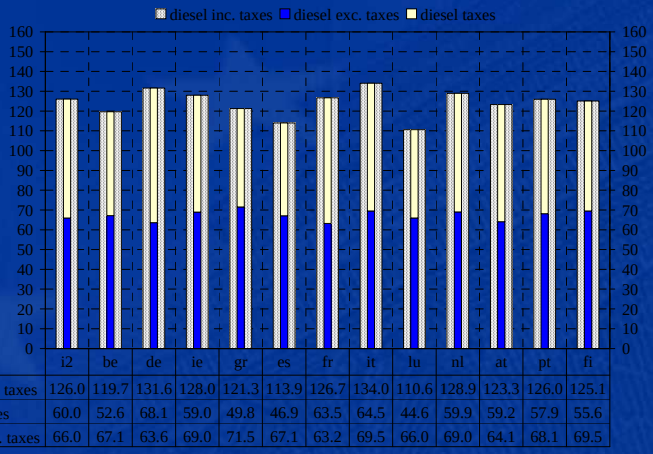

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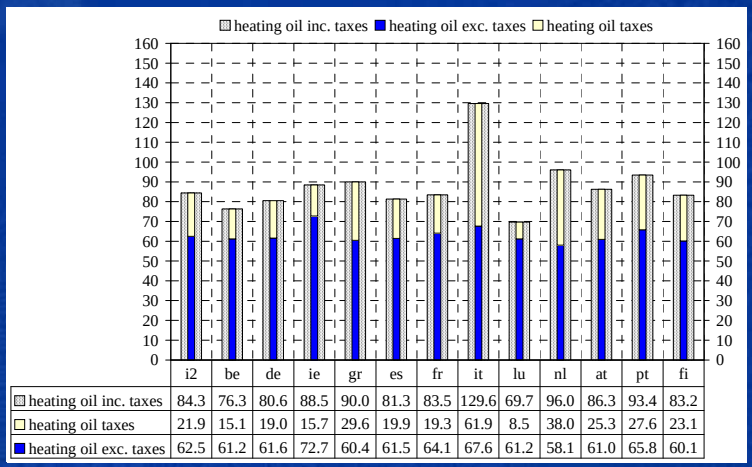

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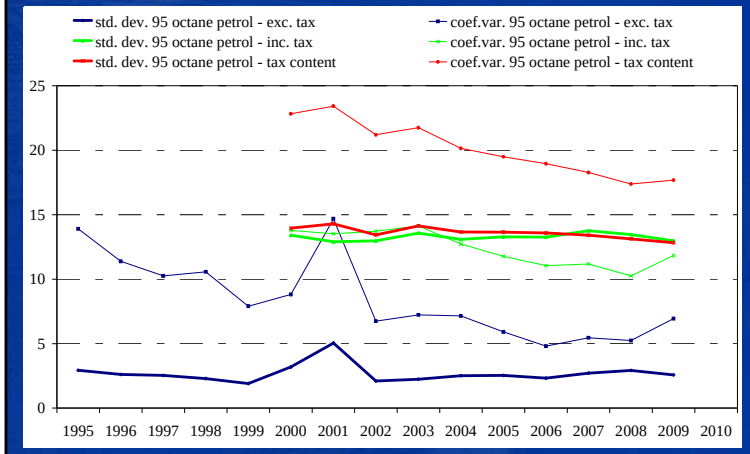
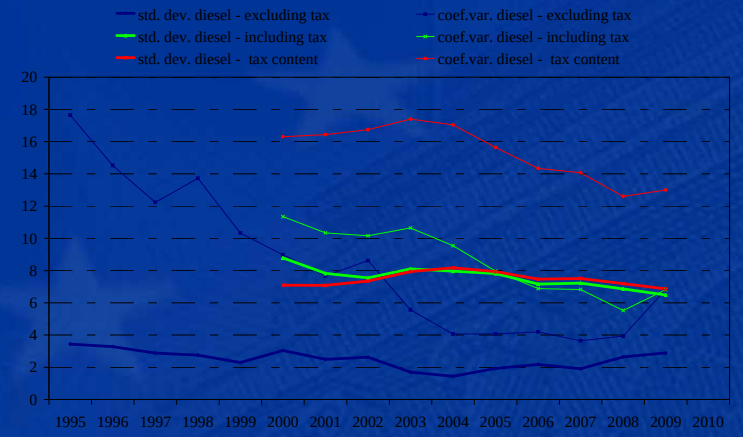
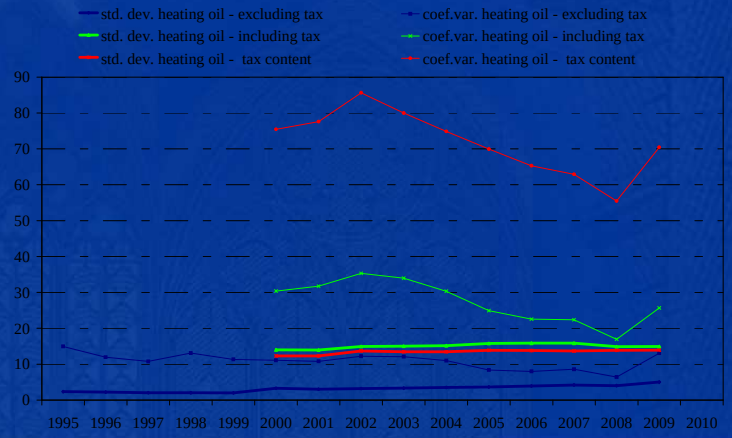
1. Evolution of dispersion across countries over time







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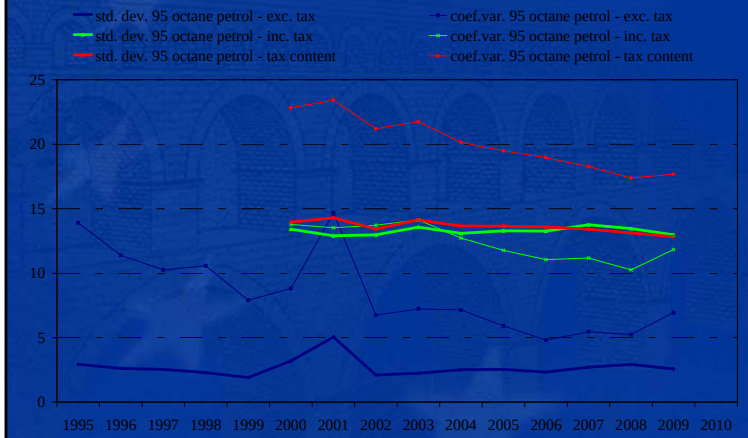

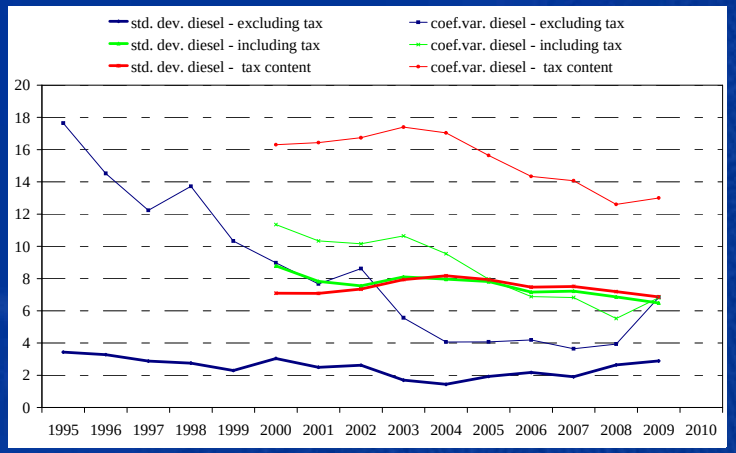

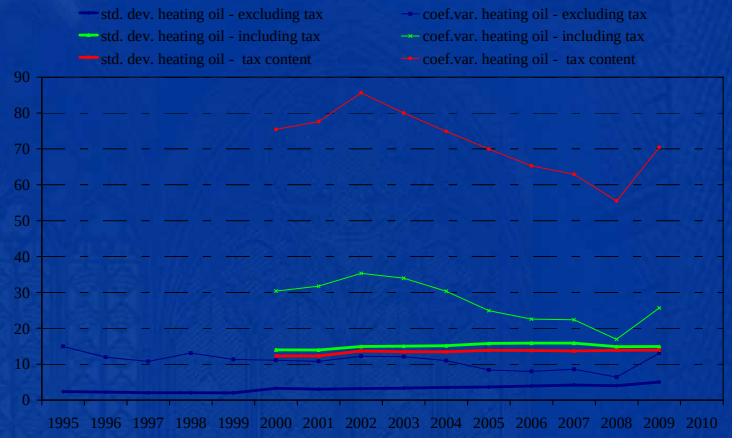

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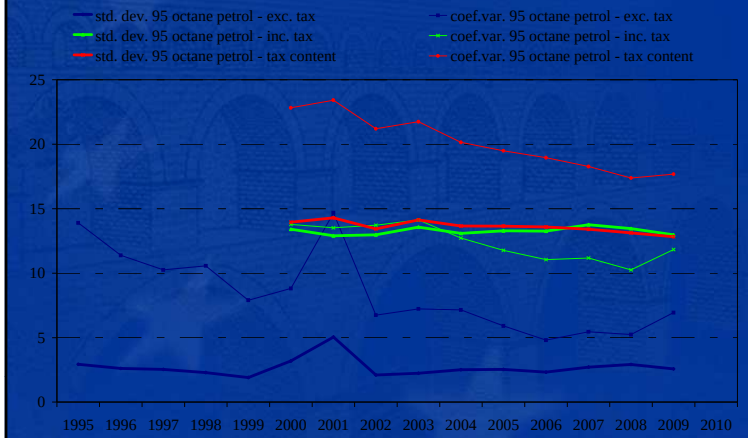
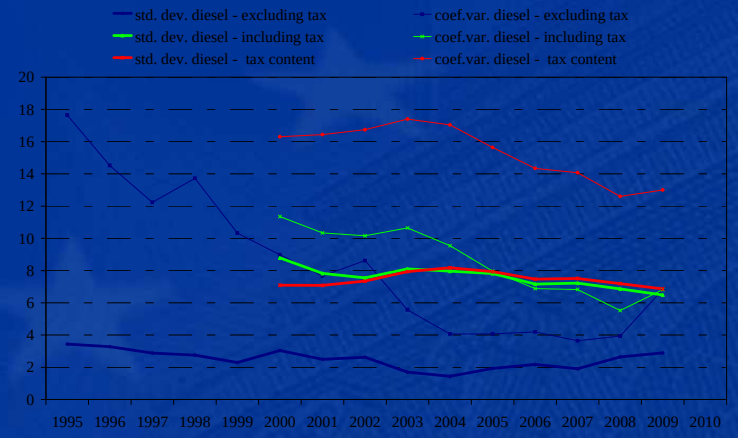
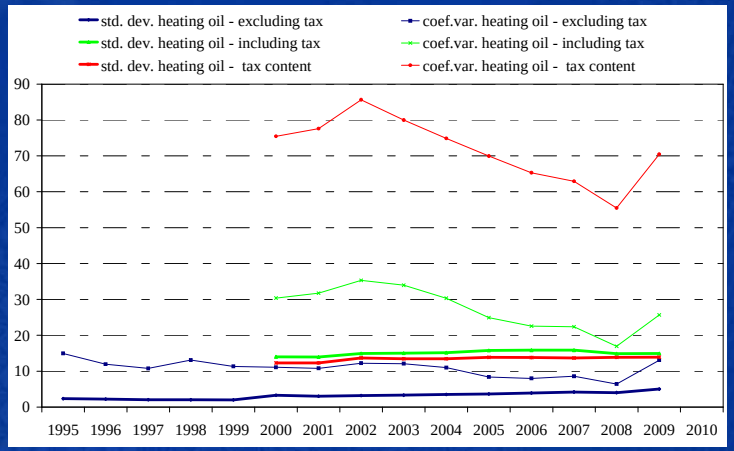






2. Econometric approach

a) **Causality: results generally indicates robust causality from upstream to downstream, with reverse causality much less significant and stable**

b) **Stationarity: results show clearly crude and refined oil prices have been non-stationary since 1994**

c) **Stability: given seeming changes in oil price behaviour, we also tested for structural breaks.**

d) **Cointegration: In view of possible breaks, cointegration tests were embedded within approach of Hatemi-J (2008)**

Use single equation approach allowing for cointegration, with variables in absolute, not logarithmic, form

2. Basic framework

$$dP^{C}_{i,t} = c_{i,j} + \sum_{k=1}^{n} \alpha_{i,j,k} dP^{C}_{i,t-k} + \sum_{k=0}^{n} \beta_{i,j,k} dP^{I}_{j,t-k} + \gamma_{i,j}\left(P^{C}_{i,t-1} - \theta_{i,j} P^{I}_{j,t-1}\right)$$

where,

$P^{C}_{i,t}$ is the consumer prices of oil energy type i (petrol, diesel or heating fuel),

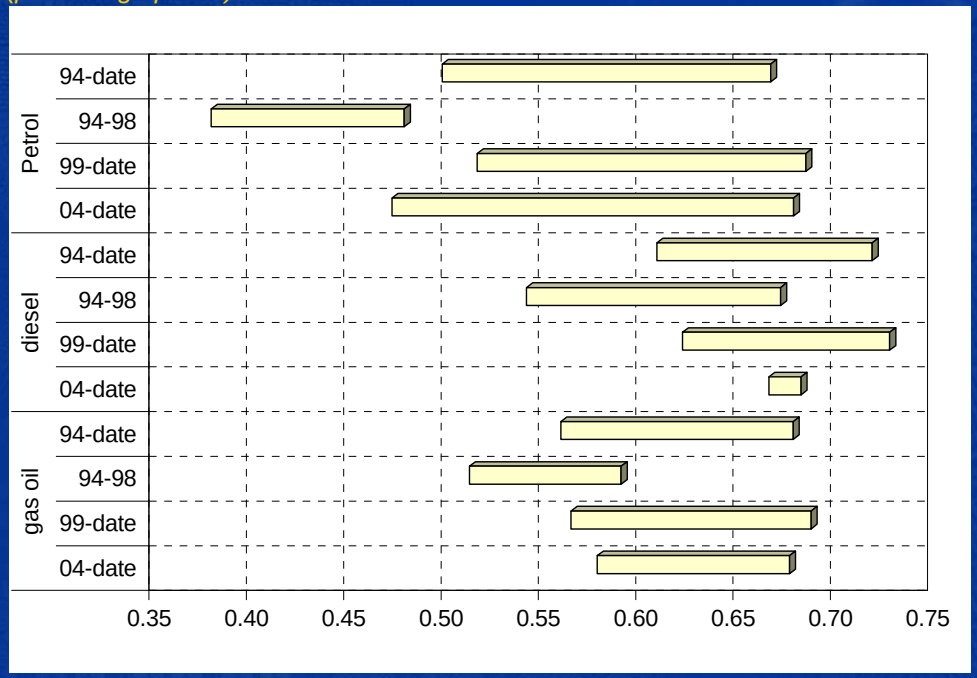
$P^{I}_{j,t}$ is the spot price of oil input j (crude, refined gasoline, diesel or gas oil)

NB: equation estimated using absolute not log values (have also estimated using log values)

2. How important are refining margins?

Gain in R2 using relevant refined prices

(percentage points)



Sources: ECB calculations

2. What is the extent and speed of pass-through?

(response to 10 cent increase per litre)

Pass through of 10 cent per litre change in refined gasoline price into consumer price (exc. taxes) for petrol (from models estimated over the period 2000-2008)

	wk1	wk2	wk3	wk4	wk5	wk6	wk7	wk8	wk9	wk10	wk11	wk12
euro area	**1.9** (1.5;2.3)	***6.0*** (5.5;6.4)	**7.5** (7.0;8.0)	**8.4** (7.9;8.4)	**9.3** (8.8;9.7)	**9.3** (8.8;9.8)	**9.5** (9.1;10.0)	**9.7** (9.2;10.2)	**9.9** (9.4;10.4)	**9.9** (9.4;10.4)	**9.9** (9.4;10.4)	**9.9** (9.5;10.3)
be	1.8 (0.9;2.8)	*7.6* (6.7;8.7)	8.7 (7.8;9.7)	9.5 (8.5;10.6)	9.8 (8.8;10.8)	9.8 (8.8;10.8)	10.6 (9.6;11.7)	9.9 (8.9;10.9)	9.3 (8.3;10.4)	9.5 (8.8;10.3)	9.9 (9.3;10.6)	10.0 (9.4;10.5)
de	1.9 (1.0;2.7)	*7.4* (6.4;8.3)	8.8 (7.9;9.8)	9.7 (8.8;10.6)	10.6 (9.7;11.6)	10.0 (9.1;10.9)	9.8 (8.9;10.7)	10.2 (9.2;11.2)	10.3 (9.3;11.3)	10.2 (9.4;11.0)	10.1 (9.4;10.7)	10.1 (9.5;10.6)
ie	1.2 (0.1;2.1)	0.7 (-0.6;1.8)	1.5 (0.1;2.7)	1.9 (0.5;3.2)	2.2 (0.9;3.5)	2.7 (1.3;4.1)	3.2 (1.7;4.6)	4.2 (2.7;5.7)	*5.3* (3.9;6.7)	6.2 (4.9;7.5)	6.9 (5.8;8.1)	7.6 (6.5;8.9)
gr	1.2 (0.6;1.7)	*6.2* (5.6;6.9)	8.6 (7.9;9.3)	9.7 (9.0;10.3)	10.0 (9.4;10.7)	10.2 (9.6;10.9)	10.3 (9.6;11.0)	10.3 (9.6;11.0)	10.4 (9.7;11.1)	9.9 (9.3;10.6)	9.8 (9.2;10.4)	9.9 (9.4;10.4)
es	1.6 (1.3;2.0)	4.5 (4.0;4.9)	*6.2* (5.7;6.7)	7.7 (7.1;8.2)	8.6 (8.0;9.2)	9.1 (8.5;9.7)	9.3 (8.6;9.9)	9.6 (9.0;10.2)	9.7 (9.1;10.3)	9.8 (9.2;10.4)	9.8 (9.2;10.4)	9.8 (9.2;10.4)
fr	1.6 (1.2;2.0)	*6.1* (5.6;6.6)	8.0 (7.5;8.6)	8.9 (8.4;9.5)	9.6 (9.0;10.2)	9.6 (8.9;10.2)	9.6 (8.9;10.2)	9.7 (9.1;10.3)	10.1 (9.4;10.7)	10.0 (9.3;10.8)	9.9 (9.2;10.7)	9.9 (9.3;10.7)
it	1.4 (1.0;1.8)	4.7 (4.1;5.2)	*6.5* (5.9;7.0)	7.5 (6.8;8.1)	8.6 (7.9;9.2)	8.9 (8.1;9.6)	9.7 (9.0;10.3)	9.5 (8.8;10.2)	9.8 (9.0;10.5)	9.6 (9.0;10.3)	9.7 (9.1;10.4)	9.7 (9.2;10.4)
lu	2.5 (1.8;3.1)	*8.5* (7.9;9.0)	9.5 (8.9;10.1)	9.8 (9.2;10.5)	10.7 (10.1;11.3)	10.4 (9.8;11.1)	10.3 (9.7;10.9)	10.0 (9.4;10.6)	10.4 (9.8;11.0)	10.4 (9.9;10.8)	10.3 (10.0;10.6)	10.3 (10.0;10.5)
nl	*5.8* (5.2;6.5)	9.9 (9.2;10.6)	10.6 (9.9;11.3)	10.5 (9.7;11.2)	11.0 (10.3;11.7)	10.3 (9.6;11.0)	10.1 (9.4;10.9)	10.6 (9.9;11.4)	10.4 (9.6;11.2)	10.7 (10.0;11.4)	10.6 (10.1;11.2)	10.6 (10.1;11.1)
at	1.2 (0.6;1.8)	*5.0* (4.3;5.8)	6.4 (5.6;7.3)	7.5 (6.6;8.4)	8.3 (7.3;9.1)	8.6 (7.8;9.5)	8.9 (8.1;9.8)	9.1 (8.3;10.0)	9.3 (8.4;10.2)	9.5 (8.6;10.3)	9.4 (8.5;10.2)	9.3 (8.5;10.1)
pt	0.3 (-0.6;1.2)	1.3 (0.2;2.4)	2.7 (1.4;4.1)	4.5 (3.1;6.0)	*6.2* (4.7;7.8)	7.5 (5.9;9.1)	7.4 (5.6;9.1)	7.7 (5.8;9.7)	8.3 (6.3;10.4)	8.7 (6.6;10.8)	9.0 (6.9;11.3)	9.1 (7.0;11.5)
fi	3.3 (2.1;4.6)	*5.6* (4.2;7.2)	5.0 (3.4;6.4)	4.8 (3.2;6.5)	6.2 (4.7;7.7)	7.1 (5.4;8.6)	9.0 (7.3;10.5)	10.6 (9.1;12.3)	10.1 (8.5;11.7)	9.6 (8.3;10.8)	9.5 (8.3;10.8)	9.2 (8.0;10.6)

Notes:

Figures underlined and in italics denote 50% pass through reached. Figures underlined denote 90% pass through reached. Figures in parenthesis represent the 99% confidence intervals calculated using bootstrap techniques (10,000 iterations).

2. What is the extent of pass-through using logs?

(percentage response to increase in crude oil price)

Excluding taxes

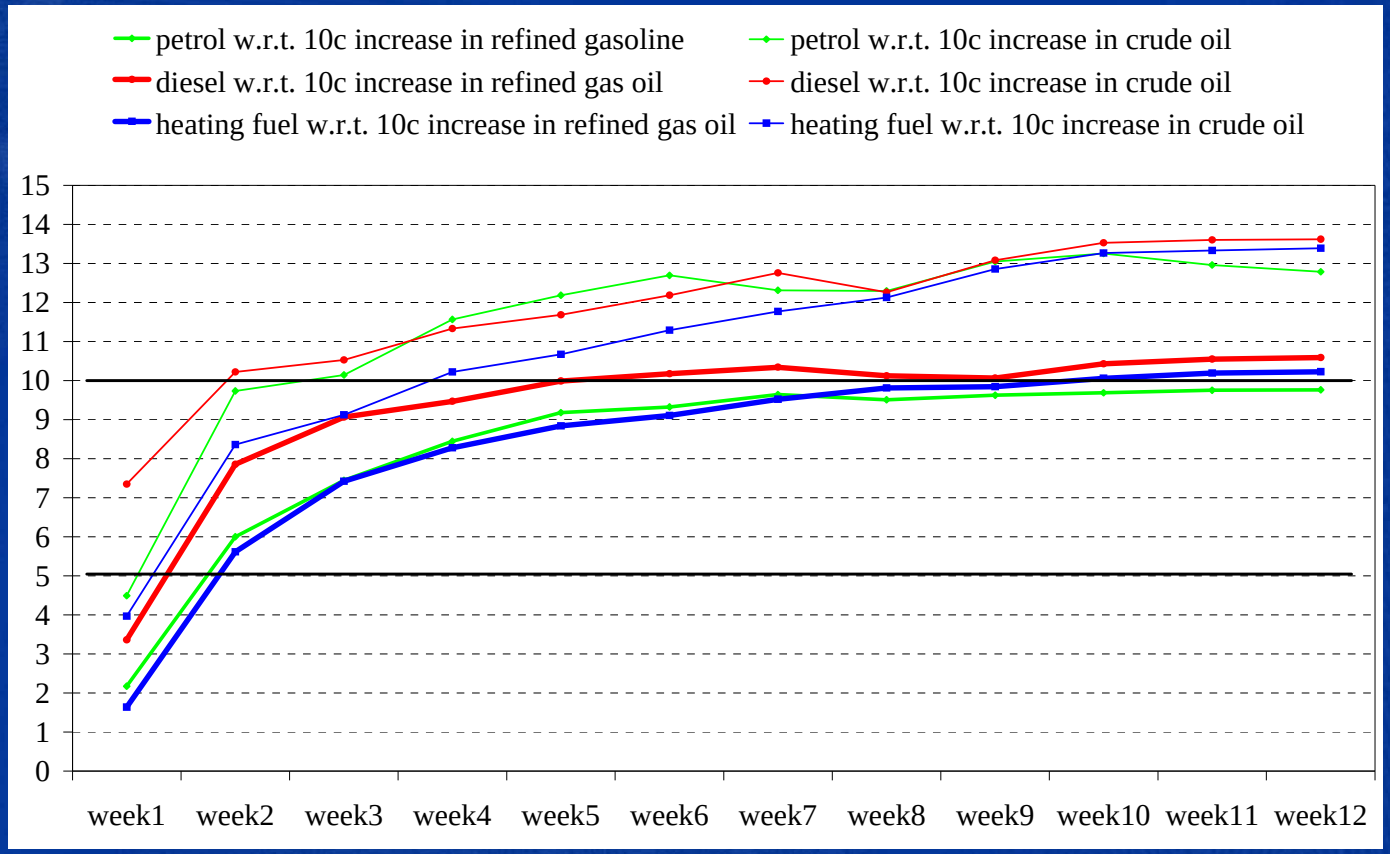
	1994-2008	1994-1999	2000-2008	2004-2008
Petrol	53%	43%	66%	65%
Diesel	73%	59%	81%	84%
Fuel Oil	60%	50%	68%	72%

Note: Results from estimation models of form in equation 1 but with all variables transformed using logarithms.

- **Using logs over entire time period gives rise to biased estimates**

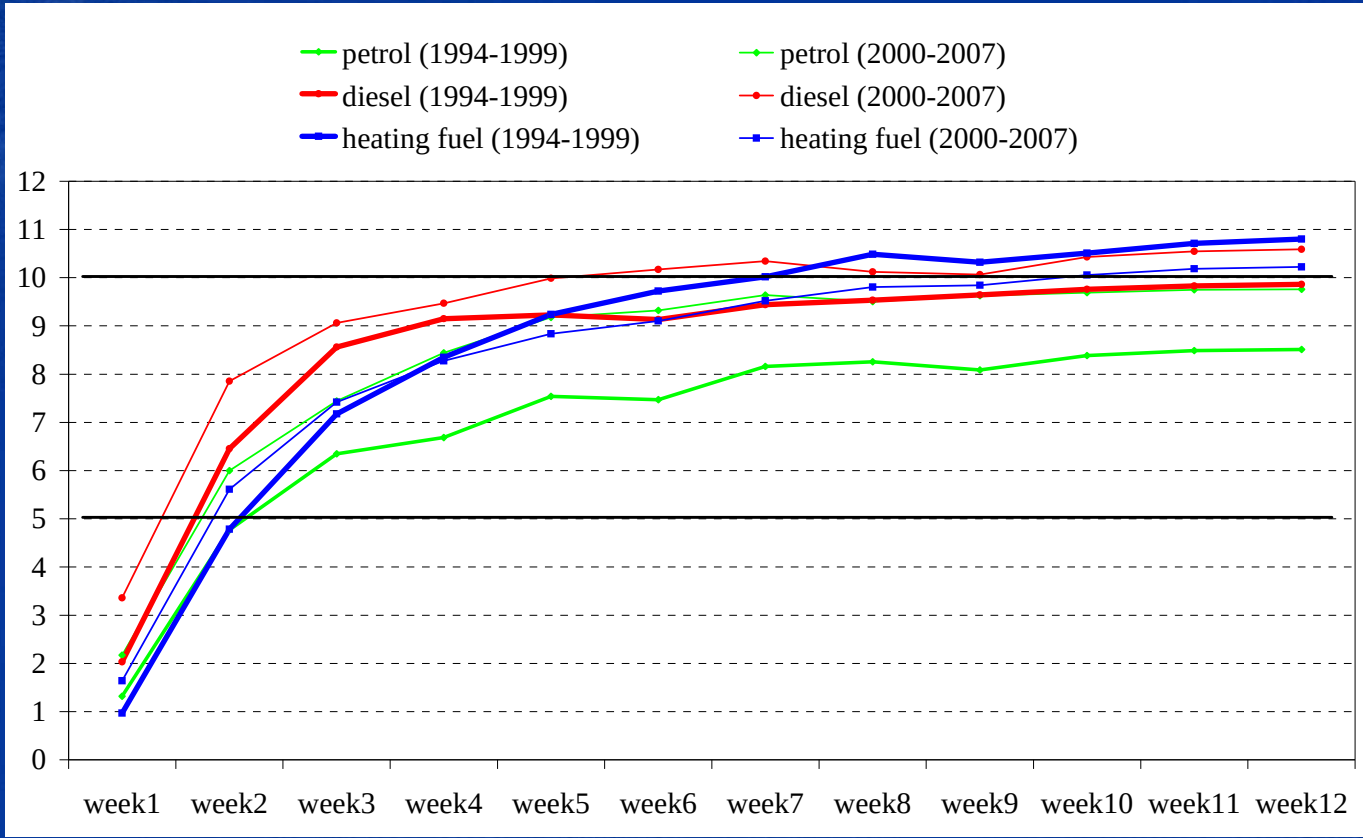
- **It is true that in percentage terms pass-through has increased but this is not due to retailers 'profiting' from oil price increases, as margins have remained broadly constant**

2. How important for pass through estimates is it to account for developments in refining margins?



Note: IRF shown for prices excluding taxes using equations estimated over period 2000-2008

3. Has pass-through changed over time?



Note: Note standard (symmetric) IRF shown using equations for prices excluding taxes estimated over periods, 1994-1999 and 2000-2007

3. Is there asymmetry?

$$\Delta P^C_{i,t} = \Delta^+_{i,t}\left(c^+_{i,j} + \sum_{k=1}^{n} \alpha^+_{i,j,k} \Delta P^C_{i,t-k} + \sum_{k=0}^{n} \beta^+_{i,j,k} \Delta P^I_{j,t-k} + \gamma^{++}_{i,j} \left(P^C_{i,t-1} - \theta_{i,j} P^I_{j,t-1} \right)^+ + \gamma^{+-}_{i,j} \left(P^C_{i,t-1} - \theta_{i,j} P^I_{j,t-1} \right)^- \right)$$

$$+ \left(1 - \Delta^+_{i,t}\right)\left(c^-_{i,j} + \sum_{k=1}^{n} \alpha^-_{i,j,k} \Delta P^C_{i,t-k} + \sum_{k=0}^{n} \beta^-_{i,j,k} \Delta P^I_{j,t-k} + \gamma^{-+}_{i,j} \left(P^C_{i,t-1} - \theta_{i,j} P^I_{j,t-1} \right)^+ + \gamma^{--}_{i,j} \left(P^C_{i,t-1} - \theta_{i,j} P^I_{j,t-1} \right)^- \right)$$

where,

$P^C_{i,t}$ **is the consumer prices of oil energy type i (petrol, diesel or heating fuel),**

$P^I_{j,t}$ **is the spot price of oil input j (crude/refined gasoline, diesel or gas oil)**

$\Delta^+_{i,t}$ **is a dummy variable, 1 when the price of oil input is higher than the previous period**

3. Is there asymmetry (cont'd)?

	ECM(+)	ECM(-)
dP(+)	(a) + -	(b) + +
dP(-)	(c) - -	(d) - +

We also allow for possible asymmetry in response to ECM term depending on whether prices are increasing or decreasing (Honarvar) and whether the prices are above or below their equilibrium level (e.g. Beradi et al, 2000)

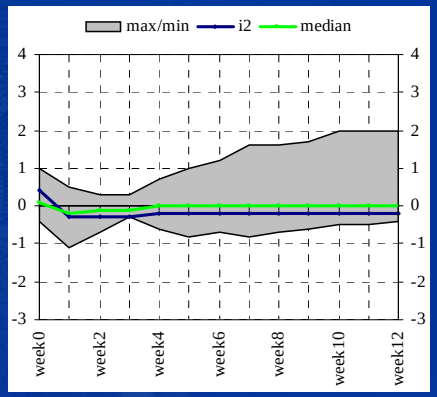
3. Is there evidence of asymmetry? Detailed results for petrol/gasoline prices

e95rop2	overall	AR sum	AR(i)	dynam sum	dynam(i)	EC adj	ECM_only
i2	0.52	0.96	0.83	0.90	0.69	0.12	0.20
be	0.59	0.84	0.22	0.73	0.96	0.86	0.57
de	0.39	0.44	0.33	0.38	0.90	0.15	0.64
ie	0.94	0.28	0.68	0.99	0.76	0.83	0.65
gr	0.11	0.12	0.35	0.23	0.35	0.13	0.41
es	0.88	0.61	0.69	0.99	0.48	0.35	0.53
fr	0.02	0.47	0.26	0.74	0.62	0.03	0.09
it	0.19	0.63	0.19	0.43	0.76	0.59	0.96
lu	0.02	0.29	0.02	0.48	0.07	0.58	0.73
nl	0.21	0.44	0.37	0.59	0.19	0.06	0.31
at	0.82	0.24	0.81	0.78	0.76	0.39	0.98
pt	0.30	0.01	0.04	0.29	0.42	0.65	0.42
fi	0.39	0.05	0.08	0.29	0.61	0.50	0.63

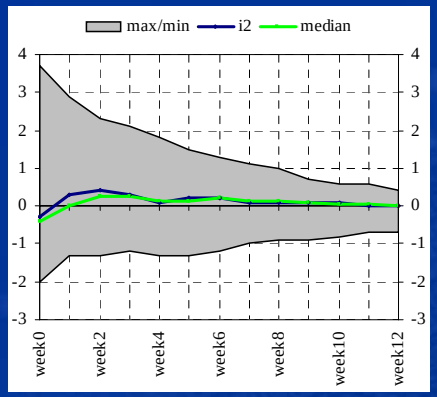
Note: table shows probabilities from Wald tests of coefficient restrictions implying symmetry. A low value signifies possible asymmetry. However, power of tests not very high.

3. Is there evidence of asymmetry?

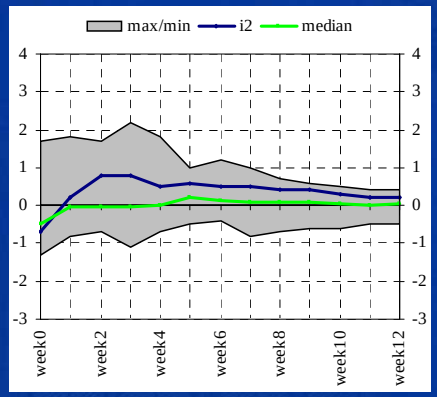
(a) Petrol



(b) Diesel



(c) Heating fuel



Note: max/min denotes the range between the highest and lowest differences across the 12 euro area

Note: chart shows IRF in response to a ten cent per litre increase and decrease in refined gasoline prices; both shown for consumer prices excluding taxes using equations estimated over period 2000-2008, i2 denotes euro area aggregate

4. Main points – descriptive analysis

- **Dispersion in consumer energy prices before tax is quite low, although given the homogeneity of product the gap between the highest and lowest price levels is substantial**
- **Since 1996 there has been relatively little change in distribution and retailing margins**

4. Main points – econometric analysis

- **Oil prices are passed through very quickly and completely into consumer "oil" energy prices**
- **Using absolutes values rather percentage changes highlights that pass through has been 100% and has not changed much over time**
- **Analysis and understanding of refining margins matters (particularly since 1999)**
- **Little evidence of *meaningful* asymmetry in pass through, *at least at distribution and retailing level***

4. Possible avenues for extending analysis

- **More pair wise analysis (e.g. link between tax and oil price increases/decreases, link/causality between crude oil prices and refining margins)**
- **Understanding cross-country differences in price levels**
- **Revisit analysis linking Oil Bulletin data to HICP- although oil bulletin data will still most likely significantly out-perform model using refined prices.**
- **Impact of oil prices on "non-oil" energy consumer prices**

EUROPEAN CENTRAL BANK

EUROSYSTEM

Consumer liquid fuel prices in an environment of high and volatile oil prices

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Directorate Economic Developments
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IEW, Venice 17 June 2009

The views expressed are those of the presenter and not necessarily those of the ECB

EUROPEAN CENTRAL BANK

EUROSYSTEM

Consumer liquid fuel prices in an environment of high and volatile oil prices

Reserve Slides

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IEW, Venice 17 June 2009

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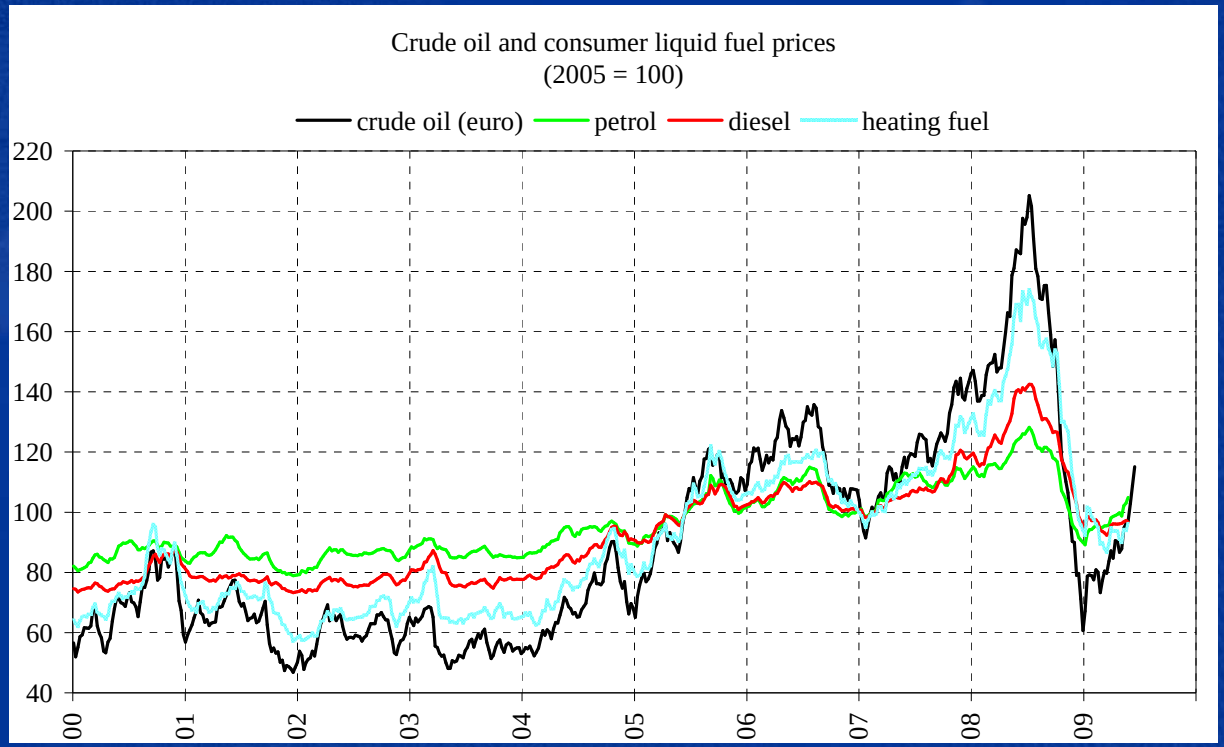
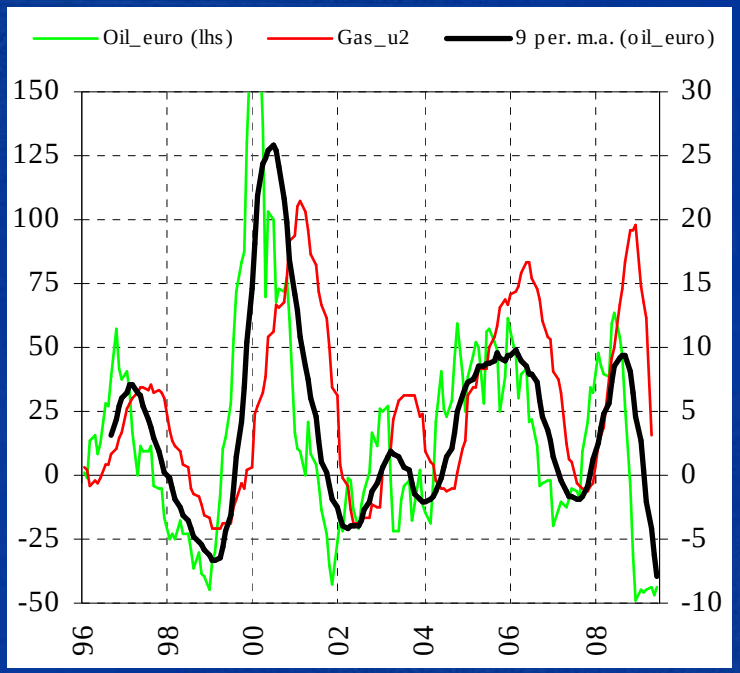
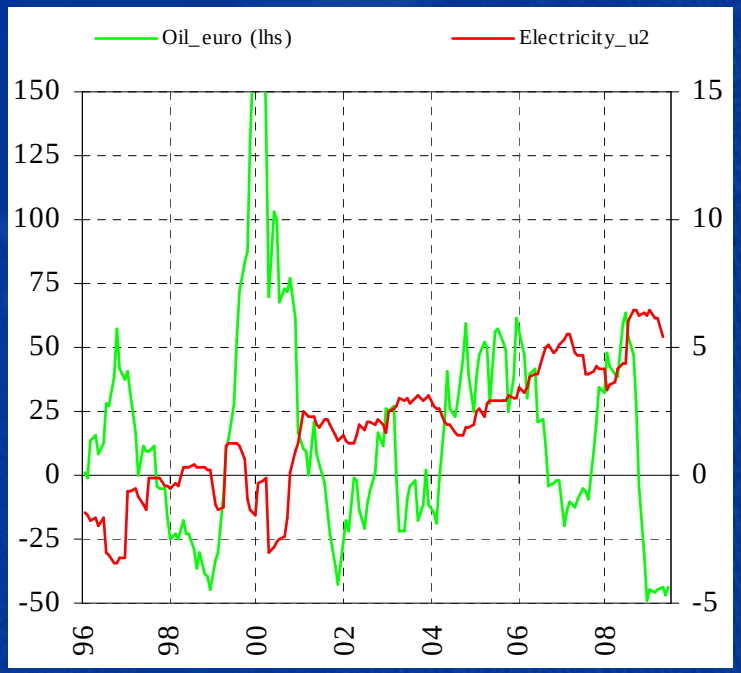
1. Direct effect – excise taxes push up price level but dampen volatility

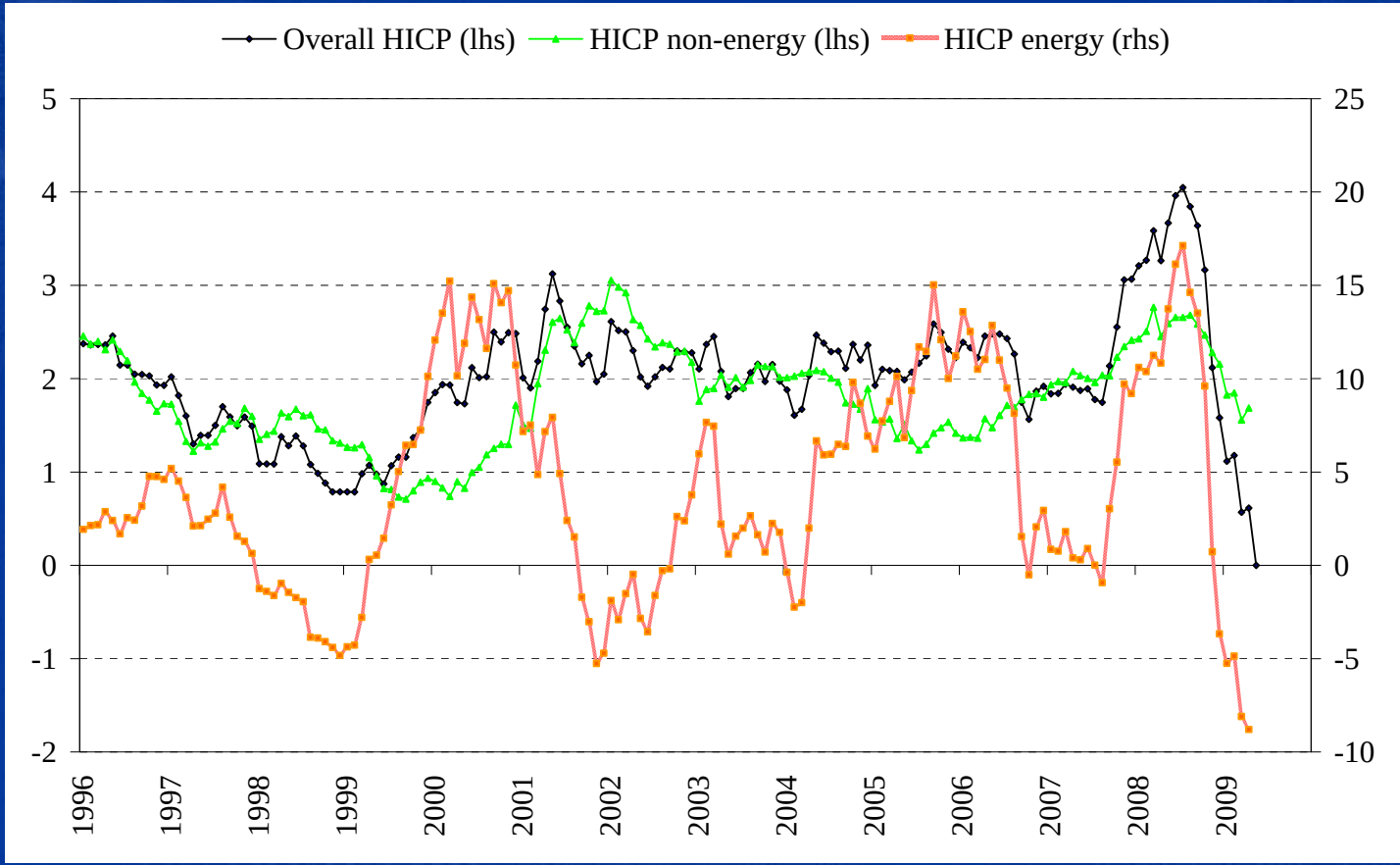


1. Impact on 'non-oil energy' prices





1. Since 1999 energy has pushed up inflation on average – both directly and indirectly



1. Focus on weekly Oil Bulletin data

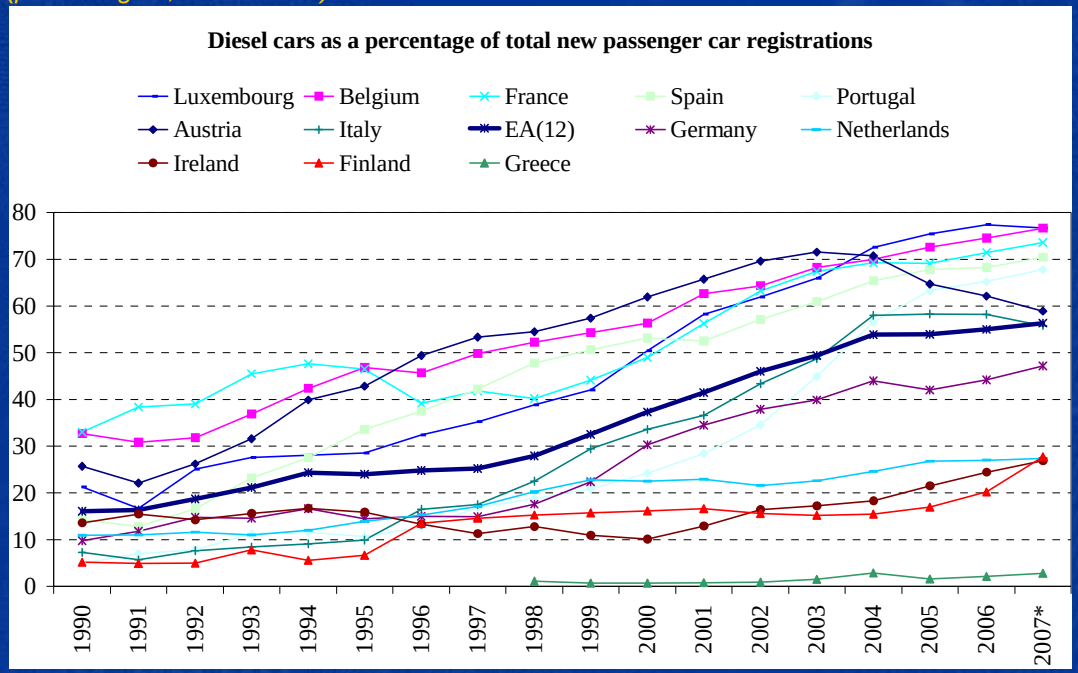
Relative advantages and disadvantages of Oil Bulletin price data

	Relative advantages	Relative disadvantages
Oil Bulletin	• Price inclusive and exclusive of tax • Information on price levels available • Weekly frequency • Quite timely (usually available within three days of reference period) • More detail (i.e. petrol and diesel) available on "oil-energy" prices • Excluding tax prices available since 1994 • Very close fit with HICP data	• Only "oil-energy" prices available • Not necessarily of high statistical quality • Inclusive of tax prices only available since 2000

1. Breakdown of car fuel may be relevant

Importance of diesel cars

(percentages ; annual data)



Sources: Eurostat and ACEA

1. Key features of paper
(relative to European empirical literature)

1. Analysis of euro area aggregate and individual countries (Arpa et al, 2006 and Galeotti et al, 2003)
2. Estimation over different time periods, 1994-1999 and 2000-2008 (none)
3. Models estimated for three different fuel types – petrol, diesel and heating fuel (Arpa et al, 2006 and Berardi et al, 2000)
4. Explicit consideration of different stages of pricing chain – refining, distribution/retail, and taxes (Galeotti et al)
5. Use of high frequency (weekly) data (many papers but not all, e.g. Galeotti et al)
6. Consideration of prices including and excluding taxes (Arpa et al)
7. Models estimated using absolute price data rather than logs of indices (Asplund et al, 2000)
8. Timely – using data up to April 2008 (Arpa et al use data up to 2005)
9. Allow for possible of asymmetries (most but with differing formulations)
   - Although not yet in response to exchange rate (e.g. Galeotti et al)

2. Stationarity analysis

Mean, standard deviation and unit root statistics for crude oil prices and refining margins

		mean (euro)	std. dev. (level)	std. dev. (monthly changes)	ADF t-statistic (prob)*
1994-2008	**crude oil**	**29.6**	**17.2**	**3.2**	**-1.5 (0.52)**
1994-1999		*14.6*	*3.2*	*1.2*	-0.8 (0.82)
2000-2004		*28.3*	*4.5*	*3.0*	-3.2 (0.02)
2005-2008		*53.5*	*12.4*	*5.1*	-1.1 (0.72)
1994-2008	**refining margin gasoline**	**4.3**	**3.5**	**2.4**	**-6.3 (0.00)**
1994-1999		*2.8*	*1.3*	*1.1*	-5.3 (0.00)
2000-2004		*5.3*	*3.5*	*2.6*	-3.6 (0.00)
2005-2008		*5.3*	*4.8*	*3.5*	-3.6 (0.00)
1994-2008	**refining margin gas oil**	**6.2**	**4.6**	**1.6**	**-3.3 (0.02)**
1994-1999		*3.2*	*1.1*	*0.7*	-4.8 (0.00)
2000-2004		*5.2*	*2.8*	*1.6*	-3.3 (0.02)
2005-2008		*11.9*	*4.5*	*2.5*	-2.5 (0.12)

Notes:
** prob denotes probability associated with null hypothesis that series has a unit root*

2. Causality analysis

Pairwise Granger Causality Tests*

		crude oil (in euro)	refined gasoline (in euro)	refined gas oil (in euro)	petrol (ex. tax)	diesel (ex. tax)	heating fuel (ex. tax)
		is not caused by					
crude oil (in euro)	does not cause	X	0.00	0.00	0.00	0.00	0.00
refined gasoline (in euro)		0.05	X	-	0.00	-	-
refined gas oil (in euro)		0.16	-	X	-	0.00	0.00
petrol (ex. tax)		0.05	0.64	-	X	-	-
diesel (ex. tax)		0.04	-	0.18	-	X	-
heating fuel (ex. tax)		0.57	-	0.54	-	-	X

Notes:
** Table reports probability of null hypothesis that one variable does not Granger Cause the other. Based on estimation in levels, over entire sample (1994-2008).*

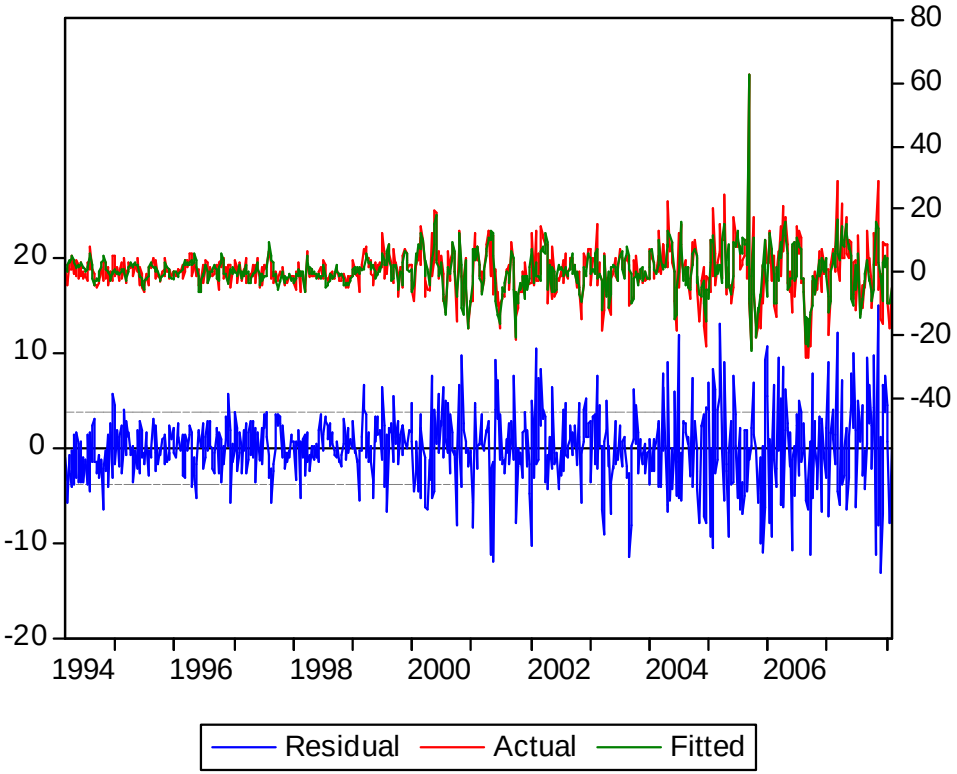
2. Cointegration/structural break analysis

Combined tests for cointegration and data determined breakpoints following Hatemi-J (2008) approach

dependent variable	independent variable	ADF whole sample	ADF break point 1	ADF break point 2
log(petrol)	log(crude)	-5.4	-7.4	-7.3
petrol	refined	-8.7	N/A	N/A
log(diesel)	log(crude)	-4.9	-6.1	N/A
diesel	refined gas oil	-9.3	-10.4	-8.7
log(fuel oil)	log(crude)	-4.5	-5.7	-6.0
fuel oil	refined gas oil	-5.4	-6.2	N/A

Notes:
Critical values are 1% (-6.0); 5% (-5.5)

2. Possible econometric issue - heteroskedacity



2. Regression results – petrol/gasoline

Summary of main regression results (for euro area data)

Downstream (P^C)	Petrol	Petrol	Petrol	Petrol
Upstream (P^I)	Gasoline	Gasoline	Gasoline	Gasoline
Estimation period	94-08	94-99	00-08	05-08
$c_{i,j}$	9.8	7.0	17.9	21.8
(t statistic)	*(3.95)*	*(2.65)*	*(4.11)*	*(2.33)*
ECM adj ($\gamma_{i,j}$)	-0.09	-0.08	-0.16	-0.19
(t statistic)	*(-3.94)*	*(-3.10)*	*(-4.23)*	*(-2.43)*
LR coef ($\theta_{i,j}$)	1.01	1.07	1.00	1.01
(t statistic)	*(57.67)*	*(10.39)*	*(54.79)*	*(27.94)*
Time trend	-	0.08	-	-
(t statistic)		*(3.50)*		
Sum alpha ($\sum_{k=1}^{K1} \alpha_{i,j,k}$)	-0.59	-0.15	-0.50	-0.67
max alpha lags	3	1	3	3
Sum beta ($\sum_{k=1}^{K2} \beta_{i,j,k}$)	1.36	0.71	1.17	1.32
max beta lags	4	3	4	4
adj R2	0.73	0.48	0.75	0.77
Regr S.E.	4.3	2.2	5.2	6.3
DW	1.96	2.00	1.96	1.94
No of obs.	774	304	470	270

2. Regression results – diesel/gasoil

Summary of main regression results (for euro area data)

Downstream (P^C)	Diesel	Diesel	Diesel	Diesel
Upstream (P^I)	Gas Oil	Gas Oil	Gas Oil	Gas Oil
Estimation period	94-08	94-99	00-08	05-08
$c_{i,j}$	10.1	3.3	11.5	21.5
(t statistic)	*(5.97)*	*(2.29)*	*(4.87)*	*(3.77)*
ECM adj ($\gamma_{i,j}$)	-0.23	-0.08	-0.29	-0.31
(t statistic)	*(-6.17)*	*(-3.50)*	*(-5.54)*	*(-4.35)*
LR coef ($\theta_{i,j}$)	1.05	1.09	1.05	1.05
(t statistic)	*(69.69)*	*(13.81)*	*(64.40)*	*(53.35)*
Time trend	0.03	0.04	0.04	-
(t statistic)	*(4.85)*	*(2.43)*	*(3.80)*	
Sum alpha ($\sum_{k=1}^{K1} \alpha_{i,j,k}$)	-0.73	-0.20	-0.70	-0.66
max alpha lags	3	0	3	2
Sum beta ($\sum_{k=1}^{K2} \beta_{i,j,k}$)	1.22	0.94	1.10	0.92
max beta lags	3	2	3	2
adj R2	0.74	0.67	0.75	0.72
Regr S.E.	4.6	1.8	5.7	7.2
DW	1.96	2.00	1.96	1.95
No of obs.	774	304	470	209

2. Regression results – heating fuel/gasoil

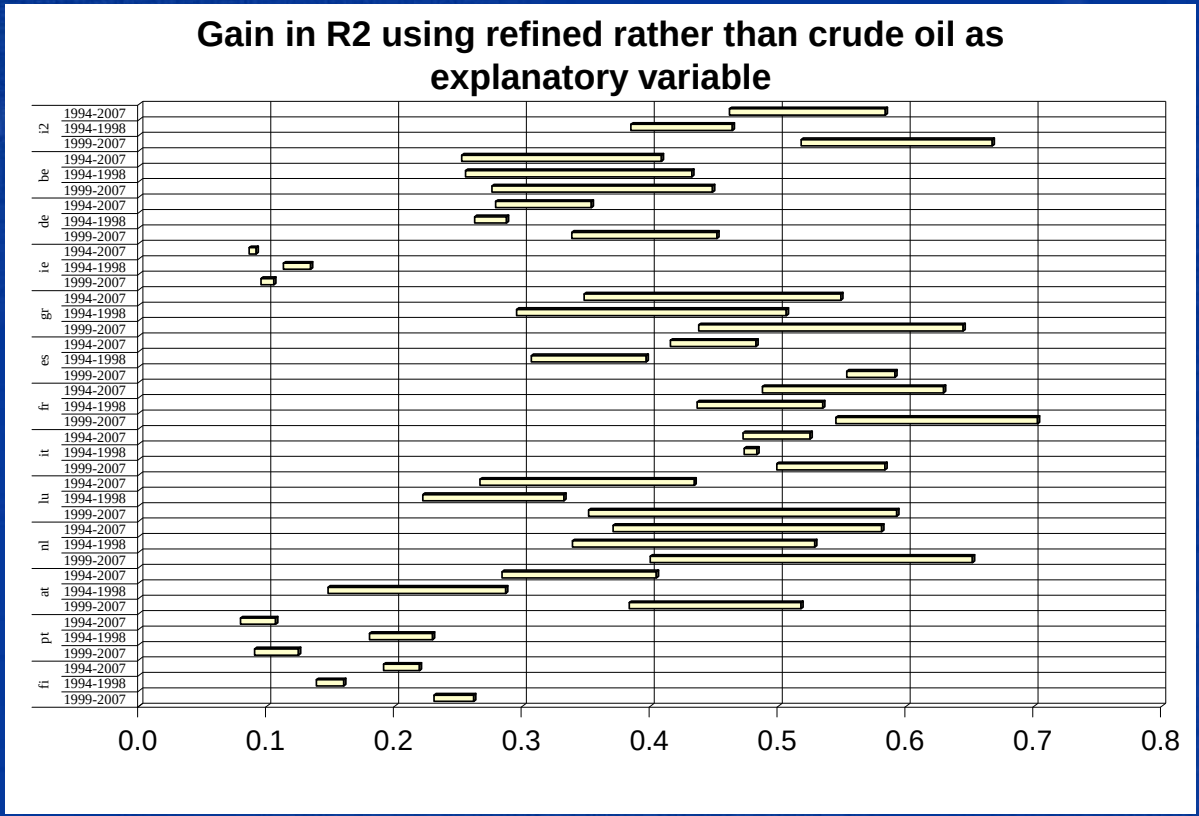
Summary of main regression results (for euro area data)

Downstream (P^C)	Fuel Oil	Fuel Oil	Fuel Oil	Fuel Oil
Upstream (P^I)	Gas Oil	Gas Oil	Gas Oil	Gas Oil
Estimation period	94-08	94-99	00-08	05-08
$c_{i,j}$	7.8	4.8	8.2	26.1
(t statistic)	*(4.88)*	*(2.84)*	*(3.35)*	*(4.03)*
ECM adj ($\gamma_{i,j}$)	-0.10	-0.08	-0.11	-0.20
(t statistic)	*(-4.88)*	*(-4.00)*	*(-4.11)*	*(-3.96)*
LR coef ($\theta_{i,j}$)	0.98	1.15	0.98	1.00
(t statistic)	*(34.50)*	*(13.84)*	*(27.38)*	*(45.69)*
Time trend	0.08	0.10	0.09	-
(t statistic)	*(5.64)*	*(5.92)*	*(3.12)*	
Sum alpha ($\sum_{k=1}^{K1} \alpha_{i,j,k}$)	-0.10	0.21	-0.12	-0.50
max alpha lags	2	0	2	2
Sum beta ($\sum_{k=1}^{K2} \beta_{i,j,k}$)	0.92	0.53	0.93	1.23
max beta lags	3	2	3	3
adj R2	0.75	0.60	0.76	0.79
Regr S.E.	3.7	2.0	4.5	5.3
DW	1.98	1.98	1.98	2.01
No of obs.	774	304	470	209

2. How important are refining margins?

Gain in R2 for petrol equation using relevant refined prices

(percentage points)

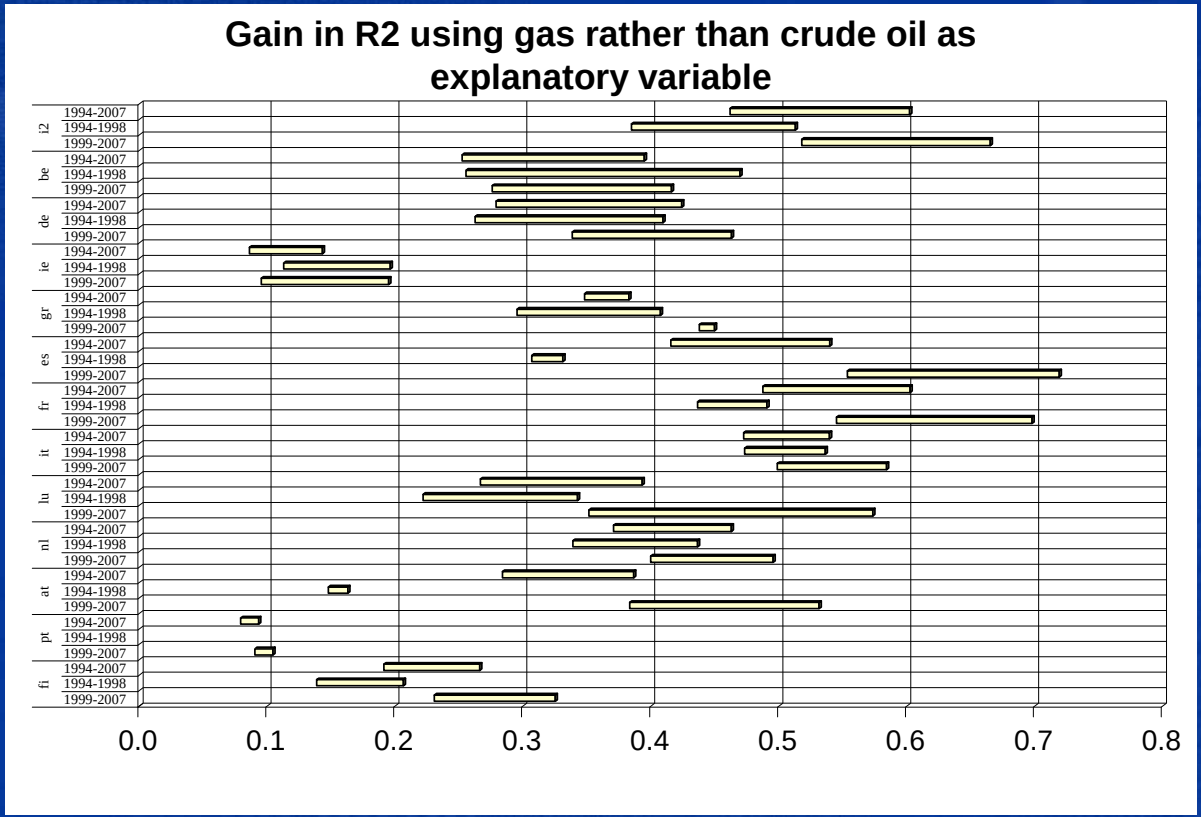


Sources: ECB calculations

2. How important are refining margins?

Gain in R2 for diesel equation using relevant refined prices

(percentage points)

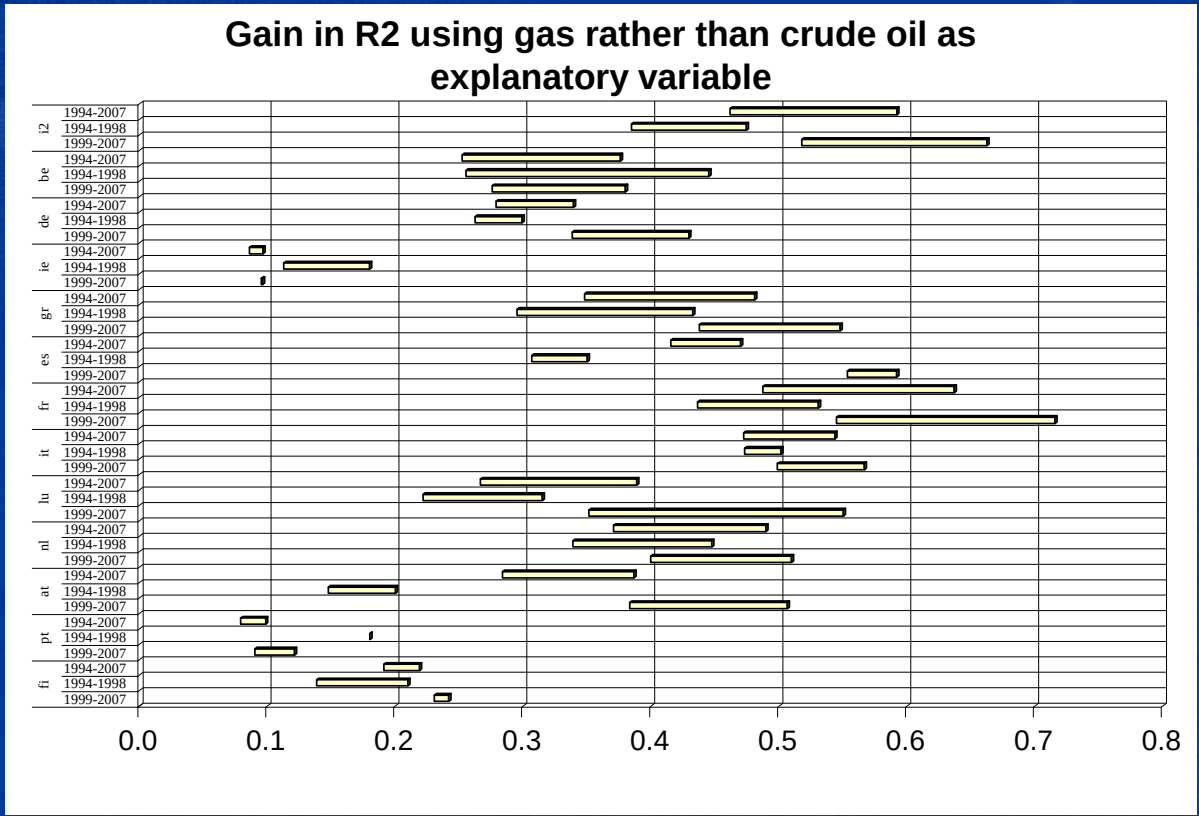


Sources: ECB calculations

2. How important are refining margins?

Gain in R2 for heating oil equation using relevant refined prices

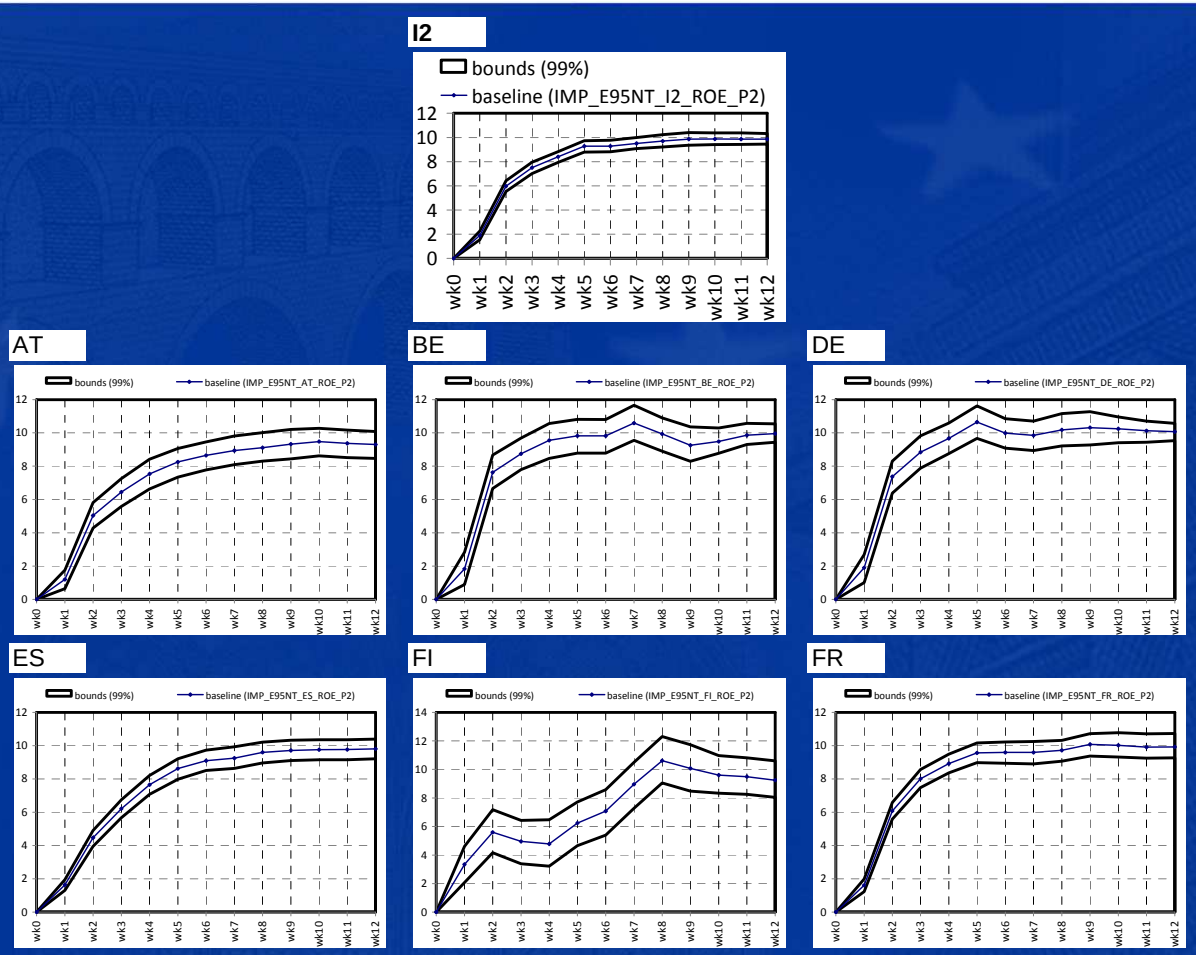
(percentage points)



Sources: ECB calculations

2. What is the extent and speed of pass-through?

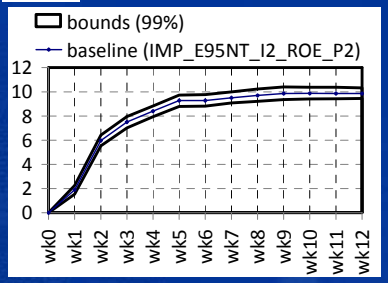
(response to 10 cent increase per litre)



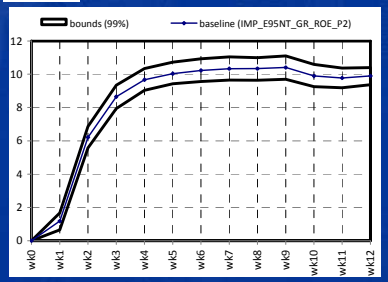
2. What is the extent and speed of pass-through?

(response to 10 cent increase per litre)

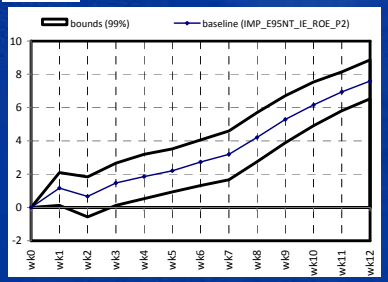
I2



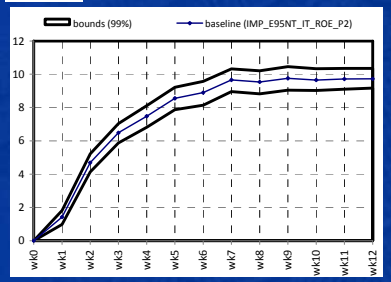
GR



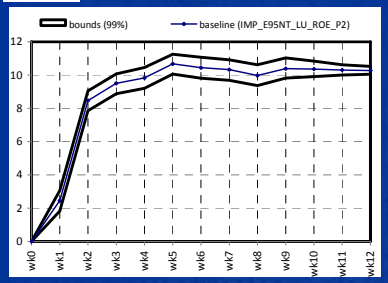
IE



IT



LU



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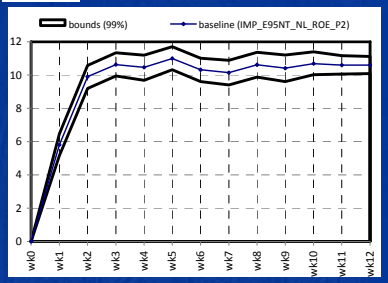
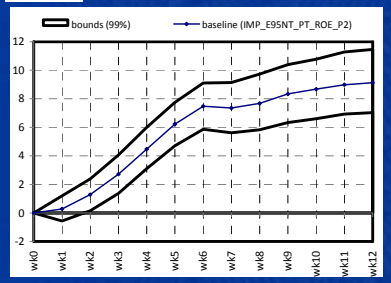


PT



2. What is the extent and speed of pass-through?

(response to 10 cent increase per litre)

Including taxes (using model estimated 1999-2008)

irfe95wt_roe_p2	week1	week2	week3	week4	week5	week6	week7	week8	week9	week10	week11	week12
i2	**2.6**	**7.1**	**8.8**	**10.0**	**10.8**	**11.0**	**11.3**	**11.1**	**11.3**	**11.3**	**11.3**	**11.3**
be	3.2	10.2	11.5	12.6	13.0	13.3	14.6	13.7	12.4	12.7	13.2	13.5
de	3.0	8.8	10.7	11.8	12.5	12.0	12.0	11.7	11.9	12.0	12.0	12.0
ie	0.9	0.7	2.3	2.8	3.7	4.3	4.9	6.5	8.2	9.1	10.0	10.9
gr	1.8	8.2	10.9	12.3	12.5	12.7	12.9	12.9	12.8	12.2	12.2	12.5
es	2.1	5.1	6.9	8.6	9.5	10.3	10.6	10.6	10.6	10.6	10.5	10.6
fr	2.7	7.9	10.1	11.4	12.0	12.2	12.3	12.0	12.3	12.5	12.5	12.5
it	1.6	5.2	7.2	8.5	9.7	10.3	11.1	10.8	11.0	10.8	10.9	10.9
lu	3.7	9.9	10.9	11.2	11.9	11.6	11.9	11.1	11.4	11.4	11.4	11.3
nl	6.7	11.6	12.0	12.2	12.3	12.1	11.7	11.7	11.5	11.6	11.7	11.7
at	1.4	5.8	7.9	9.3	10.2	10.9	11.4	11.1	11.1	11.6	11.9	12.0
pt	0.2	1.3	3.0	5.2	7.2	8.6	8.9	9.3	9.7	9.9	9.9	10.0
fi	4.5	8.4	6.5	6.8	8.1	8.9	11.4	12.1	12.0	12.2	12.2	12.1

Headline

- **Text, text, text,**
- **For highlighting text, you can use one of the following colours:**
  - **Yellow,**
  - **mustard,**
  - **orange.**

Instructions:
• you may use this slide for the text of your presentation
• if you wish to highlight parts of your text, you may choose between the above colours
• as with the title, the font should always be Gill Sans MT, with a font size between 18 and 36