Crude Oil Prices and Retail Prices: Is there an Asymmetric Transmission? Application For France and Germany

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10th IAEE European Conference
Energy, Policies and Technologies for Sustainable Economies
Vienna - 8th September 2009
Context in our overall study (Thesis)

- Asymmetric relationship between oil prices and activity in Europe and EMU
- Role of the European Central Bank in this nonlinear transmission
- Estimates display an asymmetric response
- Is this reaction optimal or justified? Investigation of the pass-through between oil prices and inflation between 1970 and 2007
- The asymmetric pass-through leads us to examine one source of the downward rigidity: sticky prices of refined products
Historical context

- **2002-2008:** A large and long-lasting increase in world crude oil prices until 135 U.S dollars the barrel
- **2008-2009:** A rapid and large decrease in crude oil price reaching 35 U.S dollars
- Spot prices of refined products and pump prices follow logically the same evolution
- This period of high volatility has seen the revival of an "asymmetric" feeling of consumers
- Increases in crude oil price would be translate more rapidly and entirely to the pump prices
- The pass-through of crude oil price decreases would be imperfect and slower
Review of the literature

- A large range of papers about this topic
- Most of them deals with gasoline markets
  - Bacon (1991), Borenstein et al. (1997), Galeotti et al. (2003), Grasso and Manera (2007)
- Estimation results display opposite conclusions
- Results are highly sensitive to:
  - Methodology
  - Samples: country and period
  - Data frequency
- Generally, papers confirm the asymmetric pattern of the relationship
- Audenis et al. (2002) is the closest work of our paper
Aims of the paper (1)

- A central question:
  - Are European consumers right?
- Our main goal is to assess empirically this question: amount and delay
- Derived questions from the main concern
  - Are there differences between petroleum products? Gasoline, diesel and heating oil
  - Which stage contributes the most to asymmetry? Refining vs distribution
  - What role for exchange rate in the pass-through? Smoothing or accelerating effect
  - What differences between two countries of the EMU? France and Germany
Outline of the presentation

1. Introduction
2. Stylised facts
3. Econometric Model
4. Results
5. Conclusion
Spot prices on Rotterdam Market

Figure: Weekly spot prices of Brent, gasoline, gasoil and heating oil 1998:1-2008:10

Source: EIA
Figure: Weekly retail prices of gasoline, diesel and heating oil in France

Source: EIA
Figure: Diesel prices in Euros, USD and the euro/dollar exchange rate over 1998-2008

Source: EIA and FRED
Select a model

- Variables are I(1), prices are cointegrated
- Choice of an Error correction Model (ECM) from Engle-Granger (1987)
- Asymmetry assessed by confronting increases and decreases of explanatory variables
- Introduction of an asymmetry into the Error Correction Term (ECT): $\epsilon^+_t vs \epsilon^-_{t-1}$, initiated by Granger and Lee (1987)
- Asymmetry tested for three relationships:
  - Single stage: crude oil-retail prices
  - Refining step: crude oil-spot prices of products
  - Distribution step: spot prices of products-retail prices
- The exchange rate introduced in the second stage (distribution)
Error Correction Model

- Three relationships ⇒ Three equations estimated with OLS:

\[
\Delta r_t = \alpha + \beta^+ \epsilon^+_{t-1} + \beta^- \epsilon^-_{t-1} + \sum_{i=0}^{k} \gamma^+_i \Delta c^+_t - i + \sum_{i=0}^{k'} \gamma^-_i \Delta c^-_{t-i} \\
+ \sum_{i=0}^{l} \lambda^+_i \Delta e^+_{t-i} + \sum_{i=0}^{l'} \lambda^-_i \Delta e^-_{t-i} + u_t
\]

\[
\Delta s_t = \alpha + \beta^+ \epsilon^+_{t-1} + \beta^- \epsilon^-_{t-1} + \sum_{i=0}^{k} \gamma^+_i \Delta c^+_t - i + \sum_{i=0}^{k'} \gamma^-_i \Delta c^-_{t-i} + u_t
\]

\[
\Delta r_t = \alpha + \beta^+ \epsilon^+_{t-1} + \beta^- \epsilon^-_{t-1} + \sum_{i=0}^{k} \gamma^+_i \Delta s^+_t - i + \sum_{i=0}^{k'} \gamma^-_i \Delta s^-_{t-i} \\
+ \sum_{i=0}^{l} \lambda^+_i \Delta e^+_{t-i} + \sum_{i=0}^{l'} \lambda^-_i \Delta e^-_{t-i} + u_t
\]

- With \( r \): retail prices, \( s \): spot prices, \( e \): exchange rate
- Different lags allowed (\( k, k', l, l' \)) according to AIC
Data construction and sources

- **Weekly variables of:**
  - *Crude oil:* Brent spot price (FOB), U.S.D/barrel.
  - *Spot prices:* 50ppm Conventional Gasoline Regular (FOB), the Gasoil (FOB) set on the Rotterdam market and the New York Harbor No. 2 Heating Oil (FOB) in U.S.D/gallon.
  - *Retail prices:* Before-tax prices in U.S.D/gallon. Premium Gasoline Prices, the retail diesel price and the retail distillate heating oil (each Monday).

- **Daily data of the Euro/Dollar bilateral exchange rate**

- **Sources:** EIA, European Commission, Fred

- **Sample:** 1998:1-2008:10 (530 to 560 observations)
# Results

**Gasoline**

Estimation results for Gasoline

<table>
<thead>
<tr>
<th></th>
<th>Crude-spot</th>
<th>2nd stage spot-retail</th>
<th>Single stage crude-retail</th>
<th>2nd stage spot-retail</th>
<th>Single stage crude-retail</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$</td>
<td>-0.0055</td>
<td>0.0042</td>
<td><strong>0.0113</strong>*</td>
<td>-0.0012</td>
<td><strong>0.0127</strong>*</td>
</tr>
<tr>
<td>$\beta^+$</td>
<td>-0.0407*</td>
<td>-0.0836**</td>
<td>-0.0741***</td>
<td>-0.2857***</td>
<td>-0.0864***</td>
</tr>
<tr>
<td>$\beta^-$</td>
<td>-0.0633*</td>
<td>-0.1257***</td>
<td>0.0046</td>
<td>-0.3113**</td>
<td>-0.0850**</td>
</tr>
<tr>
<td>$\sum \gamma^+_i$</td>
<td>1.0646***</td>
<td>0.5365***</td>
<td>0.4441***</td>
<td>0.5458***</td>
<td>0.3401**</td>
</tr>
<tr>
<td>$\sum \gamma^-_i$</td>
<td>0.7972***</td>
<td>0.5912***</td>
<td>0.6036***</td>
<td>0.4779***</td>
<td>0.8015***</td>
</tr>
<tr>
<td>$\sum \lambda^+_i$</td>
<td>-0.8533***</td>
<td>-0.9827***</td>
<td>-0.2643</td>
<td>-0.7009*</td>
<td></td>
</tr>
<tr>
<td>$\sum \lambda^-_i$</td>
<td>-0.1586</td>
<td>-0.0693</td>
<td>-0.3011</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Observations: 530 532 560 531 560
### Results

#### Diesel

**Estimation results for Diesel**

<table>
<thead>
<tr>
<th></th>
<th>France 1st stage Crude-spot</th>
<th>France 2nd stage spot-retail</th>
<th>Germany 2nd stage spot-retail</th>
<th>Germany 2nd stage crude-retail</th>
<th>Germany Single stage crude-retail</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha )</td>
<td>-0.0021</td>
<td>0.0045*</td>
<td>-0.0017</td>
<td>0.0127**</td>
<td></td>
</tr>
<tr>
<td>( \beta^+ )</td>
<td>-0.1149***</td>
<td>-0.0173</td>
<td>-0.2162***</td>
<td>-0.0814***</td>
<td></td>
</tr>
<tr>
<td>( \beta^- )</td>
<td>-0.0626**</td>
<td>-0.0070</td>
<td>-0.2246***</td>
<td>-0.1253***</td>
<td></td>
</tr>
<tr>
<td>( \sum \gamma_i^+ )</td>
<td>0.8089***</td>
<td>0.7167***</td>
<td>0.7579***</td>
<td>0.474***</td>
<td></td>
</tr>
<tr>
<td>( \sum \gamma_i^- )</td>
<td>0.5569***</td>
<td>0.7238***</td>
<td>0.4390***</td>
<td>0.4329***</td>
<td></td>
</tr>
<tr>
<td>( \sum \lambda_i^+ )</td>
<td>-1.0382***</td>
<td>-1.0624***</td>
<td>-0.8496***</td>
<td>-0.9169***</td>
<td></td>
</tr>
<tr>
<td>( \sum \lambda_i^- )</td>
<td>-0.3559***</td>
<td>-0.2074</td>
<td>-0.0659</td>
<td>0.1089</td>
<td></td>
</tr>
</tbody>
</table>

**Observations**

|                | 562                           | 560                           | 561                           | 560                           | 560                           |

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"Crude oil price and petroleum prices"
## Results

### Heating oil

#### Estimation results for Heating oil

<table>
<thead>
<tr>
<th></th>
<th>1st stage</th>
<th>France</th>
<th>2nd stage</th>
<th>Single stage</th>
<th>Germany</th>
<th>2nd stage</th>
<th>Single stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude-spot</td>
<td>spot-retail</td>
<td>crude-retail</td>
<td>spot-retail</td>
<td>crude-retail</td>
<td>spot-retail</td>
<td>crude-retail</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.0074*</td>
<td>-0.0023</td>
<td><strong>0.0057</strong>*</td>
<td>0.0034</td>
<td><strong>0.0083</strong>*</td>
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</tr>
<tr>
<td>$\beta^+$</td>
<td>-0.2050***</td>
<td>-0.0320**</td>
<td>-0.0418***</td>
<td>-0.0587*</td>
<td>-0.0698***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta^-$</td>
<td>-0.1103***</td>
<td>-0.0301*</td>
<td>-0.0186</td>
<td>-0.0576***</td>
<td>-0.0343</td>
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<td></td>
</tr>
<tr>
<td>$\sum \gamma_i^+$</td>
<td>0.4319**</td>
<td>0.6727***</td>
<td>0.4405***</td>
<td>0.6971***</td>
<td>0.5349***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sum \gamma_i^-$</td>
<td>0.5817***</td>
<td>0.6064***</td>
<td>0.4998***</td>
<td>0.6859***</td>
<td>0.4755***</td>
<td></td>
<td></td>
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<tr>
<td>$\sum \lambda_i^+$</td>
<td>-0.2139</td>
<td>-0.8895***</td>
<td>-0.3860*</td>
<td>1.4135***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sum \lambda_i^-$</td>
<td>-0.0154</td>
<td>-0.3188***</td>
<td>0.1395</td>
<td>-0.1581</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Observations</td>
<td>559</td>
<td>559</td>
<td>560</td>
<td>561</td>
<td>561</td>
<td>561</td>
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</tr>
</tbody>
</table>
Wald tests on aggregated coefficients (F-tests)

<table>
<thead>
<tr>
<th></th>
<th>1st stage</th>
<th>France</th>
<th>Single stage</th>
<th>Germany</th>
<th>Single stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude-spot</td>
<td>2nd stage</td>
<td>crude-retail</td>
<td>2nd stage</td>
<td>crude-retail</td>
</tr>
<tr>
<td>Gasoline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta^+ = \beta^-$</td>
<td>0.214</td>
<td>0.294</td>
<td>7.238***</td>
<td>0.068</td>
<td>0.001</td>
</tr>
<tr>
<td>$\sum \gamma_i^+ = \sum \gamma_i^-$</td>
<td>1.599</td>
<td>0.121</td>
<td>7.60</td>
<td>0.99</td>
<td>3.173*</td>
</tr>
<tr>
<td>$\sum \lambda_i^+ = \sum \lambda_i^-$</td>
<td>4.532**</td>
<td>5.986**</td>
<td></td>
<td>0.004</td>
<td>2.409</td>
</tr>
<tr>
<td>Diesel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta^+ = \beta^-$</td>
<td>1.306</td>
<td>0.744</td>
<td>0.827</td>
<td>6.608***</td>
<td>0.597</td>
</tr>
<tr>
<td>$\sum \gamma_i^+ = \sum \gamma_i^-$</td>
<td>5,303**</td>
<td>0.004</td>
<td>0.009</td>
<td>2.093</td>
<td>0.049</td>
</tr>
<tr>
<td>$\sum \lambda_i^+ = \sum \lambda_i^-$</td>
<td>5.767**</td>
<td>7.903***</td>
<td></td>
<td>2.254</td>
<td>6.413**</td>
</tr>
<tr>
<td>Heating oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta^+ = \beta^-$</td>
<td>1.974</td>
<td>0.217</td>
<td>0.624</td>
<td>0.000</td>
<td>0.815</td>
</tr>
<tr>
<td>$\sum \gamma_i^+ = \sum \gamma_i^-$</td>
<td>12.081***</td>
<td>1.020</td>
<td>0.312</td>
<td>0.008</td>
<td>0.236</td>
</tr>
<tr>
<td>$\sum \lambda_i^+ = \sum \lambda_i^-$</td>
<td>2.821*</td>
<td>4.011**</td>
<td></td>
<td>2.798*</td>
<td>12.052***</td>
</tr>
</tbody>
</table>
Sum up of the results

- **Consumers’ feelings are partially confirmed**
- Differences among products (single stage):
  - No asymmetry on gasoline market
  - Asymmetry for diesel
  - Mitigated results for heating oil
- Short-run *vs* long-run asymmetries:
  - On the long-run, asymmetries tend to disappear
- Stages analysis:
  - Asymmetry are stronger at the refinery step
- France *vs* Germany:
  - Germany seems to be more affected by asymmetry than France
- Exchange rate:
  - Appreciations cushion the transmission
  - Depreciations have no significant influence
- Wald tests do not display strong evidence of asymmetry for upstream prices, on the contrary to exchange rate
The main results

- The "asymmetry" is not as clear as European consumers feel. Asymmetric transmission:
  - occurs for the diesel, the more consumed product
  - occurs only on the short-term
  - is greater in Germany

- Only appreciation of the exchange rate plays a role in the pass-through between upstream prices and retail prices: it restraints the complete translation: Law of One Price works
Improvements and future research

1. Bootstrapping Wald tests

2. Assess the potential explanations of asymmetry:
   - Market structure and implications of the concentration: agreements
   - Consumer search costs
   - Inventories’ costs

3. Evaluate the other sources of rigidity in the transmission of oil prices to inflation
   - The role of wages’ adjustment
   - The relationship between crude oil prices and producer prices