Renewable energies – new forces in Brazilian trade with the EU?

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Structure

- Introduction
- Ethanol - production
  - trade
- Trade flow analysis
  - the gravity model
- Results and conclusion
Background I – increasing energy costs

OPEC Real oil prices 1970 to 2004

US$/b

From 1970 to 1981, the Arab Light official price. As of 1982, the OPEC spot Reference Basket price.

Background I – increasing energy costs

OPEC Real oil prices 1970 to 2004

Actual price: 62.96 $/b
(23. June 2005)

From 1970 to 1981, the Arab Light official price. As of 1982, the OPEC spot Reference Basket price.

Background II – increasing energy costs

Real crude prices* January 1970 to July 2005

* West Texas Intermediate in constant (July, 2005) U.S. dollars

Agricultural energetic option - ethanol

Introduction
Facts
Method
Outcome

Own calculations based on USDA, FAOStat (2004/5)
Agr. energetic option - ethanol

Introduction

Facts

Method

Outcome

Own calculations based on USDA, FAOstat (2004/5)
Ethanol: still an agr. energetic option?

Facts

- Brazil Non-Food use
- Brazil Production
- EU Non-Food use
- EU Production

Own calculations based on USDA, FAOStat (2004/5)
Background III – increasing energy costs

Real crude prices* January 1970 to July 2005


* West Texas Intermediate in constant (July, 2005) U.S. dollars
Ethanol production

Introduction

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Source: OECD (2006), based on FAOSTAT and F.O. Licht.
Ethanol export flows, 2004

Source: own calculations based on COMTRADE (2006)
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Ethanol import flows, 2004

Source: own calculations based on COMTRADE (2006)
Trade flow analysis: the gravity equation

\[ X_{ij} = \alpha_0 GDP_i^{\alpha_1} \left( \frac{GDP_i}{POP_i} \right)^{\alpha_3} GDP_j^{\alpha_2} \left( \frac{GDP_j}{POP_j} \right)^{\alpha_4} \text{DIST}_{ij}^{\alpha_5} \]

\[ \ln X_{ij} = \ln \alpha_0 + \left( \alpha_1 + \alpha_3 \right) \ln GDP_i - \alpha_3 \ln POP_i + \left( \alpha_2 + \alpha_4 \right) \ln GDP_j - \alpha_4 \ln POP_j + \alpha_5 \ln \text{DIST}_{ij} \]
Trade flow analysis: the gravity equation

\[ \ln X_{ij} = \alpha_0 + \alpha_1 \ln GDP_i + \alpha_3 \ln \left( \frac{GDP_i}{POP_i} \right) \]

\[ + \alpha_2 \ln GDP_j + \alpha_4 \ln \left( \frac{GDP_j}{POP_j} \right) \]

\[ + \alpha_5 \ln DIST_{ij} \]

\[ + \alpha_6 \ln (Area_i) + \alpha_7 \ln (Area_j) + \alpha_8 (ID) \]

\[ + \alpha_{10} (JD_T) + \ldots + \alpha_{T+n} (JD_{T+n}) \]
Specification and results

\[ \log X = f (\log\text{GDP}, \log\text{GDP}_E, \log\text{Distance}, \]
\[ \log\text{GDP/POP}, \log\text{GDP}_E/\text{POP}_E, \]
\[ \text{dummy}_{\text{inEU15}}, \text{dummy}_{\text{exEU15}}, \]
\[ \text{dummy}_{\text{inNAFTA}}, \text{dummy}_{\text{NAFTA}}, \]
\[ \text{dummy}_{\text{inMSUL}}, \text{dummy}_{\text{MSUL}}, \]
\[ \log\text{AREA}_E) \]

Trade Creation dummy: 1 if countries i and j belong to the same RTA

Trade diversion dummy: 1 if an RTA member imports from a third country

And additional dummies and variables to capture influence of:
- annual events
- price/quality variation
- energy prices
- substitutes (sugar)
### Specification and results

**basic gravity equation specifications for the ethanol trade, 1975-2004**

<table>
<thead>
<tr>
<th></th>
<th><strong>Model 1</strong></th>
<th><strong>Model 2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intercept</strong></td>
<td>-1.50191**</td>
<td>-13.78432**</td>
</tr>
<tr>
<td>logGDP</td>
<td>0.43016**</td>
<td>0.46238**</td>
</tr>
<tr>
<td>logGDP_e</td>
<td>-0.15383**</td>
<td>-0.1131**</td>
</tr>
<tr>
<td>logDistance</td>
<td>-0.19773**</td>
<td>-0.17721**</td>
</tr>
<tr>
<td>Log_(GDP/POP)</td>
<td>0.03586**</td>
<td>0.01712**</td>
</tr>
<tr>
<td>Log_(GDPe/POP_e)</td>
<td>-0.0793**</td>
<td>-0.04606**</td>
</tr>
<tr>
<td>dummy_inNAFTA</td>
<td>0.83964*</td>
<td>0.54269**</td>
</tr>
<tr>
<td>dummy_exEU</td>
<td>-0.28247**</td>
<td>0.01969**</td>
</tr>
<tr>
<td>logUnitVal</td>
<td></td>
<td>-0.69685**</td>
</tr>
<tr>
<td>logOILPR</td>
<td></td>
<td>0.22686**</td>
</tr>
<tr>
<td>logAREA_e</td>
<td>0.05602**</td>
<td>0.01978**</td>
</tr>
<tr>
<td>dummy_EU15</td>
<td>1.05025**</td>
<td></td>
</tr>
<tr>
<td>$R^2 / \overline{R^2}$</td>
<td>0.2312/0.2306</td>
<td>0.3943/0.3941</td>
</tr>
</tbody>
</table>

**significant at a level of 1%**,  
* significant at a level of 10%  
11 290 observations in Model 1, 20 696 observations in Model 2  
Own calculations.
### Specification and results

Ethanol global gravity equation, period pooled data

<table>
<thead>
<tr>
<th></th>
<th>Model 04-00</th>
<th>Model 99-95</th>
<th>Model 94-90</th>
<th>Model 89-85</th>
<th>Model 84-80</th>
<th>Model 79-75</th>
</tr>
</thead>
<tbody>
<tr>
<td>logGDP</td>
<td>0.462</td>
<td>0.333</td>
<td>0.484</td>
<td>0.491</td>
<td>0.402</td>
<td>0.498</td>
</tr>
<tr>
<td>logGDP_E</td>
<td>-0.113</td>
<td>-0.101</td>
<td>-0.093</td>
<td>-0.174</td>
<td>-0.089</td>
<td>-0.030</td>
</tr>
<tr>
<td>logDistance</td>
<td>-0.177</td>
<td>-0.025</td>
<td>-0.218</td>
<td>-0.19</td>
<td>-0.156</td>
<td>-0.091</td>
</tr>
<tr>
<td>log_(GDP/POP)</td>
<td>0.017</td>
<td>0.030</td>
<td>0.006</td>
<td>0.055</td>
<td>0.026</td>
<td>0.030</td>
</tr>
<tr>
<td>log_(GDP_E/POP_E)</td>
<td>-0.046</td>
<td>-0.021</td>
<td>-0.025</td>
<td>-0.005</td>
<td>-0.060</td>
<td>-0.030</td>
</tr>
<tr>
<td>dummy_inNAFTA</td>
<td>0.542</td>
<td>0.646</td>
<td>0.322</td>
<td>0.851</td>
<td>1.781</td>
<td>1.164</td>
</tr>
<tr>
<td>dummy_exEU</td>
<td>0.019</td>
<td>0.556</td>
<td>-0.397</td>
<td>-0.599</td>
<td>-0.449</td>
<td>-0.435</td>
</tr>
<tr>
<td>logMarketVal</td>
<td>-0.696</td>
<td>-0.86</td>
<td>-0.886</td>
<td>-0.886</td>
<td>-0.826</td>
<td>-0.571</td>
</tr>
<tr>
<td>logOILPR</td>
<td>0.226</td>
<td>0.339</td>
<td>-0.838</td>
<td>-0.187</td>
<td>2.462</td>
<td>0.679</td>
</tr>
<tr>
<td>logAREA_E</td>
<td>0.019</td>
<td>0.015</td>
<td>-0.008</td>
<td>-0.023</td>
<td>-0.078</td>
<td>-0.153</td>
</tr>
</tbody>
</table>

\[ R^2 / \bar{R}^2 \]

- 0.38/0.38
- 0.40/0.40
- 0.43/0.43
- 0.50/0.50
- 0.40/0.39
- 0.31/0.30

**Observations**

- 7072
- 5055
- 3465
- 2307
- 1730
- 846

Own calculations.
Qualification

- Estimation results display relatively low significations
- Some commonly used dummy variables have been excluded due to correlation
- Non-existing trade flows had to be excluded from analysis
- The use of the Poisson Pseudo Maximum Likelihood Estimator (PPMLE) might overcome the problems and will be tested
- Preliminary results including tariffs – here only applied tariffs – indicated insufficient results, therefore bound tariffs will be required for further analysis
Summary

- Pooled estimates of variables (size, income, distance) for ethanol trade are significant with expected signs.
- Impact on exporter’s income is more pronounced than that of importers.
- From the supply side agricultural land is relevant.
- Formation of EU and NAFTA have had a positive impact on intra-regional ethanol trade – but not for the MERCOSUR.
- EU decoupled domestic ethanol market from the world market - but effect is decreasing.
- Variations of oil price have had an influence on ethanol trade.
Conclusions

- The gravity model approach explains the trade flows as expected but only at a low level of determination - thus refinement is needed to enable estimation of potential developments

- The markets of renewable agricultural energy sources are complex as several goals are to be achieved inducing ‘erratic market movements’

- The market will remain policy driven and will depend on tensions in the energy markets as well as on the technological development

\textit{E.g. the flex-fuel-engine boosted the demand for ethanol in Brazil, allowing the consumer to choose between the cheapest and most convenient fuel}
Thank you for your attention