COMPETITION ACROSS TROPICAL FARMED SPECIES IN THE EU

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Introduction

- Tropical freshwater fish has become one of the most important aquaculture commodities in the first decade of the century.

- Production has significantly grown in developing countries, resulting in a surplus targeting the more profitable markets in developed countries.

- The real trade figures were difficult or even impossible to estimate as they were recorded aggregated into more aggregated commodities.

- New items have been introduced in the list of tariff codes since 2010 and several farmed species are now differentiated allowing the study at more disaggregated level.
Pangasius, Nile perch and tilapia rank for the three main tropical farmed fish in the EU market according to the volumes imported between 2010 and 2014. Imported volumes of pangasius fillets surpass by far the volumes of the other two species together.

<table>
<thead>
<tr>
<th>Year</th>
<th>Tilapia</th>
<th>Panga</th>
<th>Perch</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>18,981.5</td>
<td>209,854.5</td>
<td>10,202.4</td>
</tr>
<tr>
<td>2011</td>
<td>18,922.7</td>
<td>184,174.4</td>
<td>6,679.2</td>
</tr>
<tr>
<td>2012</td>
<td>15,922.2</td>
<td>143,998.5</td>
<td>8,567.9</td>
</tr>
<tr>
<td>2013</td>
<td>19,240.7</td>
<td>142,001.4</td>
<td>6,978.4</td>
</tr>
<tr>
<td>2014</td>
<td>17,915.5</td>
<td>129,165.4</td>
<td>7,450.2</td>
</tr>
<tr>
<td>Variation</td>
<td>-0.06</td>
<td>-0.38</td>
<td>-0.27</td>
</tr>
</tbody>
</table>

EUROSTAT. External trade databases COMEXT
Pangasius also accounts for the cheapest prices in the market, even they have slightly increased in the last four years.

<table>
<thead>
<tr>
<th></th>
<th>Tilapia</th>
<th>Panga</th>
<th>Perch</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2.56</td>
<td>1.75</td>
<td>4.49</td>
</tr>
<tr>
<td>2011</td>
<td>2.85</td>
<td>1.94</td>
<td>4.06</td>
</tr>
<tr>
<td>2012</td>
<td>2.81</td>
<td>2.05</td>
<td>4.16</td>
</tr>
<tr>
<td>2013</td>
<td>2.8</td>
<td>1.76</td>
<td>3.41</td>
</tr>
<tr>
<td>2014</td>
<td>3.09</td>
<td>1.80</td>
<td>4.69</td>
</tr>
<tr>
<td>Variation</td>
<td>0.21</td>
<td>0.03</td>
<td>0.05</td>
</tr>
</tbody>
</table>

EUROSTAT. External trade databases
Evolution of pangasius imports

Quantities

Prices

Source: EUROSTAT, 2013
All price series were found to be unit root. Johansen with restricted trend is used to test for price integration

Different aggregation levels have been used (Species, Continents, Countries...) in order to work with full monthly series

No evidence of integration when the aggregated price of the species was tested.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Eigenvalue</th>
<th>Trace Test p-value</th>
<th>LM Test p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.75344</td>
<td>140.19 [0.0000]</td>
<td>67.208 [0.0000]</td>
</tr>
<tr>
<td>1</td>
<td>0.66652</td>
<td>72.981 [0.0000]</td>
<td>52.712 [0.0000]</td>
</tr>
<tr>
<td>2</td>
<td>0.34445</td>
<td>20.270 [0.0016]</td>
<td>20.270 [0.0015]</td>
</tr>
</tbody>
</table>

Nile Perch prices strongly differ from tilapia and pangasius, preventing any cointegration across the three species.

Combinations of different tilapia exporting countries and Vietnamese pangasius provide an alternative.
Main tilapia exporters to the EU (Quantities in tones).

<table>
<thead>
<tr>
<th></th>
<th>China</th>
<th>Vietnam</th>
<th>Indonesia</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>16738.3</td>
<td>163.2</td>
<td>1522.3</td>
<td>421.9</td>
</tr>
<tr>
<td>2011</td>
<td>16308.9</td>
<td>425.3</td>
<td>1700</td>
<td>315</td>
</tr>
<tr>
<td>2012</td>
<td>13964.2</td>
<td>134.7</td>
<td>1340.4</td>
<td>175</td>
</tr>
<tr>
<td>2013</td>
<td>16014.1</td>
<td>980</td>
<td>1901.1</td>
<td>214.9</td>
</tr>
<tr>
<td>2014</td>
<td>12159.4</td>
<td>3269.6</td>
<td>2093.9</td>
<td>212.4</td>
</tr>
<tr>
<td>Variation</td>
<td>-0.27</td>
<td>19.03</td>
<td>0.38</td>
<td>-0.50</td>
</tr>
</tbody>
</table>

**EUROSTAT**. External trade databases

NOTE: No completed monthly series from Vietnam
### Horizontal price integration across tropical fish 2010-13

Main tilapia exporters to the EU (Prices in Euro per kilo).

<table>
<thead>
<tr>
<th></th>
<th>China</th>
<th>Vietnam</th>
<th>Indonesia</th>
<th>Tailandia</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2,42</td>
<td>2,35</td>
<td>3,85</td>
<td>3,08</td>
</tr>
<tr>
<td>2011</td>
<td>2,69</td>
<td>2,84</td>
<td>4,18</td>
<td>4,99</td>
</tr>
<tr>
<td>2012</td>
<td>2,58</td>
<td>3,03</td>
<td>4,66</td>
<td>6,65</td>
</tr>
<tr>
<td>2013</td>
<td>2,53</td>
<td>2,86</td>
<td>4,65</td>
<td>4,91</td>
</tr>
<tr>
<td>Variación</td>
<td>4,53%</td>
<td>21,69%</td>
<td>20,88%</td>
<td>59,38%</td>
</tr>
</tbody>
</table>

**EUROSTAT**. External trade databases

**NOTE:** No full monthly series from Vietnam.
Horizontal price integration across tilapia exporters 2010-14

Johansen test: **China, Thailand, Indonesia**
Number of equations = 3
Lag order = 12
Estimation period: 2011:01 - 2014:12 (T = 48)
Case 4: Restricted trend, unrestricted constant

Log-likelihood = 524.336 (including constant term: 388.118)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Eigenvalue</th>
<th>Trace test  p-value</th>
<th>Lmax test  p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.49151</td>
<td>64.985 [0.0000]</td>
<td>32.462 [0.0039]</td>
</tr>
<tr>
<td>1</td>
<td>0.37655</td>
<td>32.522 [0.0052]</td>
<td>22.679 [0.0134]</td>
</tr>
<tr>
<td>2</td>
<td>0.18540</td>
<td>9.8429 [0.1369]</td>
<td>9.8429 [0.1367]</td>
</tr>
</tbody>
</table>

Delimited market. One cointegrating vector in a model with constant and linear trend
Weak Exogeneity Test

Restriction: \( a[1] = 0 \) - China
Eigenvalue 1 = 0.383907
\( P(\text{Chi-square}(1) > 9.21325) = 0.00240269 \)
Endogenous

Restriction: \( a[2] = 0 \) - Thailand
Eigenvalue 1 = 0.488917
\( P(\text{Chi-square}(1) > 0.243698) = 0.621548 \)
Exogenous

Restriction: \( a[3] = 0 \) - Indonesia
Eigenvalue 1 = 0.480738
\( P(\text{Chi-square}(1) > 1.00574) = 0.315926 \)
Exogenous
Johansen test: Vietnam, China, Thailand
Number of equations = 3
Lag order = 12
Estimation period: 2011:01 - 2014:12 (T = 48)
Case 4: Restricted trend, unrestricted constant

Log-likelihood = 560.41 (including constant term: 424.192)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Eigenvalue</th>
<th>Trace test</th>
<th>p-value</th>
<th>Lmax test</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.85490</td>
<td>155.22</td>
<td>[0.0000]</td>
<td>92.656</td>
<td>[0.0000]</td>
</tr>
<tr>
<td>1</td>
<td>0.67880</td>
<td>62.562</td>
<td>[0.0000]</td>
<td>54.513</td>
<td>[0.0000]</td>
</tr>
<tr>
<td>2</td>
<td>0.15438</td>
<td>8.0492</td>
<td>[0.2552]</td>
<td>8.0492</td>
<td>[0.2554]</td>
</tr>
</tbody>
</table>

↓ Delimitated market. One cointegrating vector in a model with constant and linear trend
Horizontal price integration across tilapia and pangasius 2010-14

Weak Exogeneity Test

Restriction:  \( a[1] = 0 \) - Vietnam
\[\text{eigenvalue 1} = 0.683628\]
\[P(\text{Chi-square}(1) > 37.4163) = 9.54211e-010\]
Exogenous

Restriction:  \( a[2] = 0 \) - China
\[\text{eigenvalue 1} = 0.734592\]
\[P(\text{Chi-square}(1) > 28.9851) = 7.29376e-008\]
Exogenous

Restriction:  \( a[3] = 0 \) - Thailand
\[\text{eigenvalue 1} = 0.8385\]
\[P(\text{Chi-square}(1) > 5.1405) = 0.0233739\]
Exogenous
Granger Causality

Effects on Vietnamese pangasius

All lags of Vietnam: $F(12, 10) = 2.6406 [0.0669] \ast$
All lags of China: $F(12, 10) = 3.1331 [0.0399] \ast\ast$
All lags of Thailand: $F(12, 10) = 2.1537 [0.1166]$
All vars, lag 12: $F(3, 10) = 3.6693 [0.0513] \ast$

Chinese tilapia price levels are Granger cause of Vietnamese pangasius
Granger Causality

Effects on Chinese tilapia

All lags of Vietnam F(12, 10) = 2.4687 [0.0809] *
All lags of China F(12, 10) = 3.0400 [0.0439] **
All lags of Thailand F(12, 10) = 2.1387 [0.1187]
All vars, lag 12 F(3, 10) = 2.8784 [0.0894] *

Vietnamese pangasius is low significant Granger cause of Vietnamese pangasius
Granger Causality

Effects on Thai tilapia

- All lags of Vietnam: $F(12, 10) = 1.8183 [0.1758]$  
- All lags of China: $F(12, 10) = 2.3122 [0.0968]$ *  
- All lags of Thailand: $F(12, 10) = 1.9477 [0.1497]$  
- All vars, lag 12: $F(3, 10) = 1.7701 [0.2162]$  

Only low significant Granger cause from Chinese tilapia on Thai import prices
Granger Causality (Reduced VAR model Vietnam & China)

Effects on Chinese Tilapia

- All lags of China: $F(12, 22) = 1.7209 [0.1301]$  
- All lags of Vietnam: $F(12, 22) = 2.2085 [0.0517]$ **  
- All vars, lag 12: $F(2, 22) = 5.2800 [0.0134]$ ***

Vietnamese pangasius price levels are Granger cause of Chinese tilapia
Granger Causality (Reduced VAR model Vietnam & China)

Effects on Vietnamese pangasius

- All lags of China: $F(12, 22) = 2.5369 [0.0281] ***$
- All lags of Vietnam: $F(12, 22) = 3.6128 [0.0044] ***$
- All vars, lag 12: $F(2, 22) = 10.509 [0.0006] ***$

Chinese tilapia price levels are Granger cause of Vietnamese pangasius
Nile Perch prices are not related to other tropical farmed fish. No causal links have been found neither by aggregated species nor differentiated by country of origin. Perch price is then fixed according to different factors than competition with tilapia and pangasius exporters.

Country of origin makes a difference. No causal links were found when aggregating tilapia prices from different exporting countries. Differences in the importance of factors affecting tilapia prices in every exporting country may result in a differentiated price behavior of tilapia as a whole. However, price linkages have been found when considering the main Asian exporters separately.
Asian tilapia exporters operate in a delimitated market. Despite of differences in the price levels, probably due to differences in quality, all Asian tilapia prices are causally related. China the leader making price decisions according to Thai and Indonesian prices.

Pangasius prices are exogenous for tilapia. The price of Vietnamese pangasius has been found to be Granger cause of Chinese Tilapia prices. The opposite can also be confirmed.
Relief at Aktihep’s tomb. Medium Empire (2052 – 1786 BC)