

First Module: Recycling/Scrapping

- Different module for each ship type
- Starting point: Handy Size bulk carriers (DWT \leq 40,000 tn)

Data / Independent Variables:

- (a) Freight Rates (\$/day)
- (b) Recycling Prices (\$/LDT – Accounting for Bangladesh recycling prices)
- (c) Ship's Age (years)
- (d) Ship's DWT (tn)

→ Data collection: **Reliable data required** (Personal Communication ! – Clarksons Shipping Intelligence Network database)



- Dependent Variable: Scrapping Advisor Index "Scrap" / "NO scrap"
- Binary Logistic Regression: determine β_i weight factors (corresponding to independent variables)
- Module Functionality: User inserts his/her data – (a) to (d) above
- Module Output: "Scrapping Advisor Index", leading to "Scrap" / "NO scrap"



First Module: Recycling/Scrapping (Long Term)

- Long Term Chartering (1, 3, 5 years, Freight rates do not vary significantly)
- 23 representative ships selected for module development
- Data include values of the independent variables and dependent variable of the last five years
- Selection has been based on: (a) Experience, (b) Including a fundamental set of important cases, (c) Taking into account overall accuracy – reasonable size maintained
- Results of Binary Logistic Regression: Coefficients of Long Term Chartering Module

b_0	b_1	b_2	b_3	b_4
-66.90	-6.58	14.48	3.82	2.82

- Scrapping Advisor Index - SAI (Knapp et al., 2008):

$$y = b_0 + b_1 \cdot \ln(\text{Earnings}) + b_2 \cdot \ln(\text{Scrap Price}) + b_3 \cdot \ln(\text{Age}) + b_4 \cdot \ln(\text{DWT})$$

$$SAI = \frac{e^y}{1 + e^y}$$



First Module: Recycling/Scrapping (Long Term)

➤ Validation of Module Performance:

➤ **Calculated values of dependent variable (Scrapping Advisor Index - SAI) of *scrapped vessels not included in module development***

	1 Year Time charter (Earnings - \$/day)	Recycling Prices (\$/ldt)	Ship's Age (years)	Ship's DWT (tn)	SAI
Case 1	9650	443	34	39273	0.99
Case 2	9400	410	32	30052	0.91
Case 3	10238	385	35	24835	0.66
Case 4	10656	395	30	27881	0.62
Case 5	9550	390	35	22782	0.74
Case 6	9156	350	37	23796	0.52
Case 7	10500	445	33	12349	0.60

➤ **Module performance verified!**



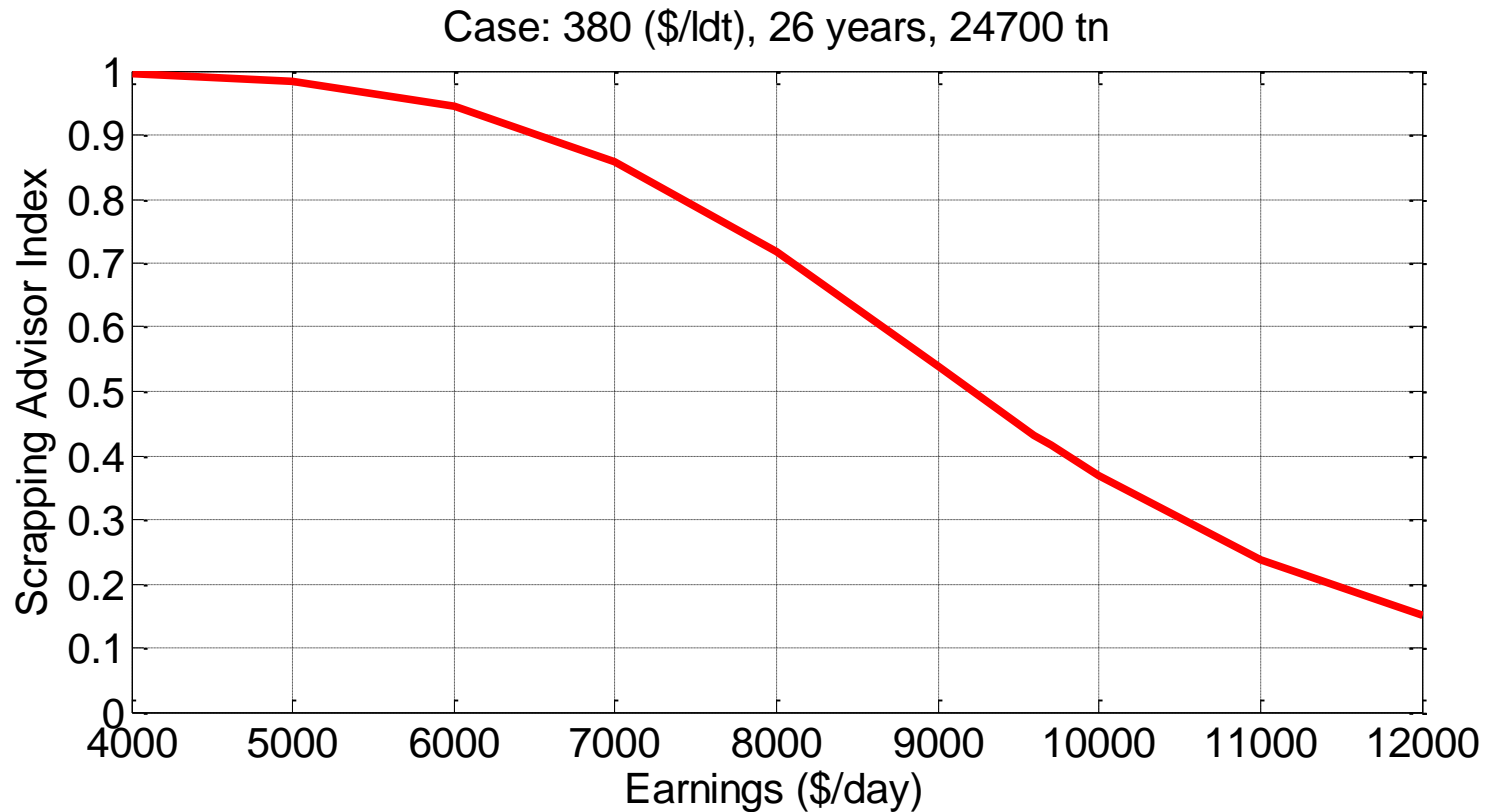
First Module: Recycling/Scrapping (Long Term)

➤ Further testing of module - Effects of:

(A) economic variables, (B) Ship Age, and (C) DWT

➤ Test case:

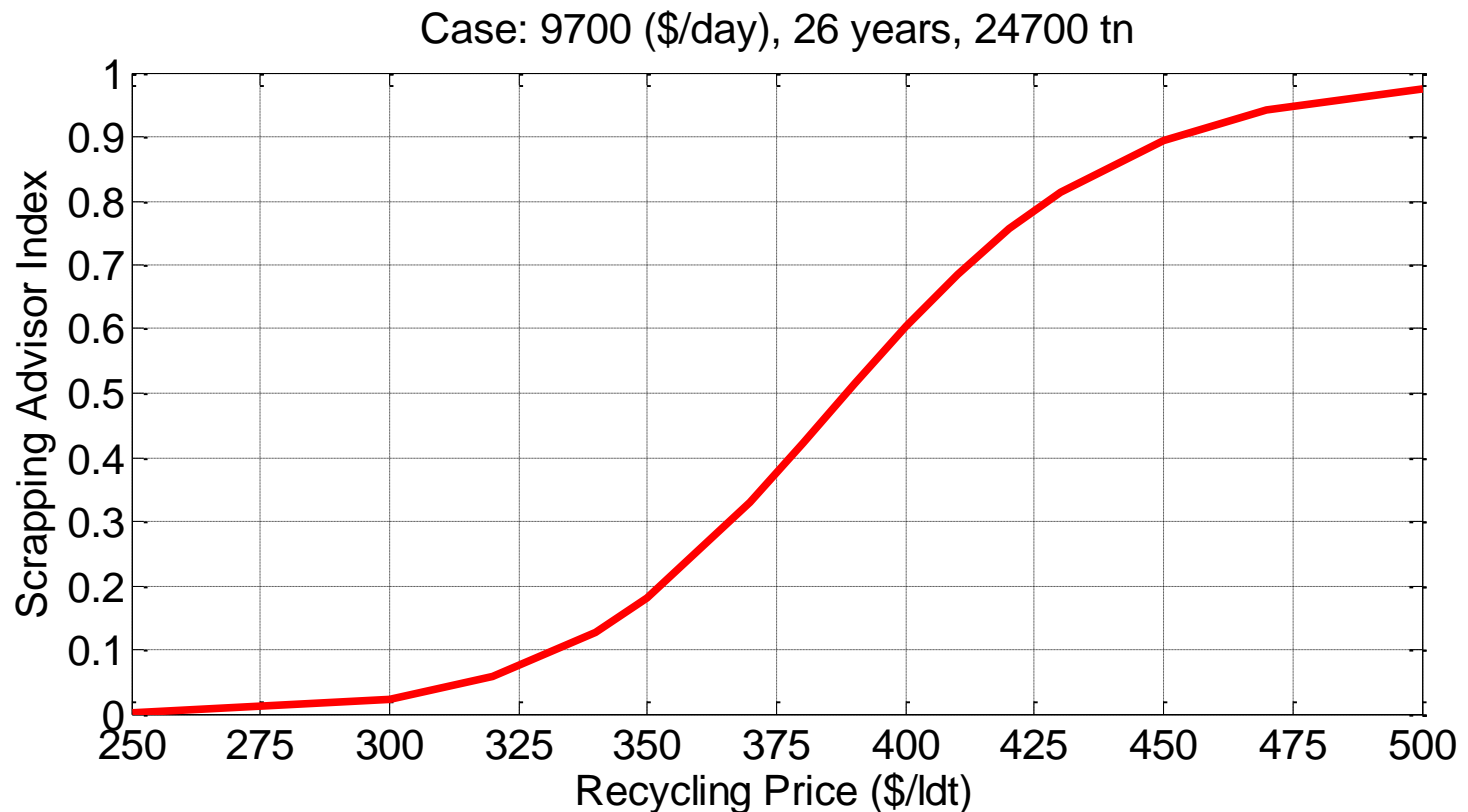
Average Ship Profile: (a) 9700 \$/day, (b) 380 \$/ltd, (c) 26 years, and (d) 24700 tn



First Module: Recycling/Scrapping (Long Term)

➤ Test case:

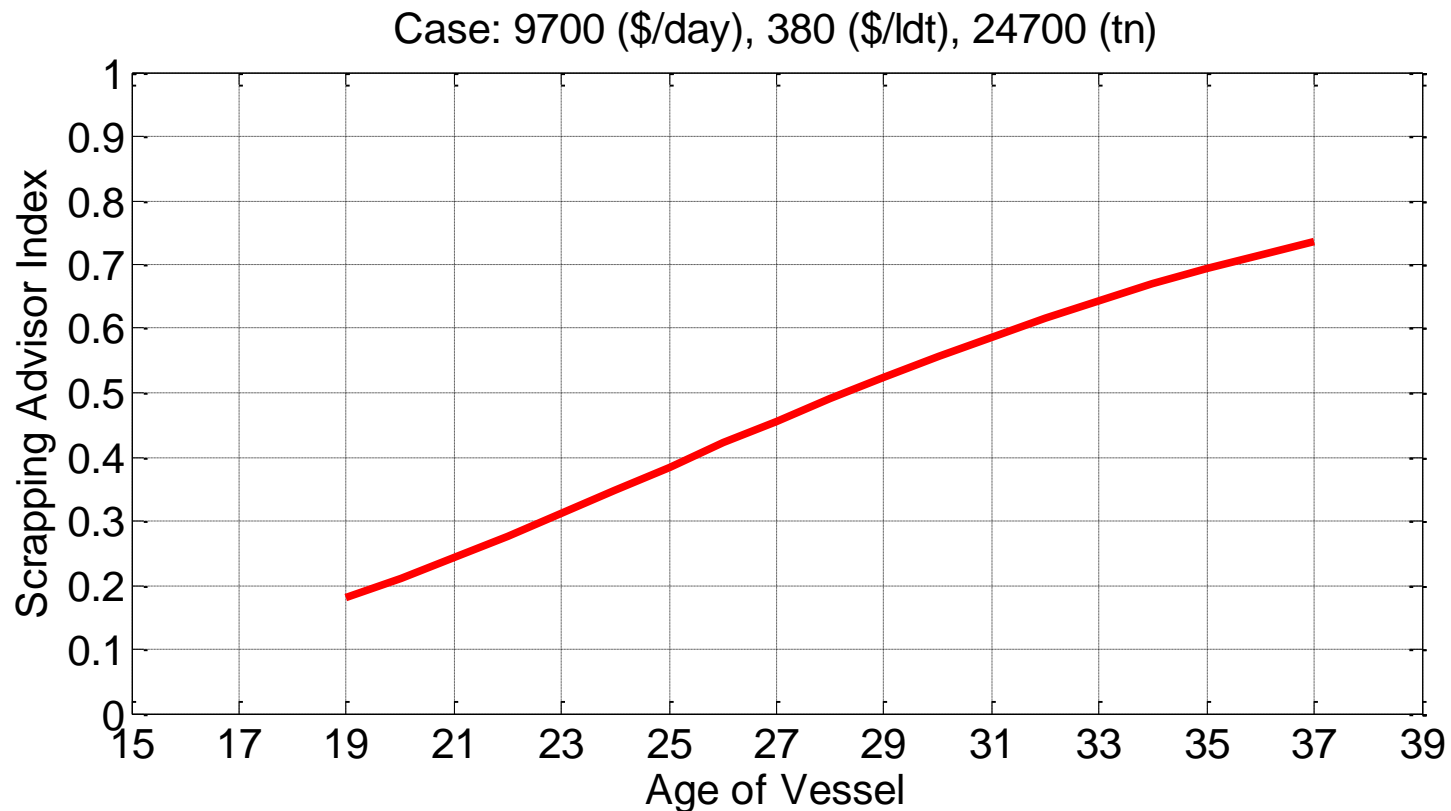
Average Ship Profile: (a) 9700 \$/day, (b) 380 \$/ltd, (c) 26 years, and (d) 24700 tn



First Module: Recycling/Scrapping (Long Term)

➤ Test case:

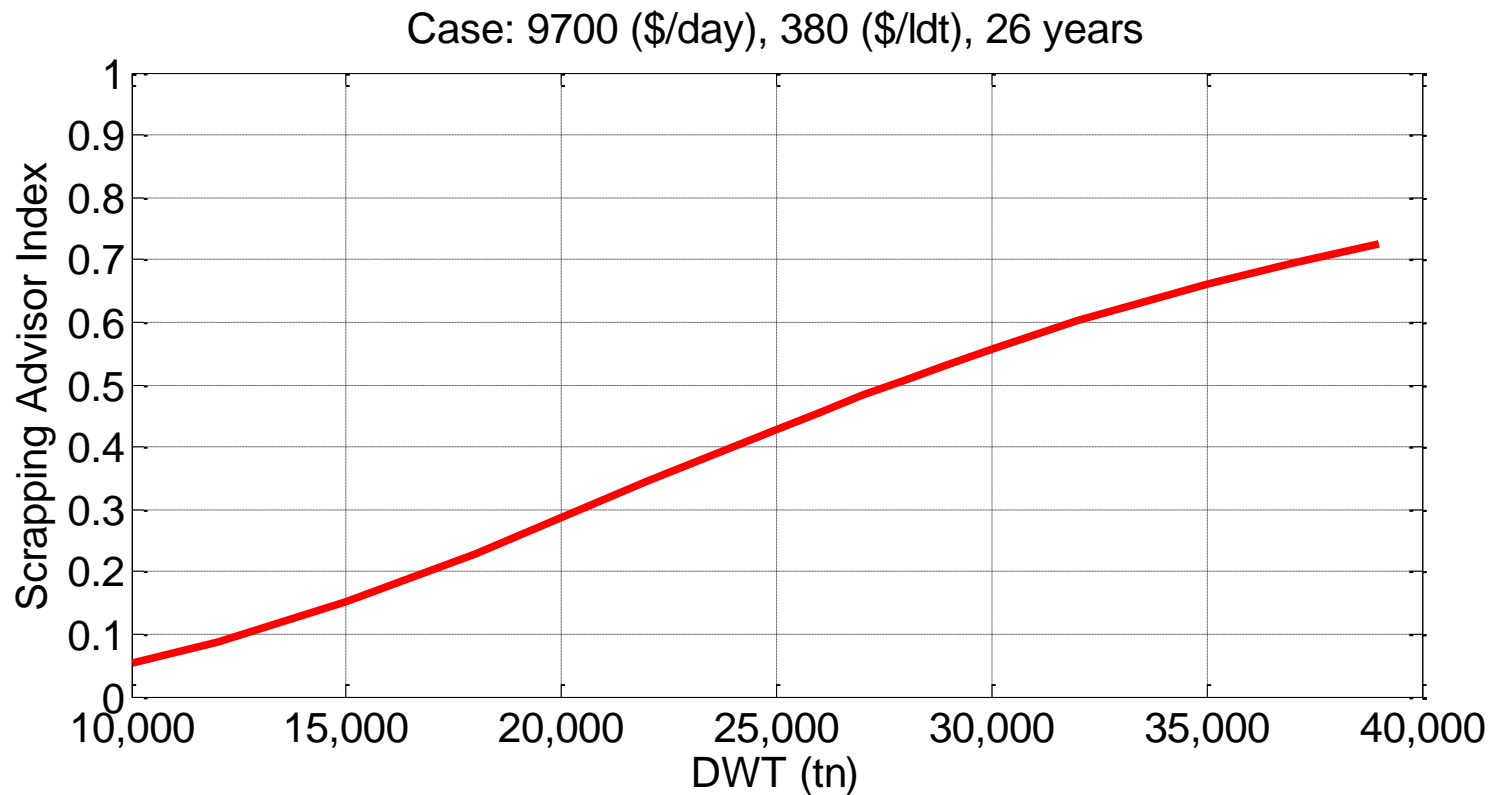
Average Ship Profile: (a) 9700 \$/day, (b) 380 \$/ldt, (c) 26 years, and (d) 24700 tn



First Module: Recycling/Scrapping (Long Term)

➤ Test case:

Average Ship Profile: (a) 9700 \$/day, (b) 380 \$/ldt, (c) 26 years, and (d) 24700 tn



First Module: Recycling/Scrapping (Short Term)

- Short Term Chartering (*1 trip or 6 months chartering, Freight rates do not vary significantly*)
- 24 representative ships selected for module development
- ***Results of Binary Logistic Regression: Coefficients of Short Term Chartering Module***

b_0	b_1	b_2	b_3	b_4
-102.11	-6.68	17.24	7.23	3.65

- ***Validation of Module Performance (scrapped vessels not included in module development)***

	Average Trip Rates (Earnings - \$/day)	Recycling Prices (\$/ldt)	Ship's Age (years)	Ship's DWT (tn)	SAI
Case 1	8427	443	34	39273	0.99
Case 2	7630	410	32	30052	0.99
Case 3	11628	385	35	24835	0.66
Case 4	7823	350	37	23796	0.87
Case 5	9917	340	35	28450	0.52
Case 6	11102	445	33	12349	0.62

- **Module performance verified!**



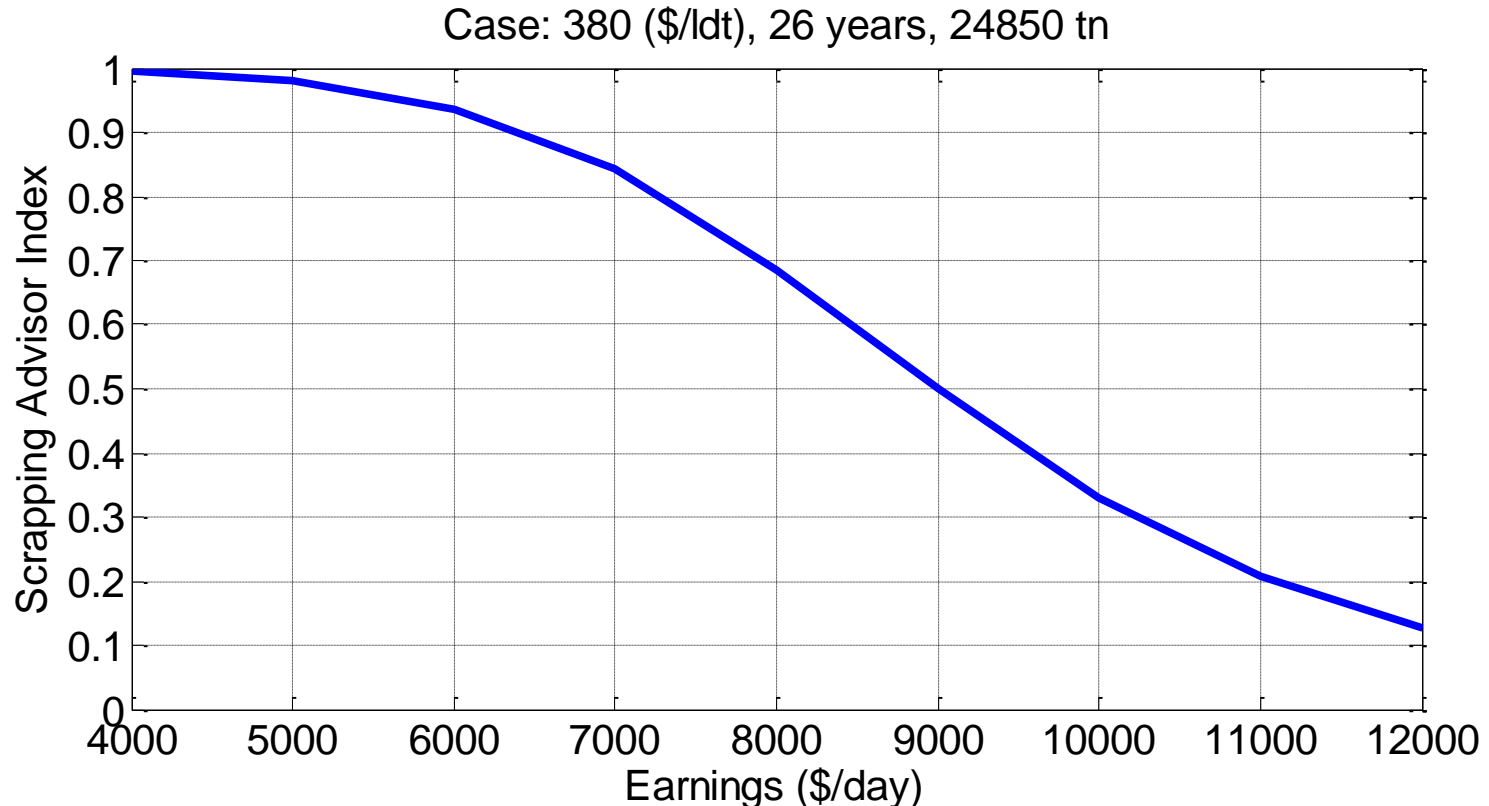
First Module: Recycling/Scrapping (Short Term)

➤ Further testing of module: Effects of:

(A) economic variables, (B) Ship Age, and (C) DWT

➤ Test case:

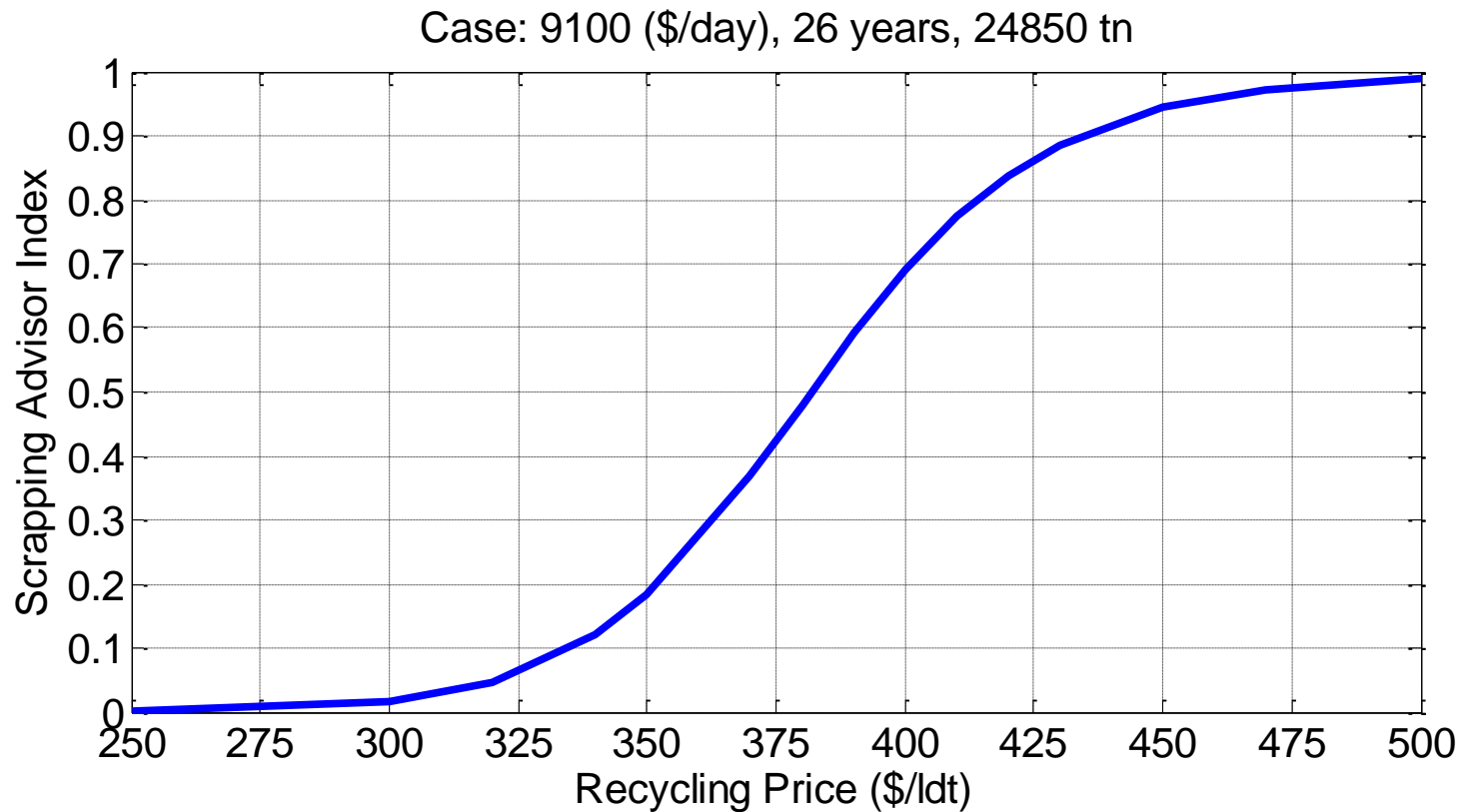
Average Ship Profile: (a) 9100 \$/day, (b) 380 \$/ltd, (c) 26 years, and (d) 24850 tn



First Module: Recycling/Scrapping (Short Term)

➤ Test case:

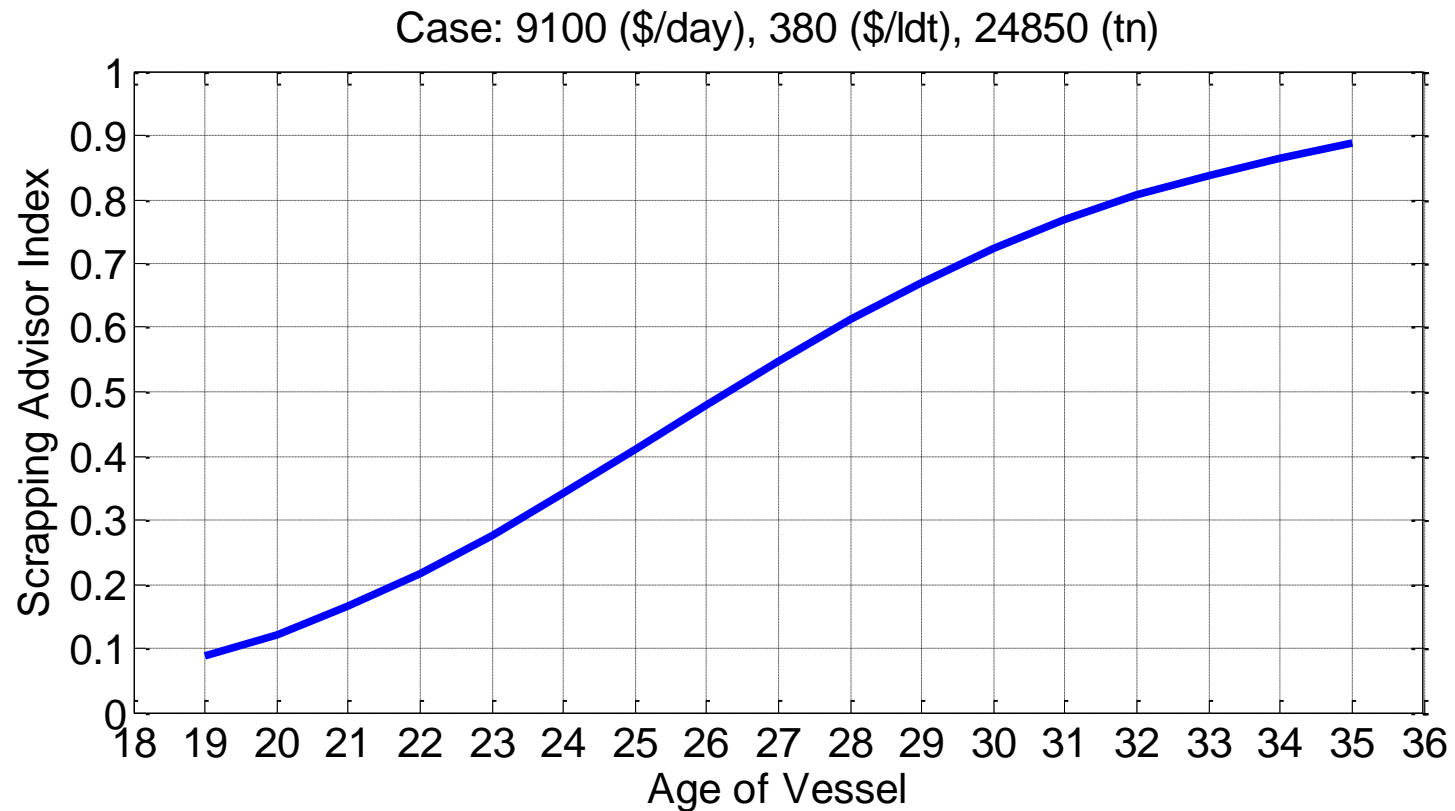
Average Ship Profile: (a) 9100 \$/day, (b) 380 \$/ltd, (c) 26 years, and (d) 24850 tn



First Module: Recycling/Scrapping (Short Term)

➤ Test case:

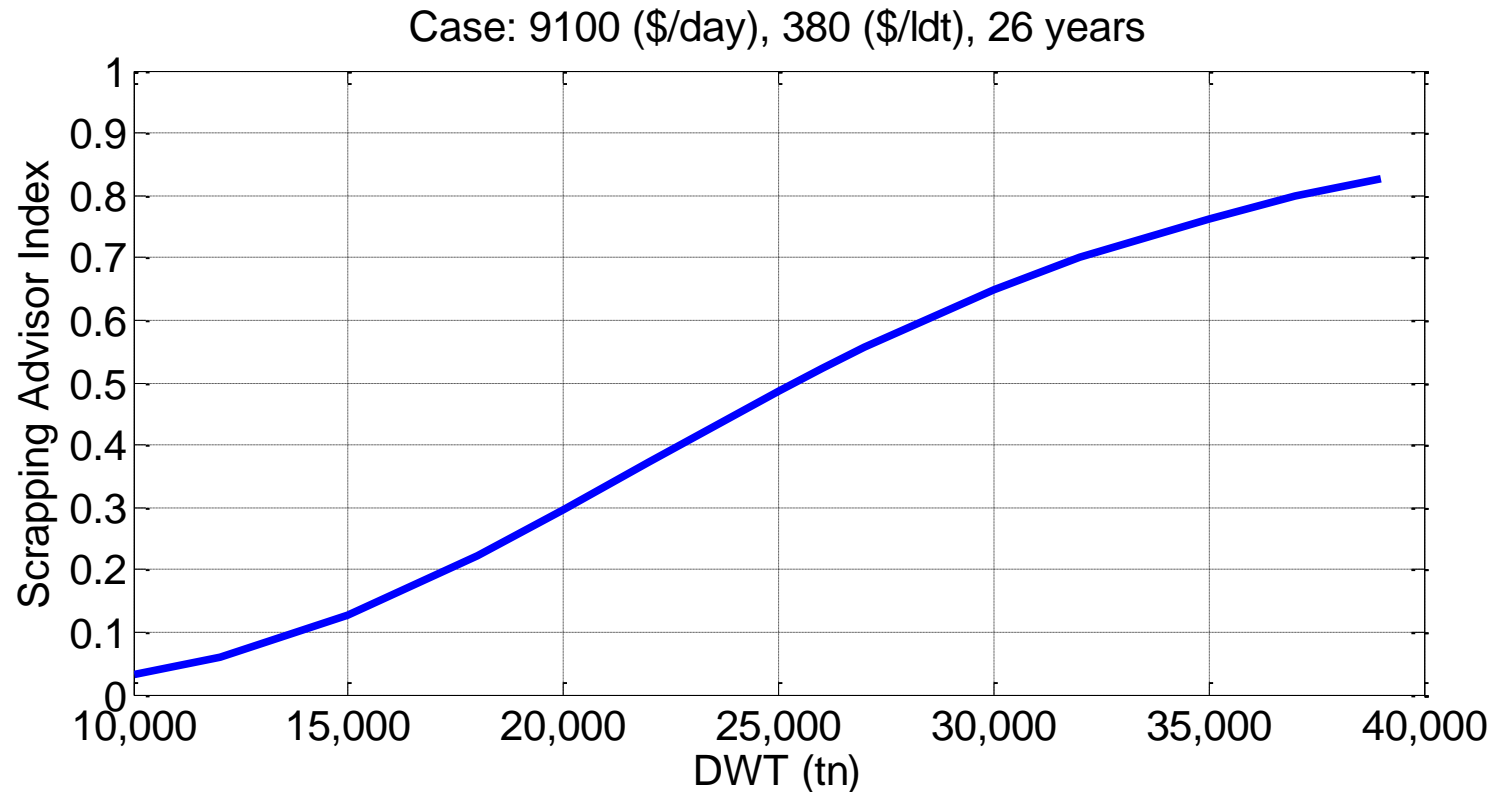
Average Ship Profile: (a) 9100 \$/day, (b) 380 \$/ltd, (c) 26 years, and (d) 24850 tn



First Module: Recycling/Scrapping (Short Term)

➤ Test case:

Average Ship Profile: (a) 9100 \$/day, (b) 380 \$/ltd, (c) 26 years, and (d) 24850 tn



First Module: Recycling/Scrapping (**Long Term**)

- **Handymax bulk carriers (DWT: 40000-50000 tn)**
- **Long Term Chartering (1, 3, 5 years chartering)**
- **20 representative ships *selected* for module development**
- **Data include values of the independent variables and dependent variable *of the last three years***
- **Results of Binary Logistic Regression: Coefficients of Long Term Chartering Module**

b_0	b_1	b_2	b_3	b_4
-464.90	-13.41	4.31	14.15	48.54



First Module: Recycling/Scrapping (Long Term)

➤ Validation of Module Performance:

➤ **Calculated values of dependent variable (Scrapping Advisor Index - SAI) of *scrapped vessels not included in module development***

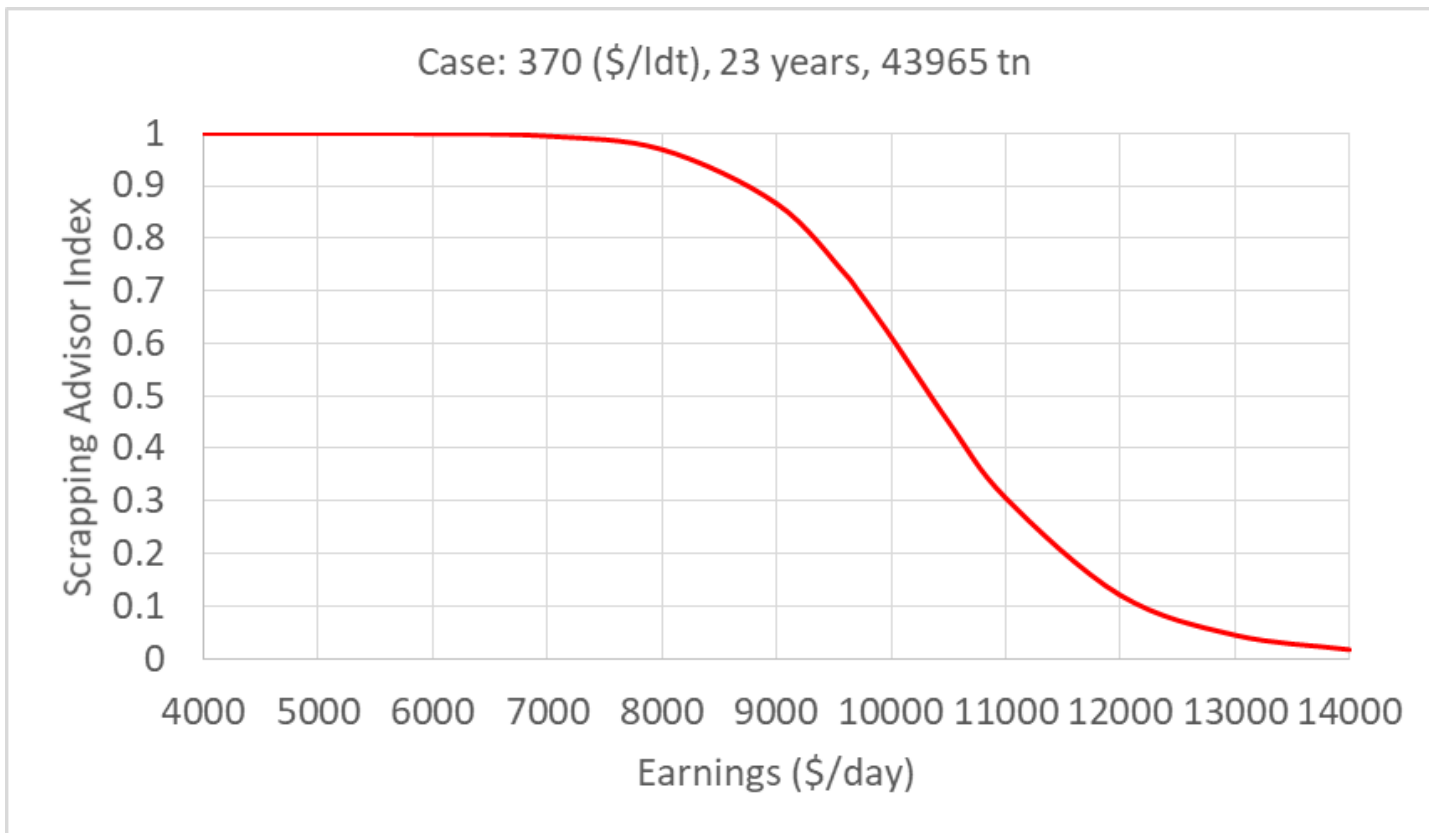
	1 Year Time charter (Earnings - \$/day)	Recycling Prices (\$/ldt)	Ship's Age (years)	Ship's DWT (tn)	SAI
Case 1	10688	380	22	45473	0.67
Case 2	10078	355	29	42692	0.88
Case 3	9775	380	29	46899	0.99
Case 4	9656	375	35	43003	0.99
Case 5	9656	360	26	45208	0.98
Case 6	9759	333	29	42203	0.84
Case 7	9759	345	26	43246	0.80
Case 8	10013	330	36	43002	0.99

➤ **Module performance verified!**



First Module: Recycling/Scrapping (Long Term)

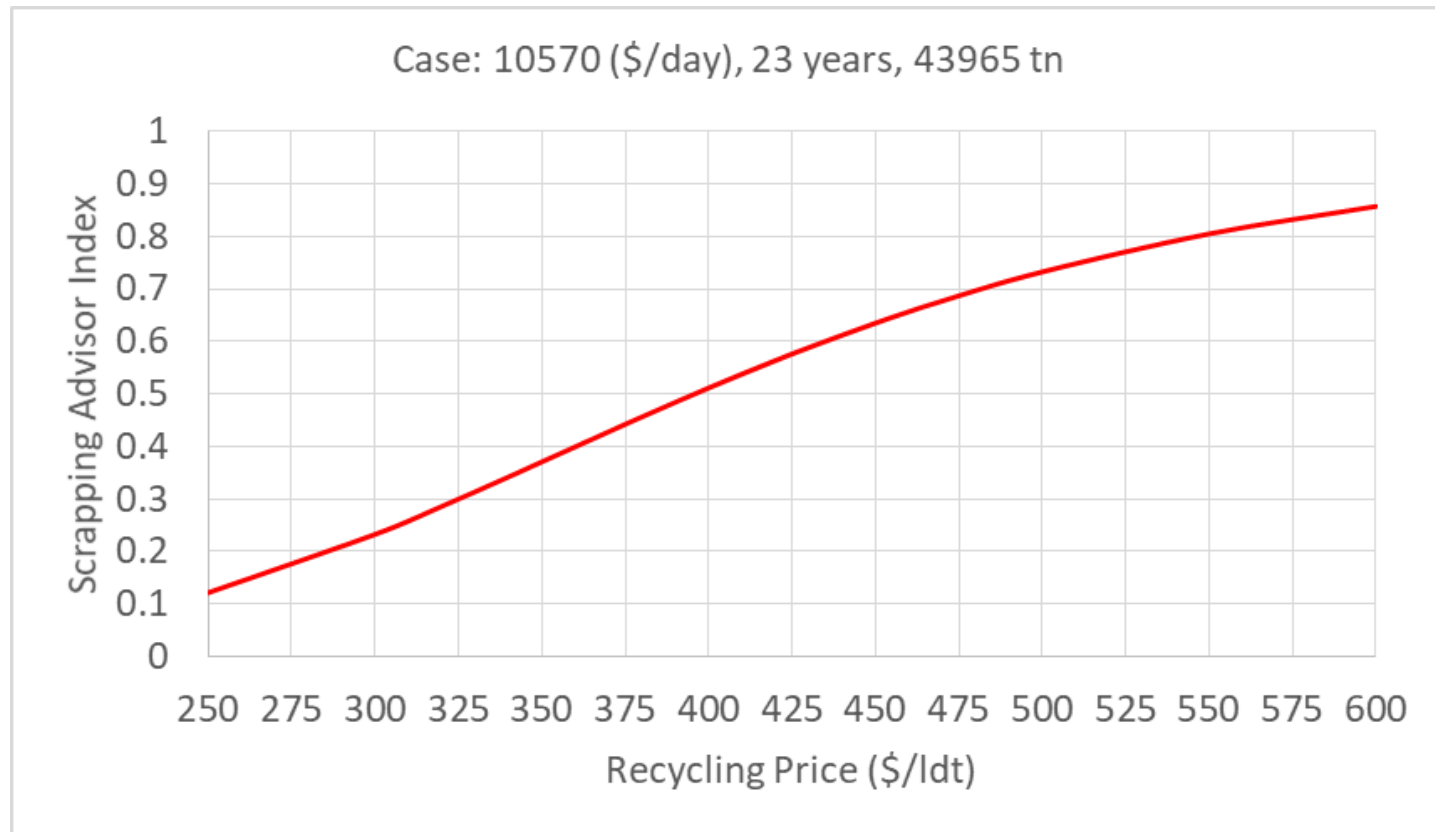
- Further testing of module - Effects of:
(A) economic variables, (B) Ship Age, and (C) DWT
- Test case:
Average Ship Profile: (a) 10570 \$/day, (b) 370 \$/ltd, (c) 23 years, and (d) 43965 tn



First Module: Recycling/Scrapping (Long Term)

➤ Test case:

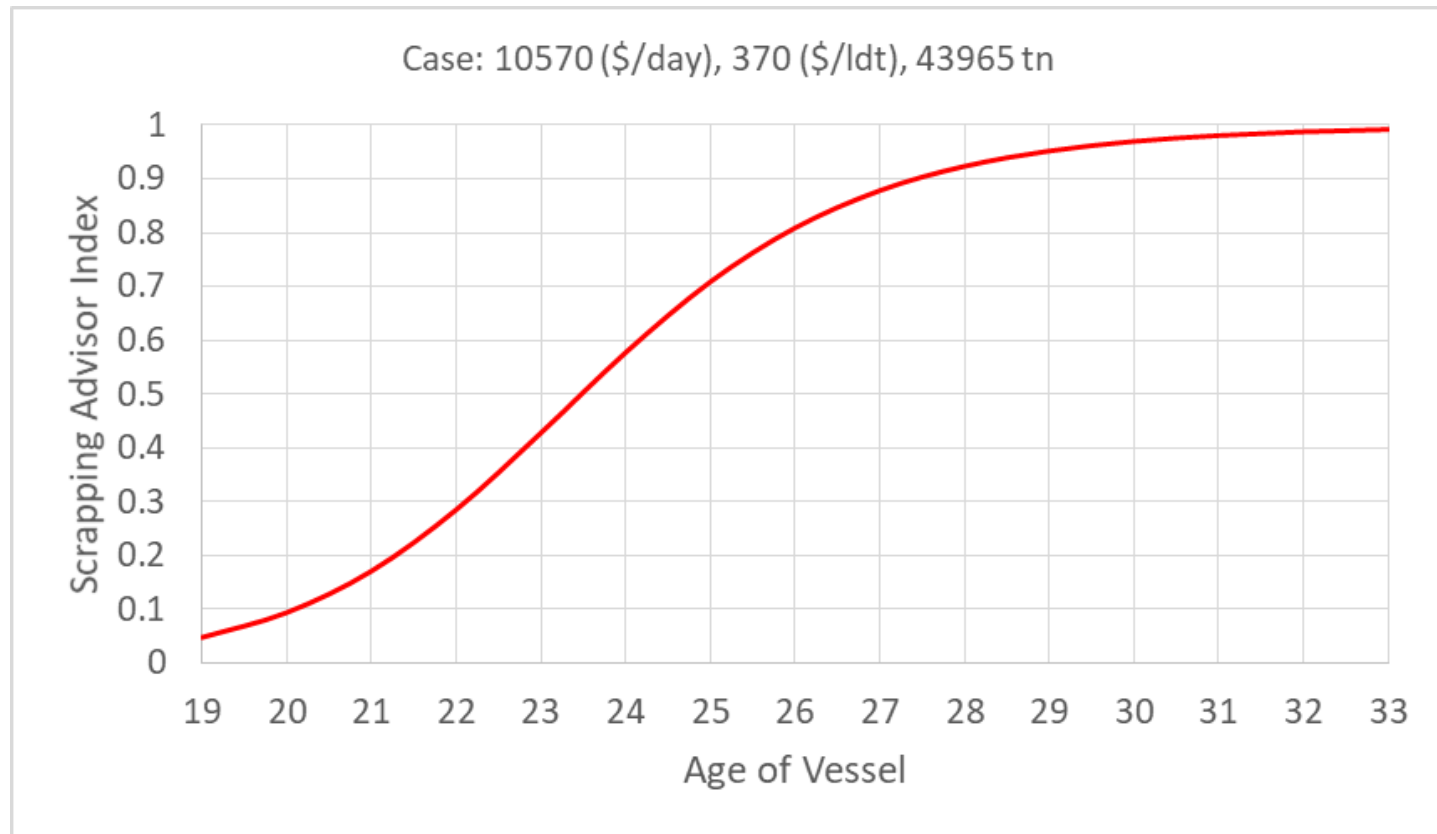
Average Ship Profile: (a) 10570 \$/day, (b) 370 \$/ltd, (c) 23 years, and (d) 43965 tn



First Module: Recycling/Scrapping (Long Term)

➤ Test case:

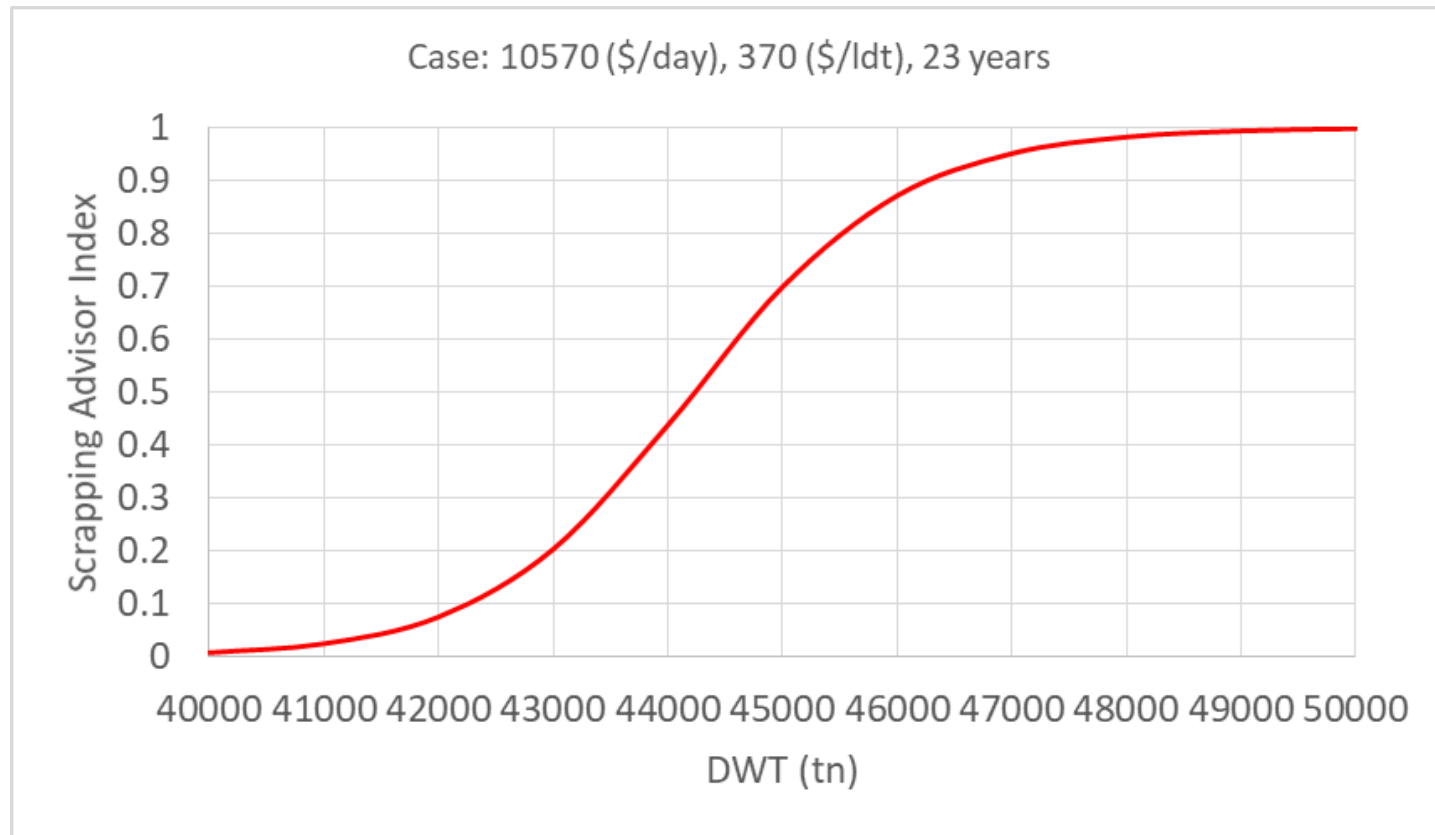
Average Ship Profile: (a) 10570 \$/day, (b) 370 \$/ldt, (c) 23 years, and (d) 43965 tn



First Module: Recycling/Scrapping (Long Term)

➤ Test case:

Average Ship Profile: (a) 10570 \$/day, (b) 370 \$/ltd, (c) 23 years, and (d) 43965 tn



First Module: Recycling/Scrapping (**Short Term**)

- **Handymax Bulkcarriers (DWT: 40000-50000 tn)**
- **Short Term Chartering (*1 trip or 6 months chartering*)**
- **20 representative ships selected for module development**
- **Data include values of the independent variables and dependent variable of the last three years**
- **Results of Binary Logistic Regression: Coefficients of Short Term Chartering Module**

b_0	b_1	b_2	b_3	b_4
-480.83	-9.27	4.29	14.20	46.48



First Module: Recycling/Scrapping (Short Term)

➤ Validation of Module Performance:

➤ **Calculated values of dependent variable (Scrapping Advisor Index - SAI) of *scrapped vessels not included in module development***

	Average Trip Rates (Earnings - \$/day)	Recycling Prices (\$/ldt)	Ship's Age (years)	Ship's DWT (tn)	SAI
Case 1	11313	380	22	45473	0.65
Case 2	10313	355	29	42692	0.90
Case 3	9913	380	29	46899	0.99
Case 4	9703	375	35	43003	0.99
Case 5	9703	360	26	45208	0.98
Case 6	9963	333	29	42203	0.84
Case 7	9963	345	26	43246	0.80
Case 8	10813	330	36	43002	0.99

➤ **Module performance verified!**



First Module: Recycling/Scrapping (Short Term)

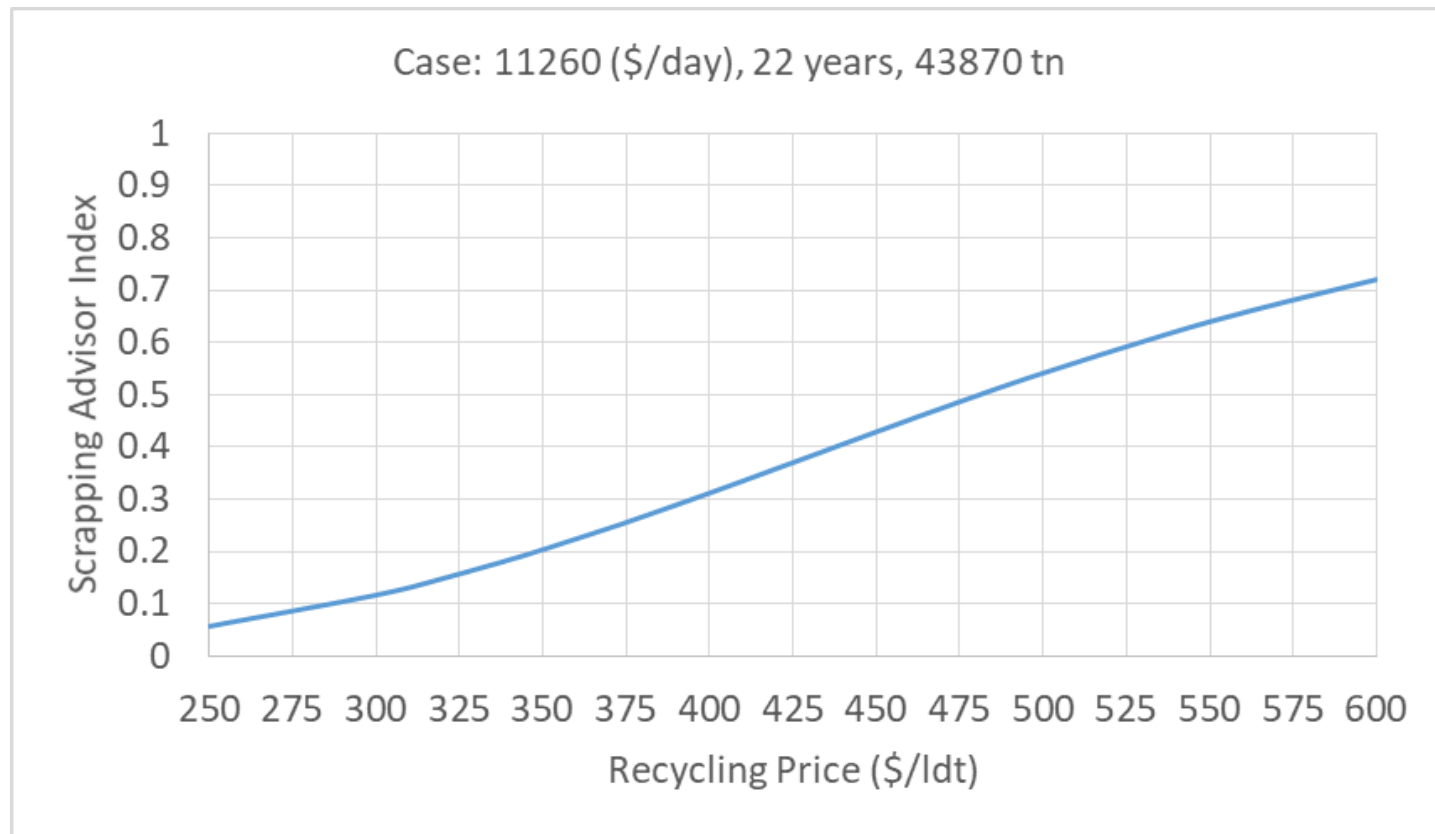
- Further testing of module - Effects of:
(A) economic variables, (B) Ship Age, and (C) DWT
- Test case:
Average Ship Profile: (a) 11260 \$/day, (b) 365 \$/ltd, (c) 22 years, and (d) 43870 tn



First Module: Recycling/Scrapping (Short Term)

➤ Test case:

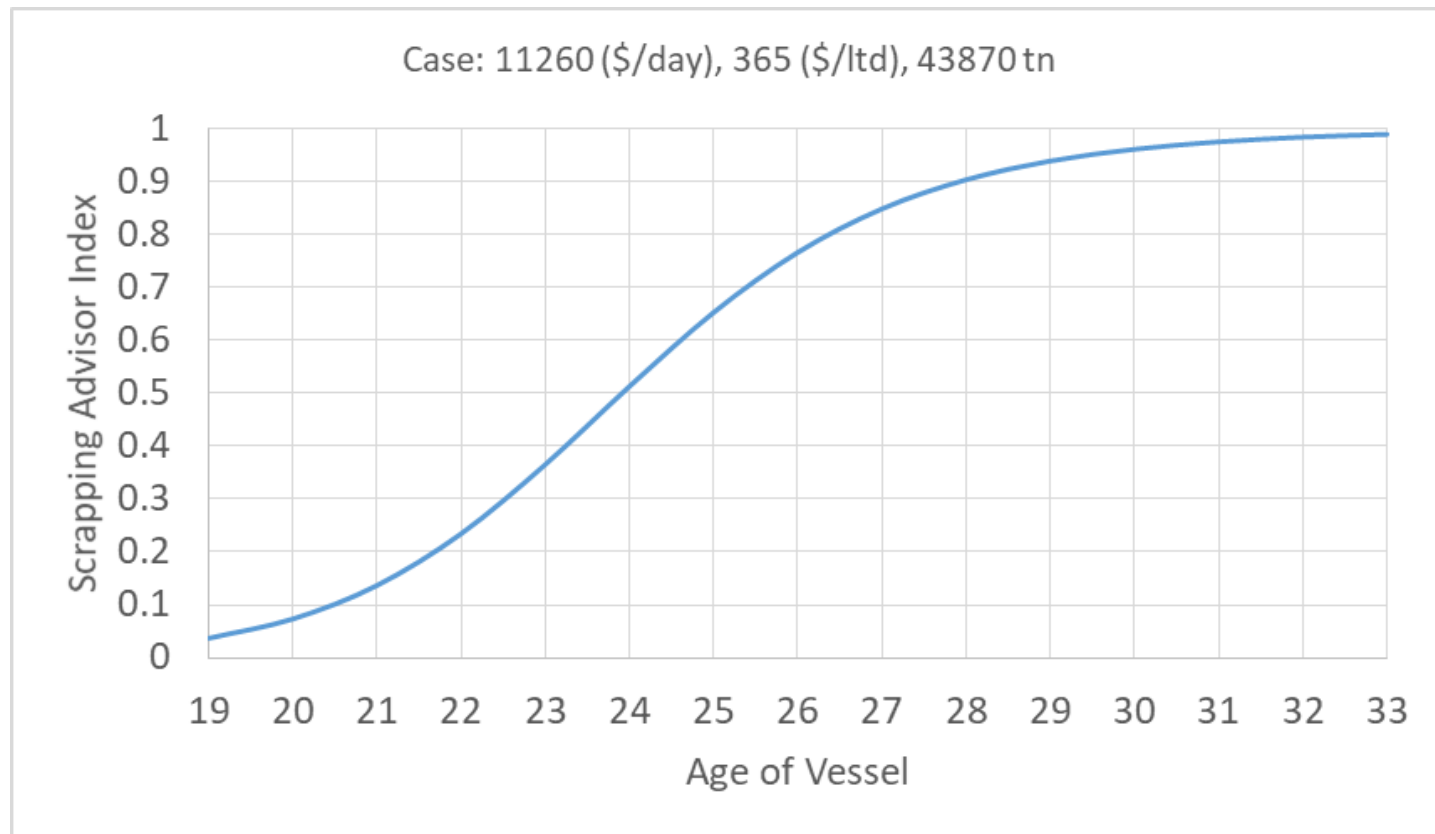
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First Module: Recycling/Scrapping (Short Term)

➤ **Test case:**

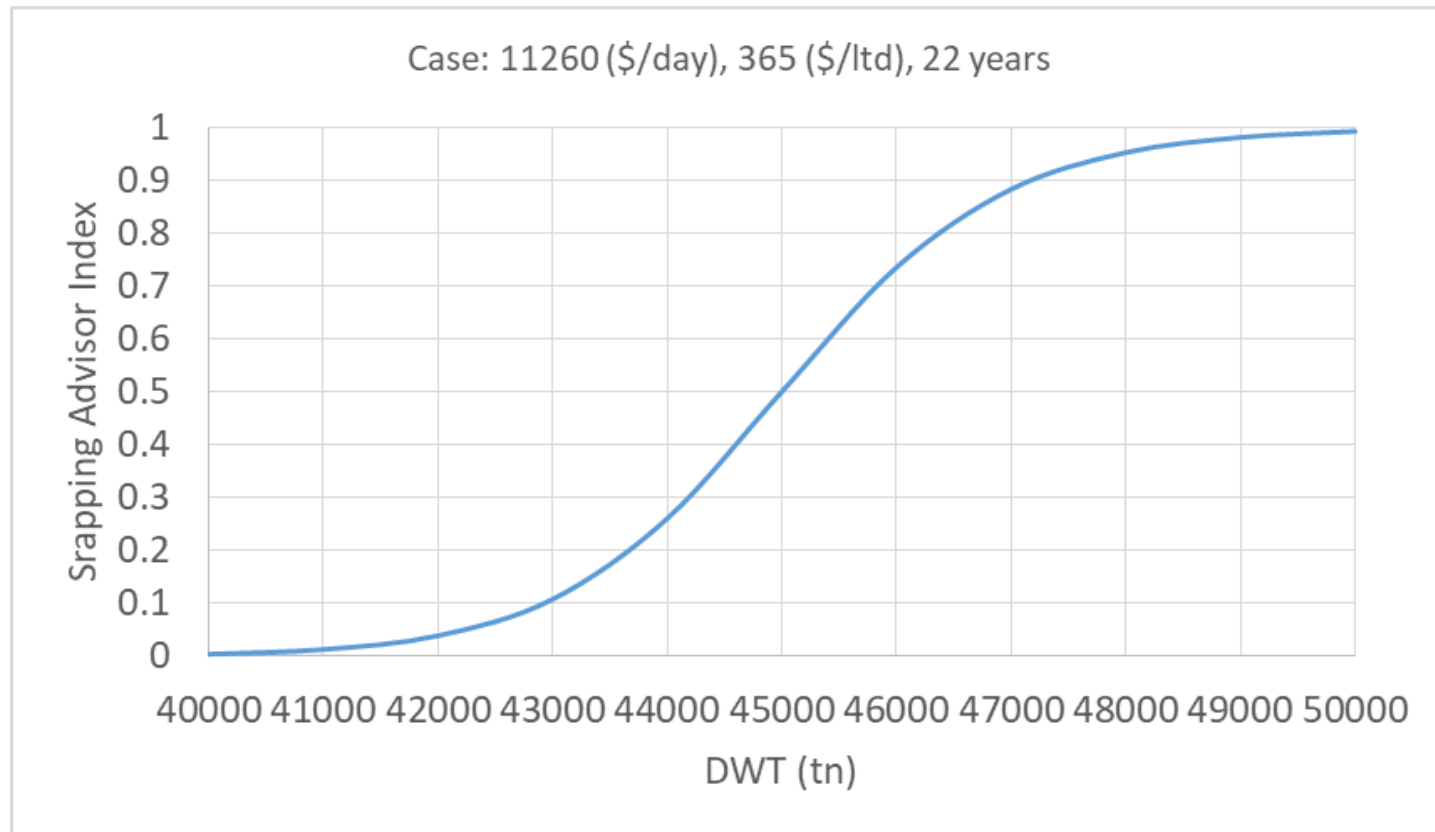
Average Ship Profile: (a) 11260 \$/day, (b) 365 \$/ltd, (c) 22 years, and (d) 43870 tn



First Module: Recycling/Scrapping (Short Term)

➤ **Test case:**

Average Ship Profile: (a) 11260 \$/day, (b) 365 \$/ltd, (c) 22 years, and (d) 43870 tn



First Module: Recycling/Scrapping (Long Term)

- Panamax bulk carriers (DWT: 60000-90000 tn)
- Long Term Chartering (1, 3, 5 years chartering)
- 20 representative ships selected for module development
- Data include values of the independent variables and dependent variable of the last three years
- Results of Binary Logistic Regression: Coefficients of Long Term Chartering Module

b_0	b_1	b_2	b_3	b_4
-164.20	-2.17	6.0	3.74	12.28



First Module: Recycling/Scrapping (**Long Term**)

➤ Validation of Module Performance:

➤ **Calculated values of dependent variable (Scrapping Advisor Index - SAI) of *scrapped vessels not included in module development***

	1 Year Time charter (Earnings - \$/day)	Recycling Prices (\$/ldt)	Ship's Age (years)	Ship's DWT (tn)	SAI
Case 1	16190	415	24	73350	0.638
Case 2	7111	372	25	87996	0.983
Case 3	13634	370	31	70280	0.664
Case 4	11653	380	22	73081	0.594
Case 5	12254	425	35	70838	0.909
Case 6	9341	415	40	65387	0.905

➤ **Module performance verified!**



First Module: Recycling/Scrapping (Long Term)

➤ Further testing of module - Effects of:

(A) economic variables, (B) Ship Age, and (C) DWT

➤ Test case:

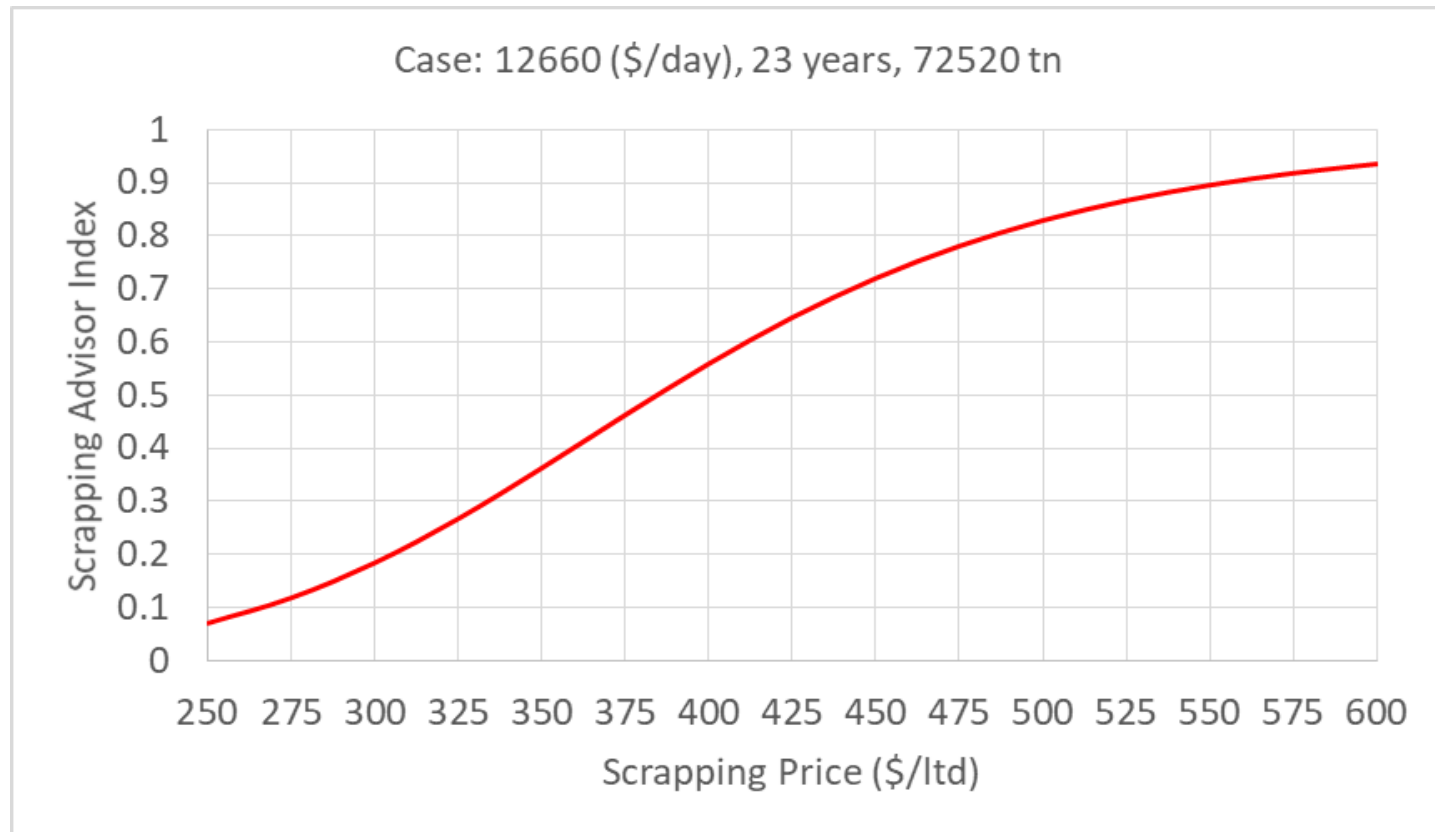
Average Ship Profile: (a) 12660 \$/day, (b) 380 \$/ltd, (c) 23 years, and (d) 70520 tn



First Module: Recycling/Scrapping (Long Term)

➤ Test case:

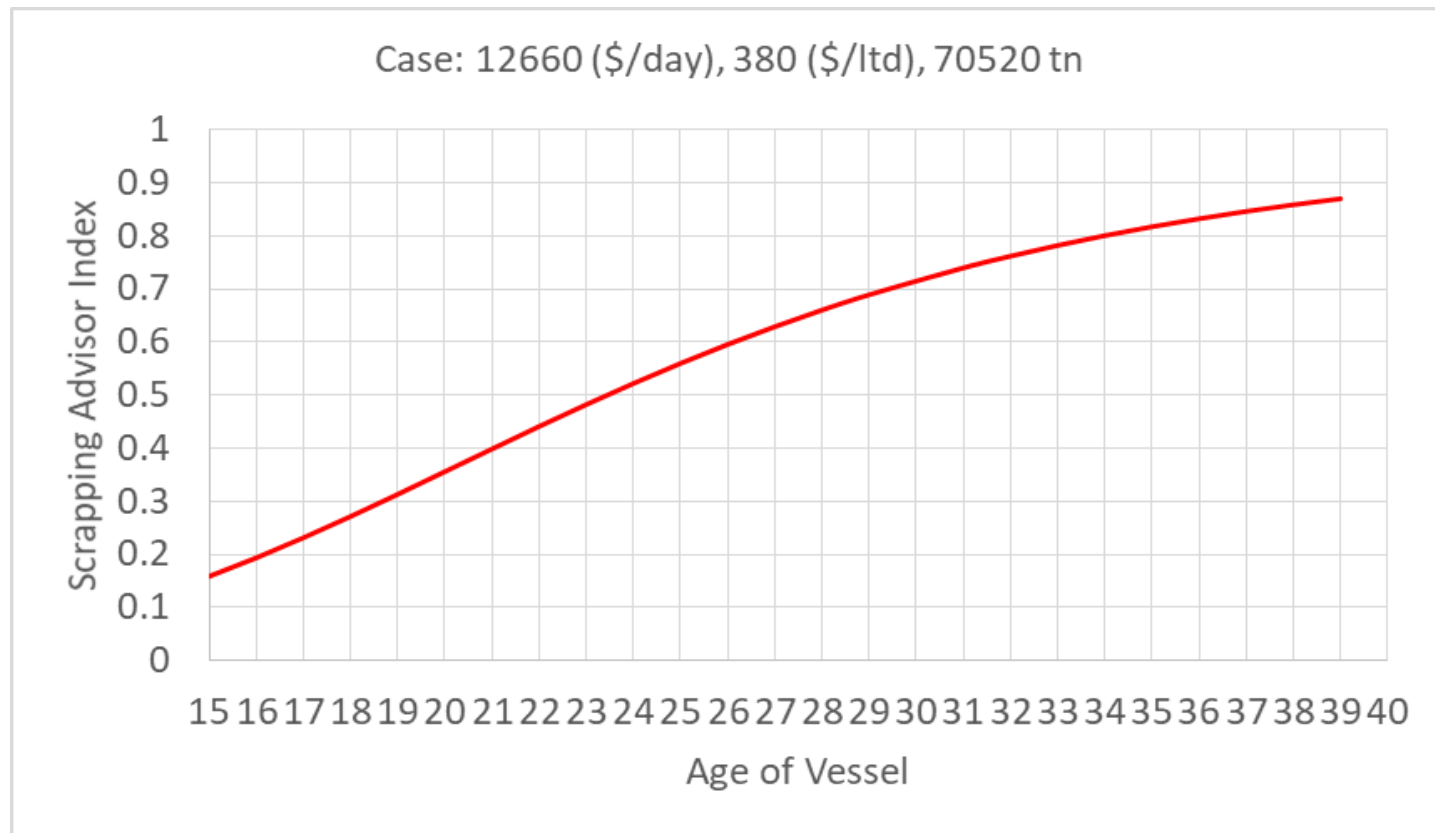
Average Ship Profile: (a) 12660 \$/day, (b) 380 \$/ltd, (c) 23 years, and (d) 70520 tn



First Module: Recycling/Scrapping (Long Term)

➤ Test case:

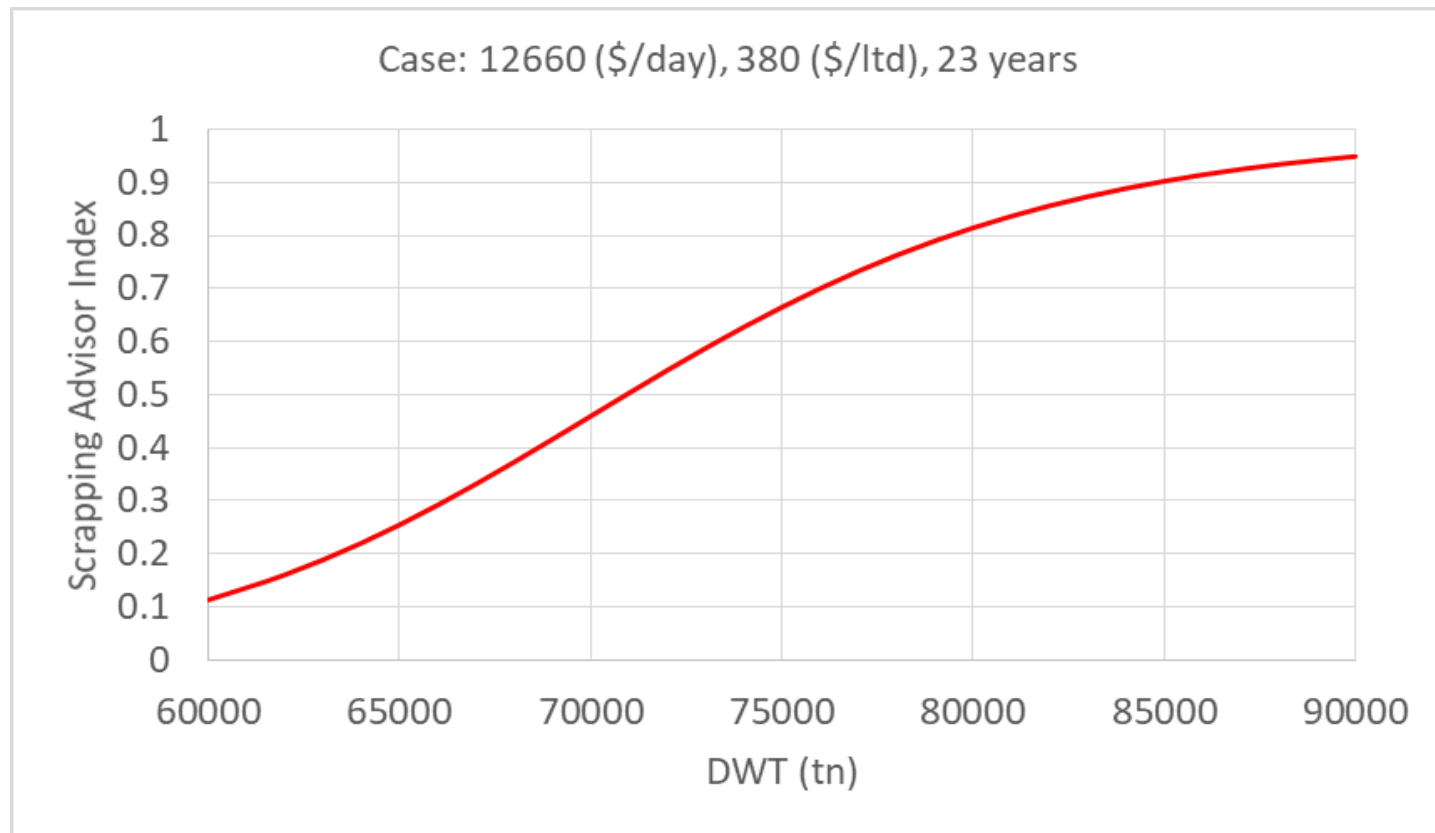
Average Ship Profile: (a) 12660 \$/day, (b) 380 \$/ltd, (c) 23 years, and (d) 70520 tn



First Module: Recycling/Scrapping (Long Term)

➤ Test case:

Average Ship Profile: (a) 12660 \$/day, (b) 380 \$/ltd, (c) 23 years, and (d) 70520 tn



First Module: Recycling/Scrapping (Short Term)

- Panamax Bulkcarriers (DWT: 60000-90000 tn)
- Short Term Chartering (*1 trip or 6 months chartering*)
- 20 representative ships selected for module development
- Data include values of the independent variables and dependent variable of the last three years
- Results of Binary Logistic Regression: Coefficients of Short Term Chartering Module

b_0	b_1	b_2	b_3	b_4
-219.00	-0.42	5.44	4.28	15.85



First Module: Recycling/Scrapping (Short Term)

➤ Validation of Module Performance:

➤ **Calculated values of dependent variable (Scrapping Advisor Index - SAI) of *scrapped vessels not included in module development***

	Average Trip Rates (Earnings - \$/day)	Recycling Prices (\$/ldt)	Ship's Age (years)	Ship's DWT (tn)	SAI
Case 1	7538	415	40	65387	0.847
Case 2	16075	415	24	73350	0.737
Case 3	6290	372	25	87996	0.980
Case 4	12453	370	31	70280	0.717
Case 5	12403	425	35	70838	0.911
Case 6	10850	420	23	68636	0.506

➤ **Module performance verified!**



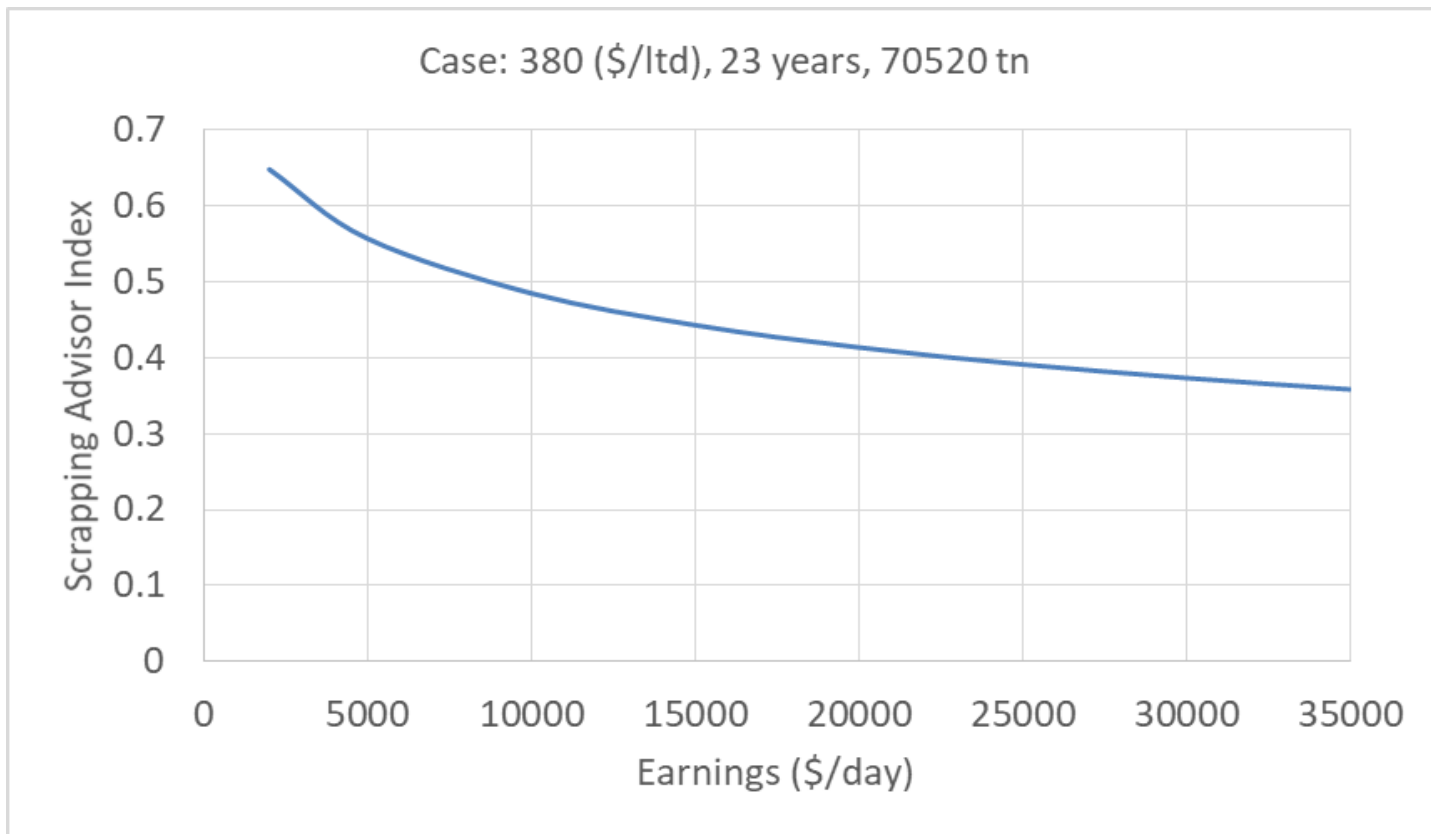
First Module: Recycling/Scrapping (Short Term)

➤ Further testing of module - Effects of:

(A) economic variables, (B) Ship Age, and (C) DWT

➤ Test case:

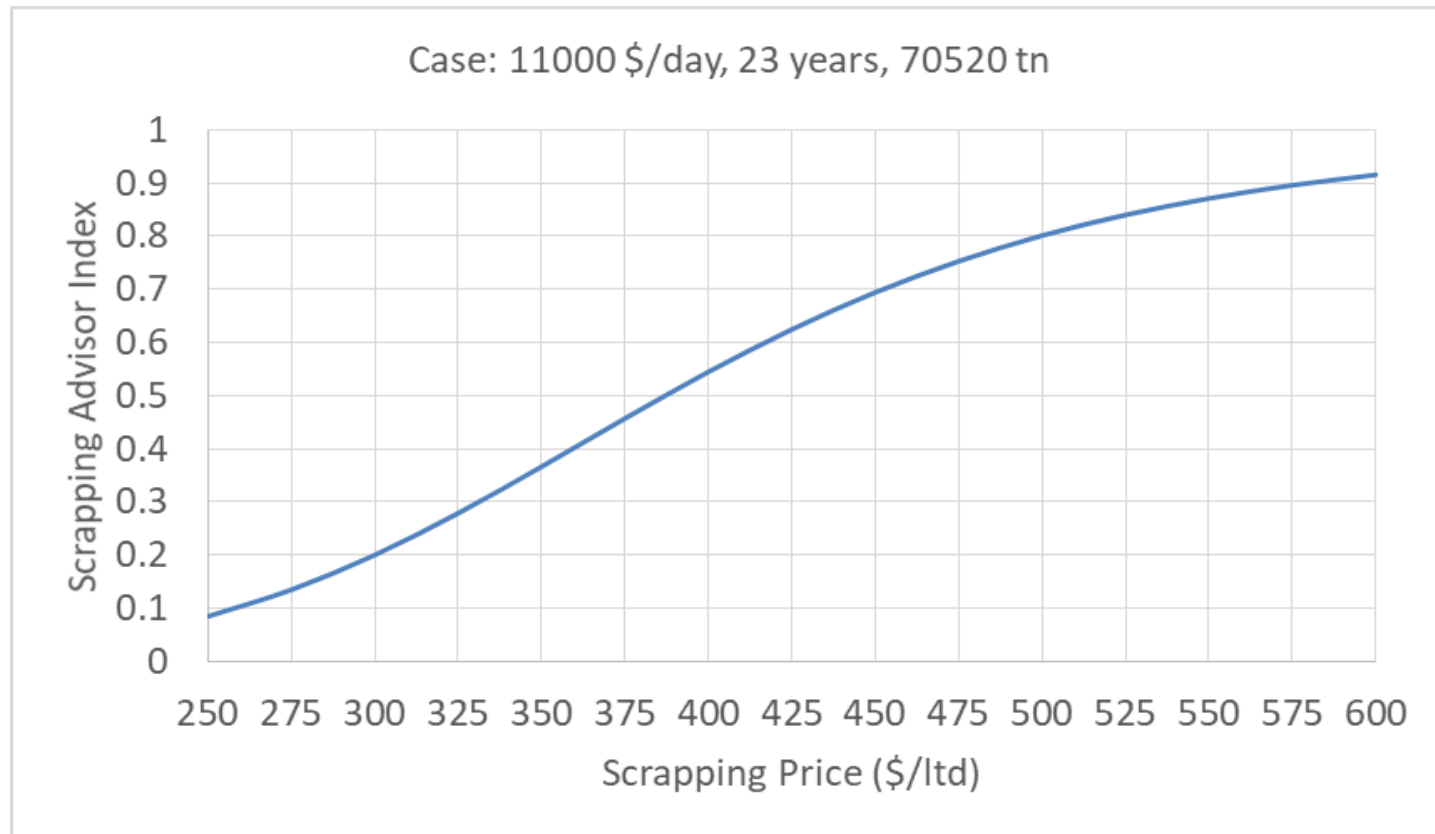
Average Ship Profile: (a) 11000 \$/day, (b) 380 \$/ltd, (c) 23 years, and (d) 70520 tn



First Module: Recycling/Scrapping (Short Term)

➤ Test case:

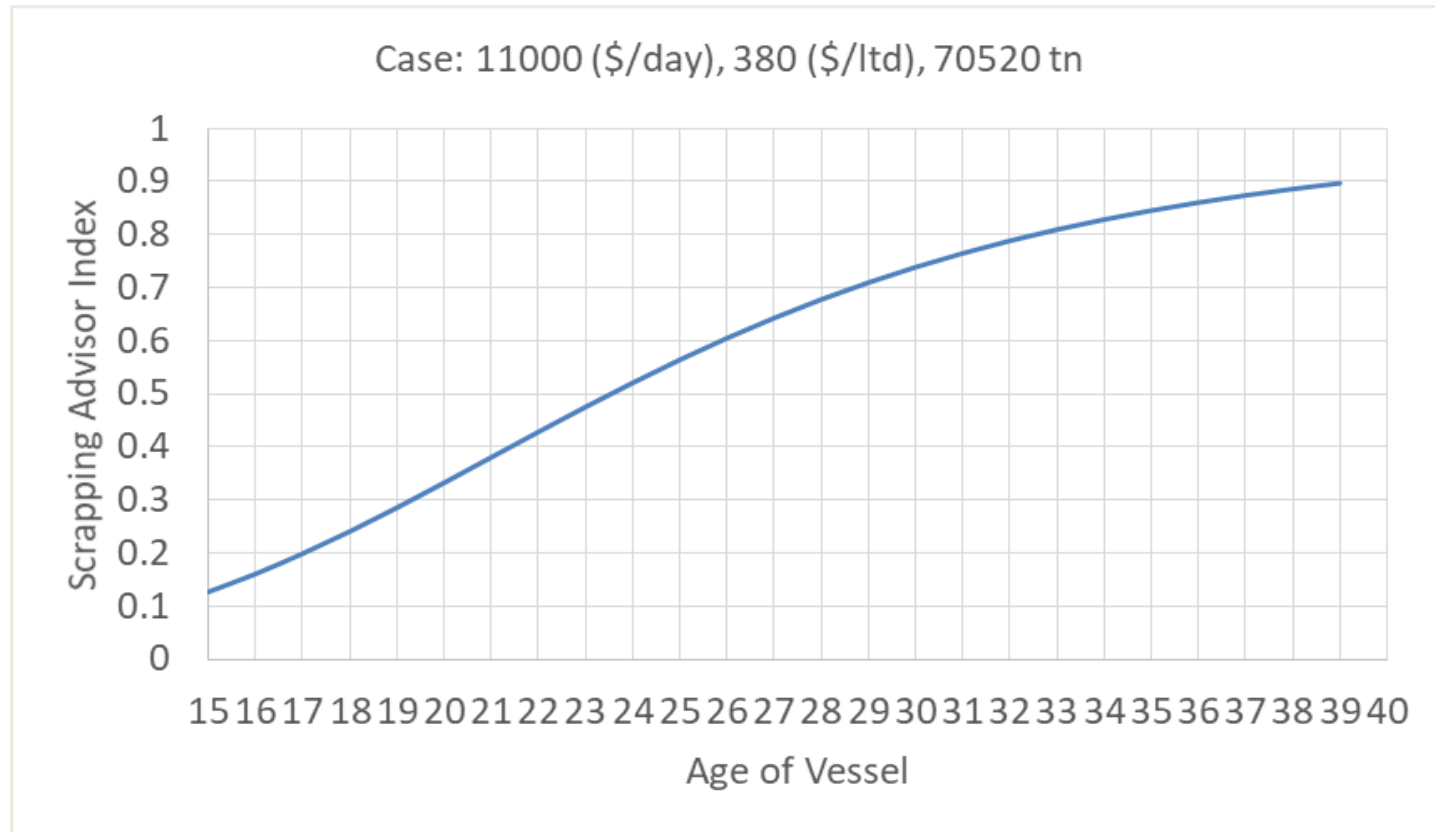
Average Ship Profile: (a) 11000 \$/day, (b) 380 \$/ltd, (c) 23 years, and (d) 70520 tn



First Module: Recycling/Scrapping (Short Term)

➤ Test case:

Average Ship Profile: (a) 11000 \$/day, (b) 380 \$/ltd, (c) 23 years, and (d) 70520 tn



First Module: Recycling/Scrapping (Short Term)

➤ **Test case:**

Average Ship Profile: (a) 11000 \$/day, (b) 380 \$/ltd, (c) 23 years, and (d) 70520 tn



First Module: Recycling/Scrapping (Long Term)

- Capesize bulk carriers (DWT: 120000-300000 tn*)
 - *Ore Carriers of up to 300000 are also included
- Long Term Chartering (1, 3, 5 years chartering)
- 20 representative ships selected for module development
- Data include values of the independent variables and dependent variable of the last three years
- Results of Binary Logistic Regression: Coefficients of Long Term Chartering Module

b_0	b_1	b_2	b_3	b_4
-45.35	-3.68	7.10	8.21	1.16



First Module: Recycling/Scrapping (Long Term)

➤ Validation of Module Performance:

➤ **Calculated values of dependent variable (Scrapping Advisor Index - SAI) of *scrapped vessels not included in module development***

	1 Year Time charter (Earnings - \$/day)	Recycling Prices (\$/ldt)	Ship's Age (years)	Ship's DWT (tn)	SAI
Case 1	15700	428	22	161010	0.792
Case 2	19344	480	23	170475	0.860
Case 3	11050	310	21	170565	0.508
Case 4	16500	434	24	208189	0.906
Case 5	18675	465	22	211320	0.833
Case 6	17500	430	19	229545	0.545
Case 7	14063	396	25	278157	0.947
Case 8	12719	385	20	172036	0.659
Case 9	16000	395	29	290160	0.975

➤ **Module performance verified!**



First Module: Recycling/Scrapping (Long Term)

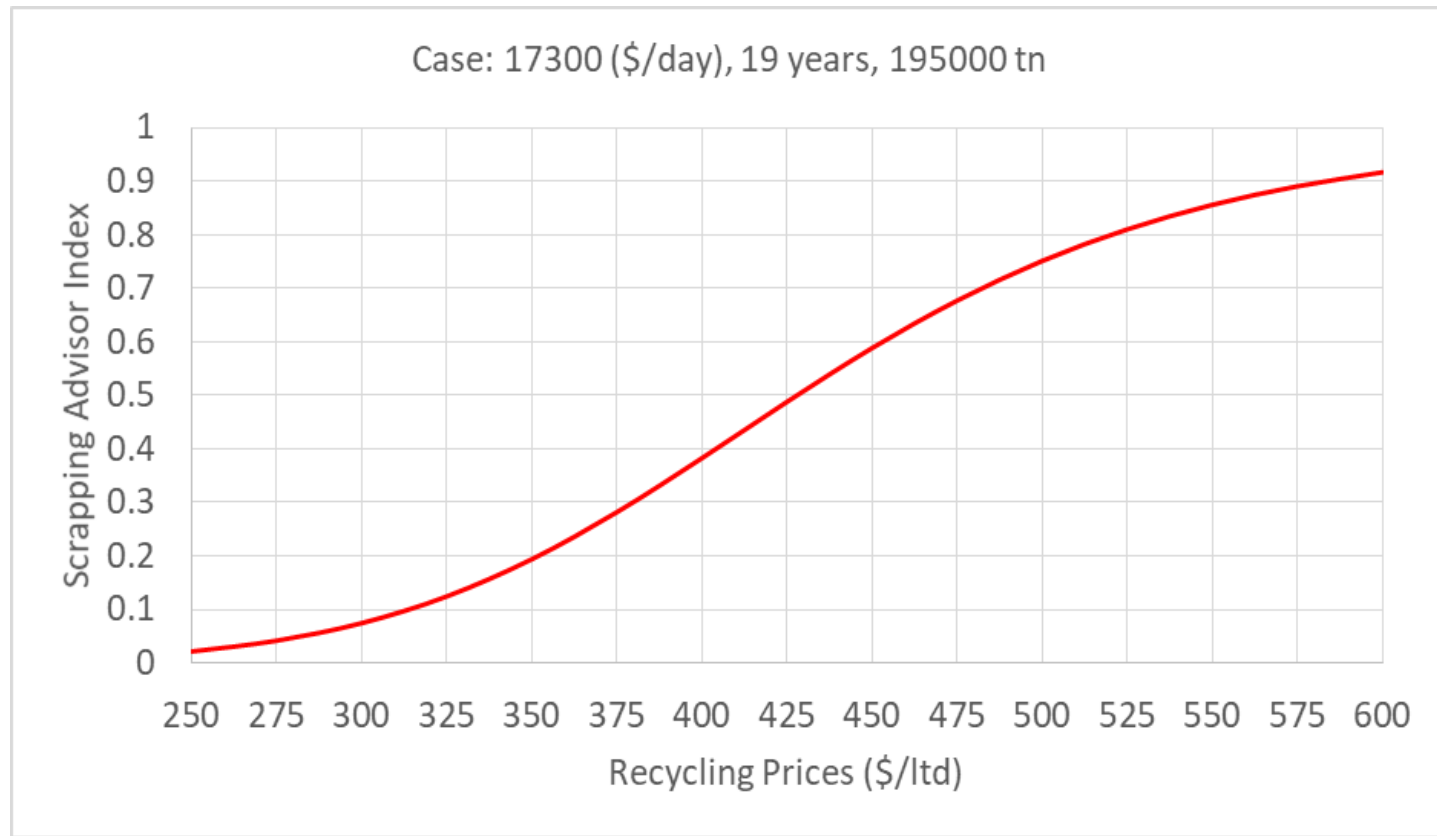
- Further testing of module - Effects of:
(A) economic variables, (B) Ship Age, and (C) DWT
- Test case:
Average Ship Profile: (a) 17300 \$/day, (b) 400 \$/ltd, (c) 19 years, and (d) 195000 tn



First Module: Recycling/Scrapping (Long Term)

➤ Test case:

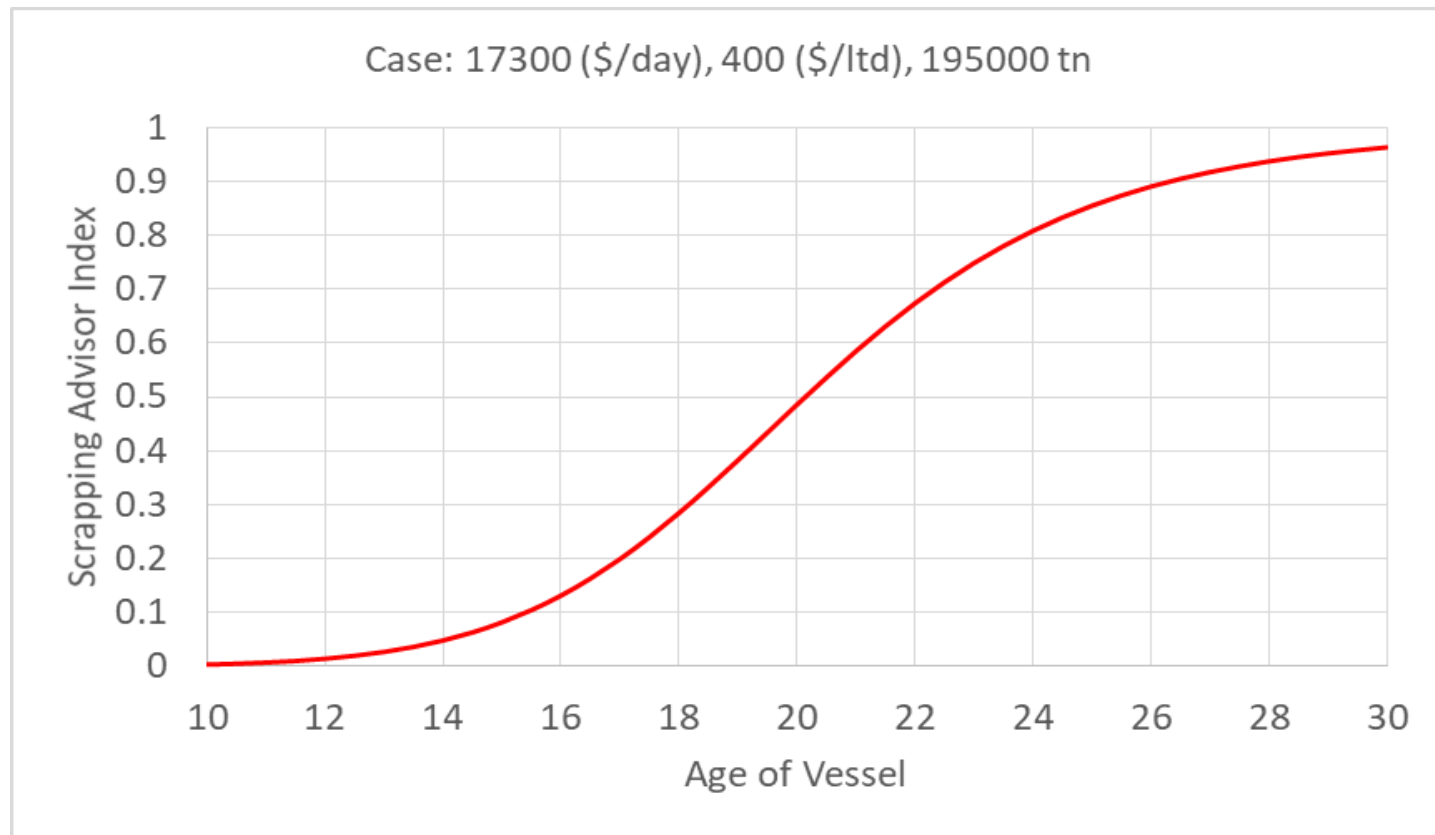
Average Ship Profile: (a) 17300 \$/day, (b) 400 \$/ltd, (c) 19 years, and (d) 195000 tn



First Module: Recycling/Scrapping (Long Term)

➤ Test case:

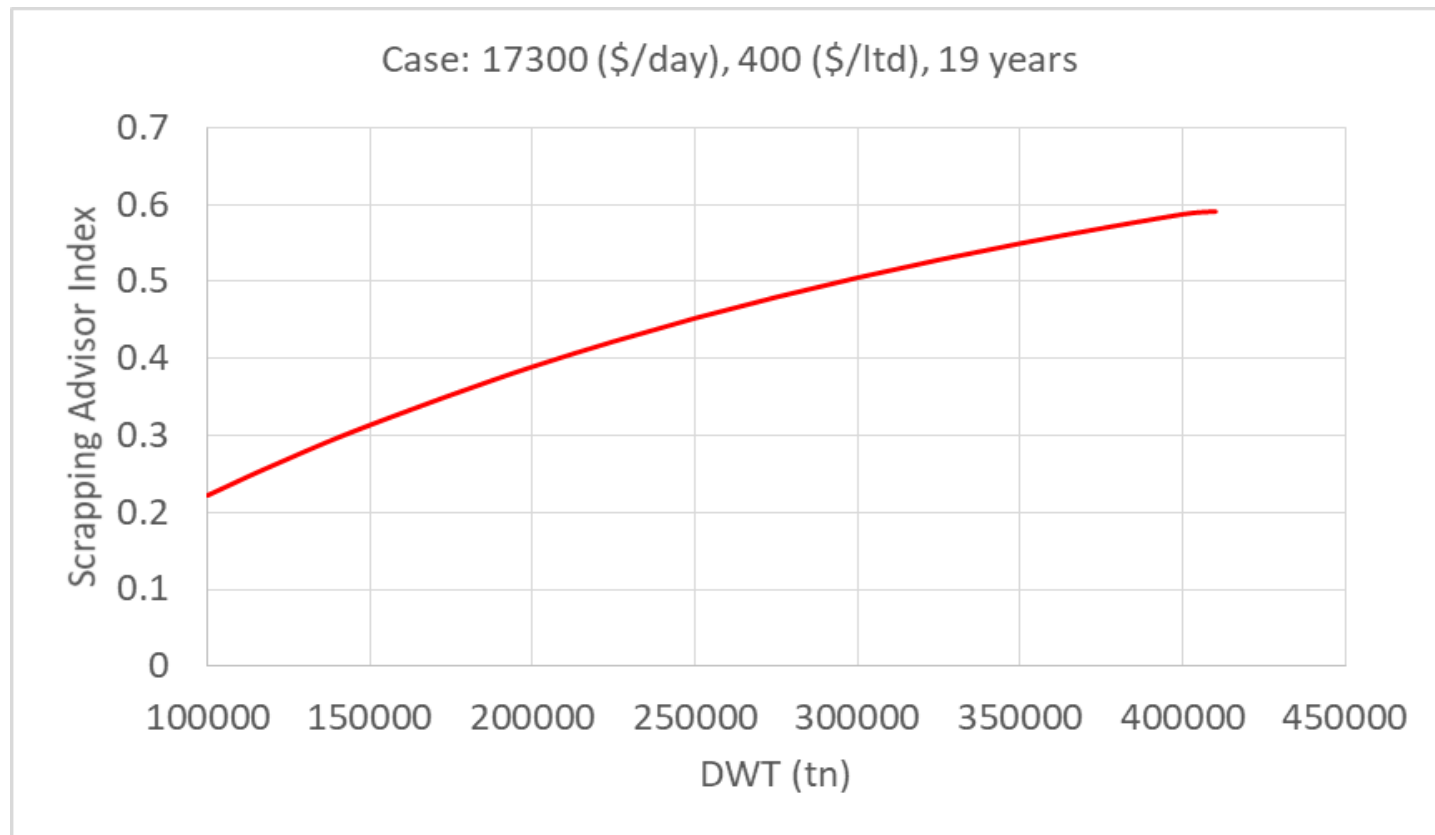
Average Ship Profile: (a) 17300 \$/day, (b) 400 \$/ltd, (c) 19 years, and (d) 195000 tn



First Module: Recycling/Scrapping (Short Term)

➤ Test case:

Average Ship Profile: (a) 17300 \$/day, (b) 400 \$/ltd, (c) 19 years, and (d) 195000 tn



First Module: Recycling/Scrapping (Short Term)

- **Capesize bulk carriers (DWT: 120000-300000 tn*)**
 - *Ore Carriers of up to 300000 are also included
- **Short Term Chartering (1 trip or 6 months chartering)**
- **20 representative ships selected for module development**
- **Data include values of the independent variables and dependent variable of the last three years**
- **Results of Binary Logistic Regression: Coefficients of Short Term Chartering Module**

b_0	b_1	b_2	b_3	b_4
-80.38	-0.97	7.52	8.57	1.56



First Module: Recycling/Scrapping (Short Term)

➤ Validation of Module Performance:

➤ **Calculated values of dependent variable (Scrapping Advisor Index - SAI) of *scrapped vessels not included in module development***

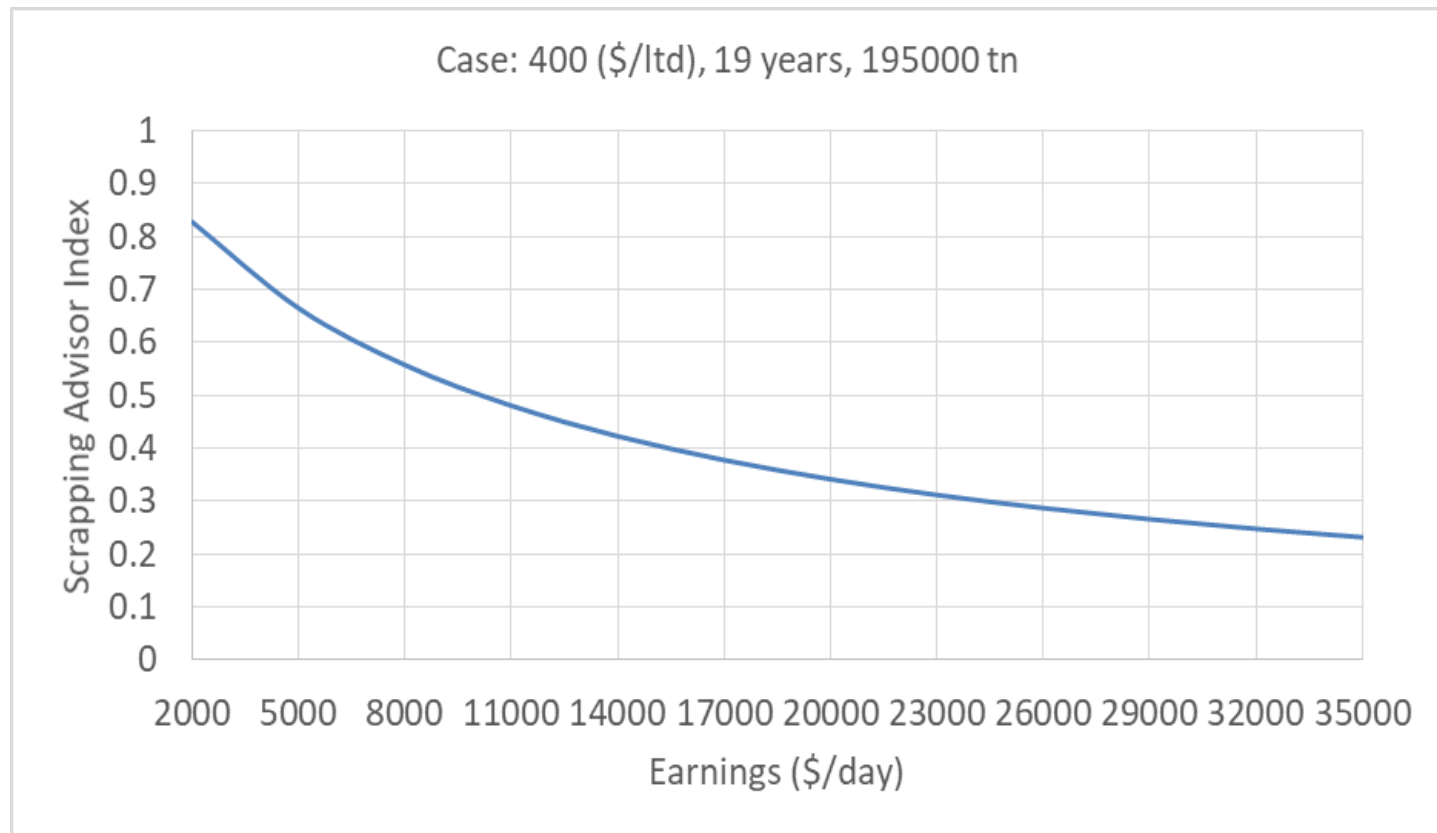
	1 Year Time charter (Earnings - \$/day)	Recycling Prices (\$/ldt)	Ship's Age (years)	Ship's DWT (tn)	SAI
Case 1	21650	428	22	161010	0.676
Case 2	12453	480	23	170475	0.931
Case 3	22906	434	24	208189	0.873
Case 4	9438	465	22	211320	0.930
Case 5	17125	430	19	229545	0.572
Case 6	2313	396	25	278157	0.986
Case 7	3313	385	20	172036	0.739
Case 8	16500	395	29	290160	0.975

➤ **Module performance verified!**



First Module: Recycling/Scrapping (Short Term)

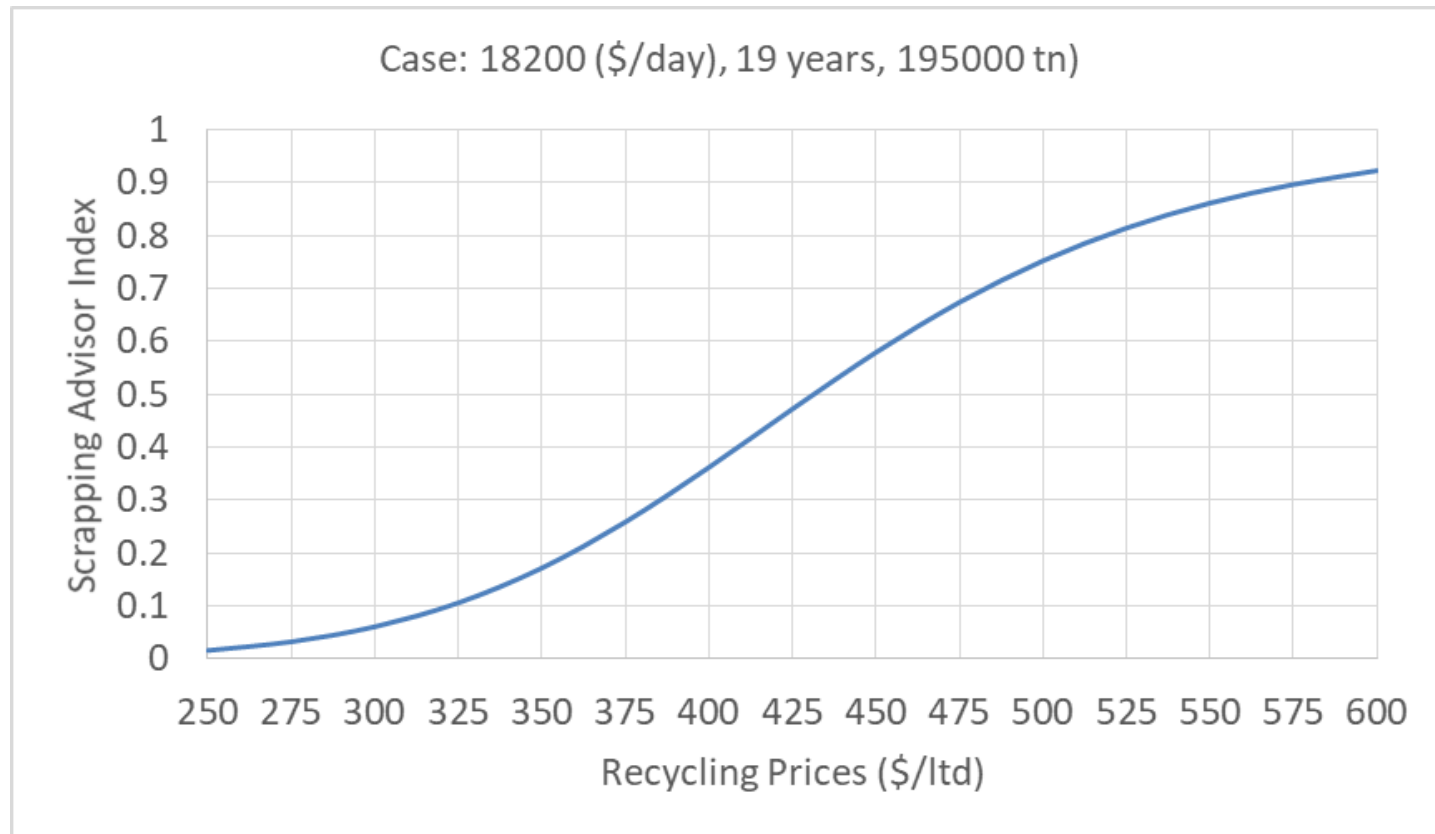
- Further testing of module - Effects of:
(A) economic variables, (B) Ship Age, and (C) DWT
- Test case:
Average Ship Profile: (a) 18200 \$/day, (b) 400 \$/ltd, (c) 19 years, and (d) 195000 tn



First Module: Recycling/Scrapping (Short Term)

➤ Test case:

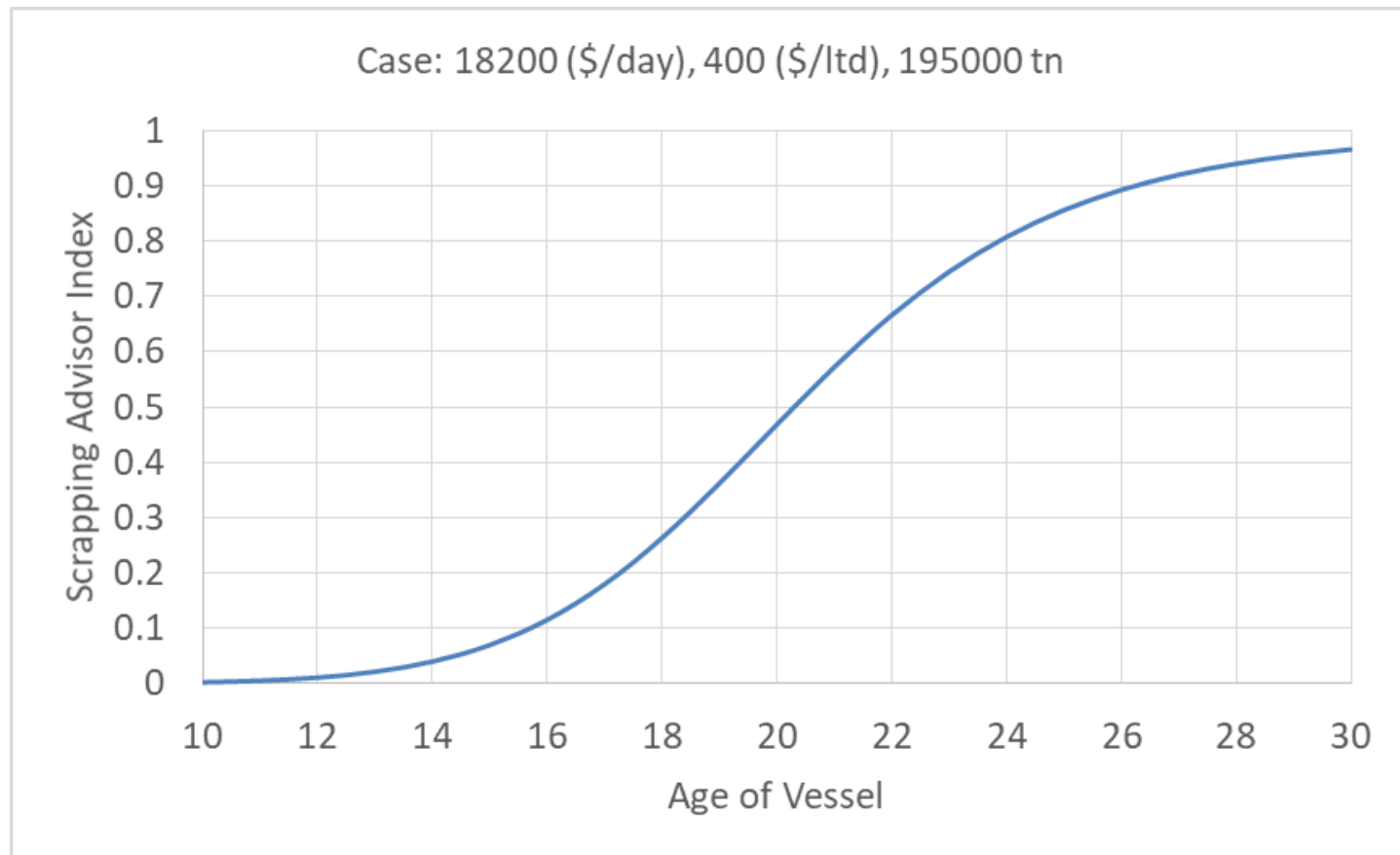
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➤ Test case:

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