IUU Fishing: Economic Effects of IUU Imports on U.S. Commercial Fishers

Species: Octopus

Model Release

In[2]:=
```
ClearAll[f];
```

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This model accompanies the USITC report, *Seafood Obtained via Illegal, Unreported, and Unregulated Fishing: U.S. Imports and Economic Impact on U.S. Commercial Fisheries*, Inv. 332-575. The report includes a quantitative analysis of the economic impact of IUU imports on U.S. commercial fishers and U.S. commercial fishing production, trade, and prices. Economic effects are modeled by species, with each species-level model customized to fit the unique features of the U.S. domestic industry. Consumers of seafood products choose between domestic marine-capture sources, imports, and in some models, domestic aquaculture products. Imports include both legal and IUU sources that enter the U.S. at the same price, so consumers cannot distinguish an IUU from non-IUU product. 2018 data is used to establish an initial equilibrium with imports of IUU products included in the baseline. The model then removes the IUU imports, as estimated in chapter 3, and solves for a new equilibrium absent those products.

Data inputs in the simulation are in the BLUE-shaded cells (with sources for the input data listed in the cell above). Outputs are in the GREEN-shaded cells. The white cells are intermediate calculations.

This PDF is a printout of the Mathematica file “IUU Fishing Model - octopus - model release.nb”

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1. Model Parameters

1.1 Elasticity of Substitution

Source: USITC's econometric estimation using the trade cost method in Riker (2020). More information can be found in the technical appendix (appendix I).

In[ ]:=
```
sigma = 6.15293 ;
```

1.2 Industry Price Elasticity of Demand

Source: USITC Staff Estimate.

In[ ]:=
```
eta = -1;
```

1.3 Illegal Imports Replacement Rates

Source: USITC Staff Estimate. Further discussion on qualitative factors and rate determination can be found in appendix I of the USITC's report.

In[ ]:=
```
repl = 0.30;
```

1.4 Price Elasticity of Supply

Source: USITC Staff Estimate and Interviews with Industry Participants.

In[ ]:=
```
ed = 2;
```

2. Data Inputs

2.1 U.S. Landings Quantities and Prices

Source: National Oceanic and Atmospheric Administration. National Marine Fisheries Service (NOAA Fisheries). Fisheries of the United States 2018. Current Fishery Statistics No. 2018. U.S. Department of Commerce. Silver Spring MD: NOAA, February 2020. https://www.-fisheries.noaa.gov/resource/document/fisheries-united-states-2018-report.

In[7]:=
```
qd0 = 9146;(*kg*)
```

In[ ]:=
```
pd0 = 9.2916;(*$/kg*)
```

2.2 Import Quantities and Prices

Source: IUU Estimate Database as described in Chapter 3 of the report.

Total imports

In[9]:=
```
qt0 = 24051486;(*kg*)
```

In[ ]:=
```
pt0 = 8.29471; (*$/kg*)
```

Illegal imports

In[11]:=
```
qi0 = 9010683;(*kg*)
```

Calculation of legal imports

In[ ]:=
```
ql0 = qt0 - qi0;
```

2.3 Export Quantities

Source:National Oceanic and Atmospheric Administration. National Marine Fisheries Service (NOAA Fisheries). NOAA US Trade in Fishery Products database. Accessed September 1, 2020. https://foss.nmfs.noaa.gov/apexfoss/f?p=215:2:14884747663545::NO

In[ ]:=
```
qe0 = 0;(*kg*)
```

2.4 Catch Limits

No aggregate ACL available, inserted arbitrarily high limit so it doesn't affect calculation.

In[14]:=
```
qcap = 10000000; (*no catch limit*)
```

2.5 Import Market Share Statistics

In[ ]:=
```
N[qt0 / (qt0 + qd0 - qe0)]
```

Out[ ]=
```
0.99962
```

3. Calibration

Baseline values of domestic apparent consumption and imports

In[ ]:=
```
vd0 = (qd0 - qe0) pd0;
```

In[∘]:= $vt0 = qt0\,pt0;$

3.1 Supply Parameters

In[18]:= $edc = ed \frac{qd0}{(qcap - qd0)};$

In[19]:= $ad = (qcap - qd0)\, pd0^{edc};$

3.2 Demand Parameters

In[∘]:= $bt = \frac{vt0}{vd0} \left(\frac{pt0}{pd0}\right)^{sigma-1};$

In[∘]:= $pind0 = \left(pd0^{1-sigma} + bt\, pt0^{1-sigma}\right)^{\frac{1}{1-sigma}};$

In[∘]:= $k = vd0\, pind0^{-sigma-eta}\, pd0^{sigma-1};$

4. New Equilibrium Calculation

In[∘]:= $qt = ql0 + qi0\,(repl);$

In[∘]:= $pind = \left(pd^{1-sigma} + bt\, pt^{1-sigma}\right)^{\frac{1}{1-sigma}};$

Equilibrium equations

Supply (landings) of octopus = exports + consumer demand

In[∘]:= $Eqn1 = qcap - ad\, pd^{-edc} == qe0 + k\, pind^{sigma+eta}\, pd^{-sigma};$

Supply of imported octopus = demand for imported product

In[∘]:= $Eqn2 = qt == k\, bt\, pind^{sigma+eta}\, pt^{-sigma};$

In[∘]:= `FindRoot[{Eqn1, Eqn2}, {pd, pd0}, {pt, pt0}]`

Out[∘]= {pd → 11.3464, pt → 11.2398}

In[∘]:= `pd1 = pd /. %;`

In[∘]:= `pt1 = pt /. %%;`

In[∘]:= $qd1 = qcap - ad\, pd1^{-edc};$

In[∘]:= $qt1 = ql0 + qi0\,(repl);$

In[∘]:= $pind1 = \left(pd1^{1-sigma} + bt\, pt1^{1-sigma}\right)^{\frac{1}{1-sigma}};$

5. Results

Percent change in domestic price of commercial landings

In[ ]:= $(pd1 - pd0)\ \frac{100}{pd0}$

Out[ ]= 22.1144

Percent change in import price

In[ ]:= $(pt1 - pt0)\ \frac{100}{pt0}$

Out[ ]= 35.5062

Percent change in species price index

In[ ]:= $(pind1 - pind0)\ \frac{100}{pind0}$

Out[ ]= 35.4982

Percent change in domestic commercial landings quantity

In[ ]:= $(qd1 - qd0)\ \frac{100}{qd0}$

Out[ ]= 39.9503

Percent change in total imports

In[ ]:= $(qt1 - qt0)\ \frac{100}{qt0}$

Out[ ]= -26.2249

Change ($) in operating income

```
In[ ]:= IntegerPart[(1/sigma) (pd1 (qd1 - qe0) - pd0 (qd0 - qe0))]
```

Out[ ]= 9792

Change (kg) in landings

```
In[ ]:= qd1 - qd0
```

Out[ ]= 3653.86