Economic Fish Condition

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1 Introduction

Many factors may affect the price of fish. We are estimating a hedonic model of Silver Hake prices to find out if silver hake prices are affected by Fish Body Condition[1]. Figures 1 through 3 are some exploratory plots of condition factor and real prices at the annual level. Similar trends figure 1 would be good species to look at. Scatter plots with a postive slope (by species) in figure 3 would also be good species to look at.

Table 1 reports the results of OLS regression of price on condition and landings at the annual level. There are up to 26 data points (years) per species. That table is intended to give us a quick look at species where we might pick up an effect of condition on price. Of course, there are major OVs (import prices) here and other misspecifications, plus there's very few DoF, so don't over-interpret. Large positive and significant coefficients are consistent with the hypothesis that condition is a good.

[1] The fish condition project is here: https://github.com/NOAA-EDAB/FisheryConditionLinks

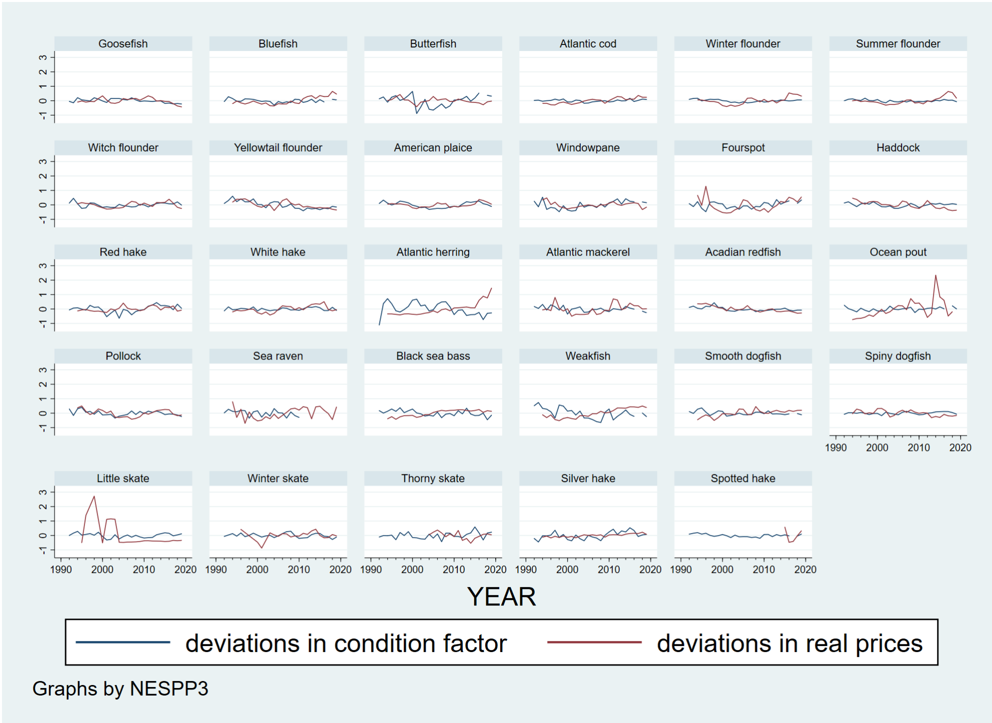

Figure 1: Panel plots of fish condition and real prices, normalized by group mean

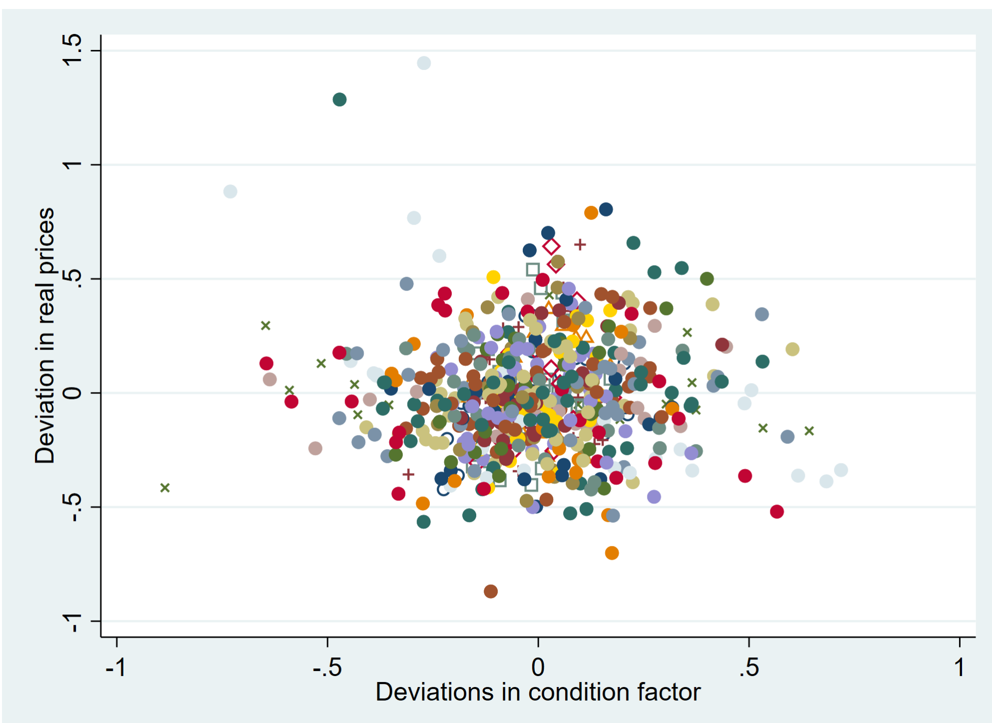

Figure 2: Scatter of Fish condition and real prices, normalized by group mean. Excluding Ocean Pout and Little Skate

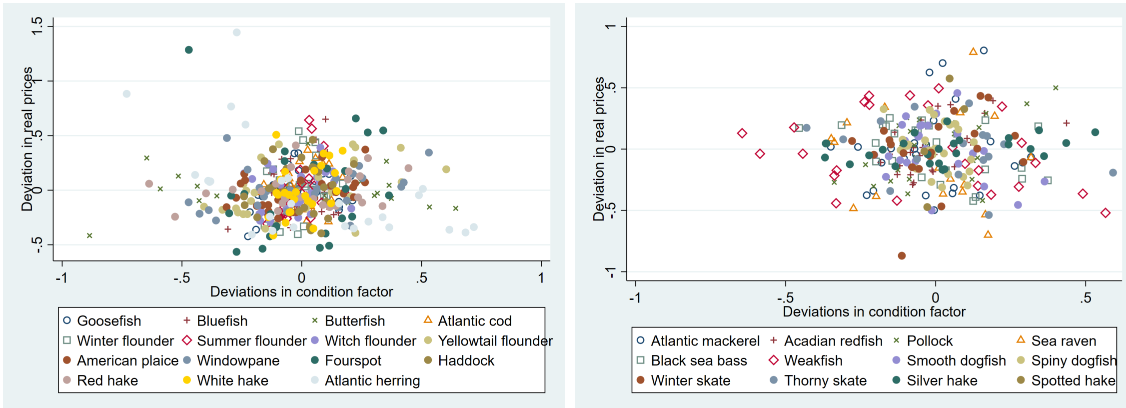

Figure 3: Scatter of Fish condition and real prices, normalized by group mean. Species are separately colorized. Excluding Ocean Pout and Little Skate

1.1 Related literature

Here is a handful of related literature on:

1.1.1 hedonic models

1. Whitefish - (Kristofersson and Rickertsen 2004; Kristofersson and Rickertsen 2007 ; Lee 2014; Hammarlund 2015; Asche, Chen and Smith 2015; Pettersen 2016; Pettersen, Brækkan and Myrland 2018)
2. Northeast US (Lee 2014; Ardini and Lee 2018)
3. Many - (Sjöberg 2015; Gobillon, Wolff and Guillotreau 2017)
4. Others -
    1. retail (Roheim, Gardiner and Asche 2007; Roheim, Asche and Santos 2011; Bronnmann and Asche 2016; Asche et al. 2015; Blomquist, Bartolino and Waldo 2015)
    2. older/classic -
    3. (Wakamatsu 2014; Wakamatsu and Miyata 2016)

1.1.2 On Whiting and Economics

1. Graddy (1995);Graddy (2006) ; Graddy and Kennedy (2010)
2. Helser, Thunberg and Mayo (1996); Thunberg, Helser and Mayo (1998)

	output beta condition	se condition	significantC	N
Winter flounder	0.119	0.0723	1	26
Goosefish	0.113	0.0717	1	26
Yellowtail flounder	0.0954	0.0295	1	26
Pollock	0.0867	0.0182	1	26
White hake	0.0843	0.0475	1	26
American plaice	0.0746	0.0279	1	26
Acadian redfish	0.0454	0.0153	1	26
Winter skate	0.0344	0.0237	1	20
Ocean pout	0.0308	0.0711	0	24
Weakfish	0.0284	0.0221	0	25
Windowpane	0.0256	0.00794	1	25
Bluefish	0.0156	0.0110	1	25
Silver hake	0.00731	0.00423	1	26
Little skate	0.00723	0.0192	0	23
Red hake	0.00409	0.00466	0	26
Atlantic mackerel	0.00241	0.00829	0	25
Butterfish	0.00107	0.00679	0	25
Summer flounder	0.000773	0.123	0	26
Fourspot	-0.000872	0.0257	0	25
Atlantic herring	-0.00737	0.00188	1	26
Sea raven	-0.0101	0.0502	0	17
Spiny dogfish	-0.0155	0.0112	1	26
Thorny skate	-0.0202	0.0152	1	16
Atlantic cod	-0.0348	0.0475	0	26
Smooth dogfish	-0.0365	0.0221	1	25
Witch flounder	-0.0419	0.0660	0	26
Haddock	-0.148	0.0445	1	26
Black sea bass	-0.168	0.0534	1	26
Spotted hake	-0.338	0.0795	1	4

Table 1: Condition Coefficients for an OLS regression of price on condition and landings. Sorted High to low based on the condition coefficient. Landings coefficient not shown.

1.1.3 Bioeconomic models

1. Product quality - Larkin and Sylvia (2004)
2. Diekert et al. (2010);

2 Theoretical Model

We are estimating the first stage of a hedonic model; these are equilibrium price functions and there's no theory about what should go into these equations or the functional form of them (Rosen 1974; Brown and Rosen 1982).

3 Empirical Model

We will want to try linear, log-linear, and log-log functional forms. Also Inverse Hyperbolic Sine (IHS) to deal with some zero quantities when quantity enters in a disaggregated form. Although many of the RHS variables are categorical, linear should still be viewed with suspicion when aggregate quantity is on the RHS.

Generally, the price per pound (p_{ijtk}) of fish that is sold by seller (vessel) i to buyer j on day t is a function of the characteristics of that fish (X_{ijtk}) and other characteristics that account for daily market conditions (Z_t).[2] Multiple sales between a vessel-buyer pair may occur on any day; these sales are indexed by k. The equilibrium price function for fish is:

$$p_{ijtk} = X_{ijtk}\beta + Z_t\gamma + u_i + v_j + w_t + \varepsilon_{itjk} \tag{1}$$

While equation 1 or various functional forms could be estimated with OLS, unobserved heterogeneity, whether at the buyer-, seller-, or day- level will lead to inconsistent estimates of β and γ. Fixed-effects estimators may be useful.

Day-level heterogeneity is most likely related to quantity supplied. We should either include day-level fixed effects or quantity supplied. Daily quantity supplied is likely to be endogenous; I find two arguements compelling. The first, there are demand characteristics unobserved to us that are observed by sellers. This makes the error term in our regression correlated with quantity supplied. Second, analgous to Graddy and Kennedy (2010); , sellers (fishing vessels) have an ability to inventory a bit when there are low prices and deplete that inventory when there are high prices. This happens at the margin, even with a highly perishable good,

[2] Might be a bad move to highligh the t in Z_t, especially when fish condition is measured yearly.

because people can adjust the timing of when they land fish.

Seller-specific heterogeneity might arise if particular fishing vessels systematically deliver high- or low-quality product, perhaps due to good handling practices after fish are caught. Buyer-specific heterogeneity might arise if particular buyers are selling into different markets in geographical or product space, or are vertically integrated with downstream components of the supply chain. Finally, buyer-seller pairs , although not explictly treated here, can have unobserved heterogenity as well (Gobillon et al. 2017).

At the time a sales transaction occurs, the characteristics X_{ijtk} have been determined and cannot be changed by either buyer or seller. In the Northeast US market for silver hake, most fish are caught and brought to market before the price is negotiated. Therefore, the characteristics of a particular lot of fish sold on a particular day are functions of previous fishing effort and can reasonably be thought of as exogenous.

We experiment with various ways to model the price equation. We estimate models that uses “all silver hake” quantities and a version that aggregates into own- and other- market category quantities as explanatory variables. We estimate linear-, log-log, and inverse hyperbolic sine (IHS) transformed models. The other-market category quantity is occasionally zero; this presents some problems for a specification that is estimated in logs, but does not present such a problem for the IHS models.

Imported whiting is likely to be a substitute and activity in the import market is likely to be important in determining the price of domestic silver hake. We experiment with including monthly import prices (we expect a positive sign here; an exogenous increase to import prices should result in higher prices of domestic whiting) and monthly import quantities (we expect a negative sign here; an exogenous increase in imported quanttiies should result in lower prices of domestic whiting). Both import prices and import quantities assumed endogenous to domestic prices.

We can put “lot size” in as an explanatory variable. I’m not sure of the sign of this coefficient. A negative coefficient would mean that sellers could split large lots and get a higher price per pound. This would be inconsistent with increasing returns to scale in the processing sector. Processing and wholesaling fish entails some quasi-fixed costs. A small lot is going to be worth less than a large lot. However, there may be some confounding due to the “aggregate supply effect.” It’s also possible that there are transactions (hold-up) costs: after a seller brings in fish, it is perishable. If the seller doesn’t take the buyers price, then the net price will be lower if they have to move to another seller. I’d suspect that repeated interactions would take care of this though.

4 Data overview

This is intended as a companion to the stata code that extracts and processes data.

4.1 NMFS Data

The dataset used for estimating the hedonic price model was constructed from NEFSC's mandatory dealer reports from 1994 to 2019. We excluded transactions with prices higher than $40 per pound (nominal). An observation is defined at a unique vessel-dealer-market category-date-vtrrecord combination.

Here is some super boring "inside baseball" detail on the NEFSC data.

1. I'm using the AA tables.
2. The raw query groups on link, nespp3, nespp4, year, month, day, dealnum, vserial, vtripid, vgearid, alevel, elevel, permit, area, effind, fzone.
3. Some species have multiple nespp3 codes, I accounted for this by reclassifying the nespp3, but not the nespp4. There are 3 numeric keys we may need to deal with – NESPP3/4; itis; and obspp.
4. I've extracted length data from port samplers (CFLEN), but I'm not doing anything with it.

Fish conditions come from Laurel; basically I'm just using the annual data. There's a bit of finessing the data links for a couple species (spotted hake and chub mackerel).

4.2 External Data

4.2.1 Trade Imports

I've extracted trade data from NMFS S&T. These data are monthly and also contain "point-of-entry" (Seattle, WA; Boston, MA; etc) and source country information. Some decision points for whiting:

1. Fresh, or Fresh and Frozen. Closely related to region. There's very little fresh imported, particularly early in the time series. Frozen is a different product though. If we're going to use frozen, I think continental US or CONUS + Alaska is reasonable. If we're going to use fresh, then I think we can use Northeast and Mid-atlantic.
2. Product form – closely related to fresh-frozen too. Exclude the "highly processed stuff?" But do we want to keep frozen blocks?

3. Prices or quantities on the right hand side? I don't have a good argument for either. Both will be endogenous; we can instrument with lags. FAO's fish production is only annual.
4. Imports, Export, or "Net trade inflows" (Imports-Exports+re-exports). This presumes quantities on the right hand side. If we use prices on the right hand side, I think we just go with import prices.

4.2.2 Normalization

In the Atlantic Cod paper, I used PPI Unprocessed Finfish. In the scallop hedonic paper, Greg and I used GDP implicit price deflator. Stick with GDP implicit price deflator. The PPI for unprocessed finfish is too volatile. I also pulled the PPI for "Seafood Product Preparation and Packaging – Fresh and frozen seafood processing"and "Prepared fresh fish/seafood, inc. surimi/surimi-based products." The second is a subset of the first and also probably too volatile.

4.3 Some Data summaries

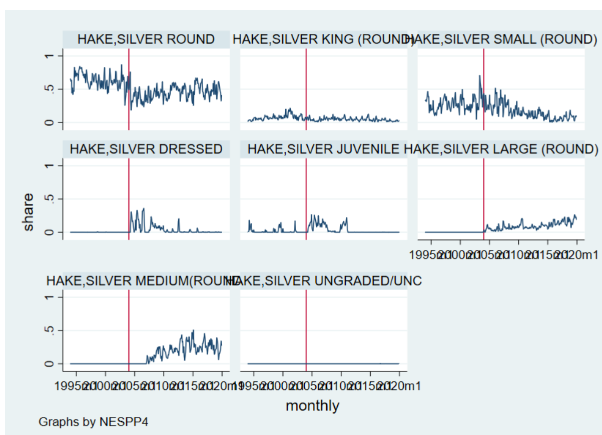

Figure 4: Silver Hake landings by market category

On Jan 1, 2004, the market category coding changed. It's not super well documented in the databases, but I deduced this from figure 4. It looks like there are 3 new categories Large, Medium, and Dressed. I should interact Round, King and Small with an indicator for post Jan 1, 2004. Eyeballing the length data at the market category from the dealer data shows that there's a "rebinning" 5.

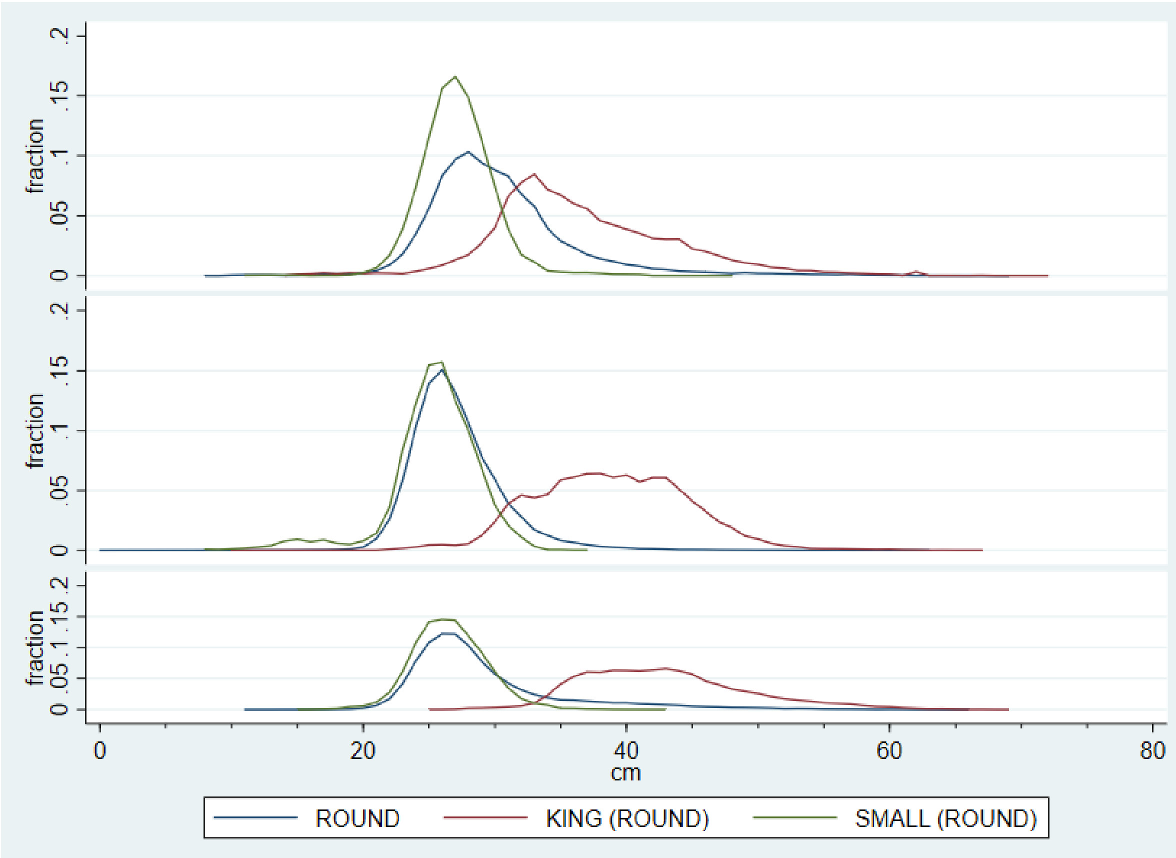

Figure 5: Silver hake sizes by market category (top: 1994-2003, middle: 2004-2012, bottom: 2013-2019)

These are the market categories: Round 5090 King 5091 Small 5092 Dressed 5093 Juvenile 5094 Large 5095 Medium 5096 Ungraded 5097.

Define D as an indicator if the trade date is before Jan 1, 2004. Doing a crosstab of nespp4 and D shows that there are just a few observations of 5093 and 5094 when D=1. There are 21 and 369 respectively. So, we won't construct interactions of these. There are also only 132 obs of ungraded, so we'll exclude these. The following dummies enter the specification (round is the base) Round∗D, King, King∗D, Small, Small∗D, Dressed, Juvenile, Large, Medium.

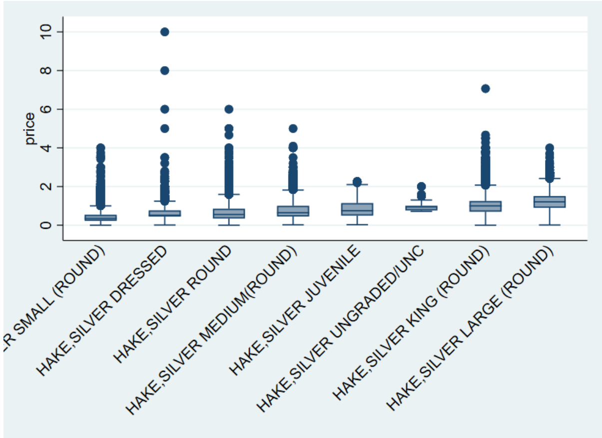

Figure 6: Silver Hake prices, 1994-2019

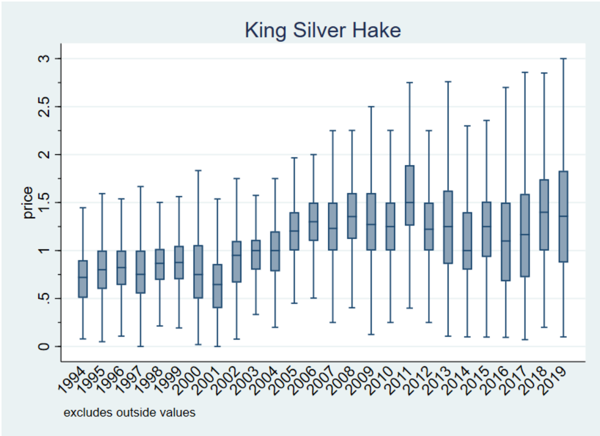

Figure 7: King Silver Hake prices

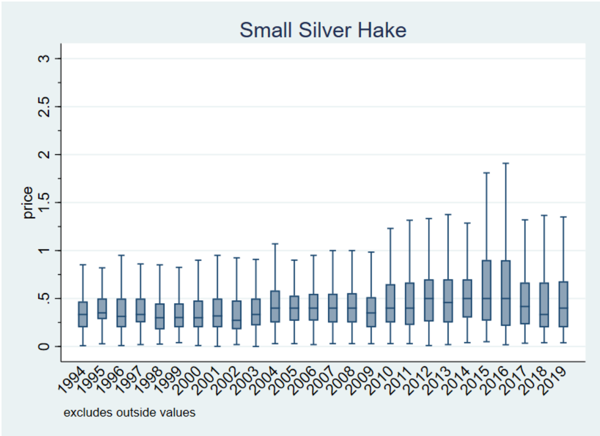

Figure 8: Small Silver Hake prices

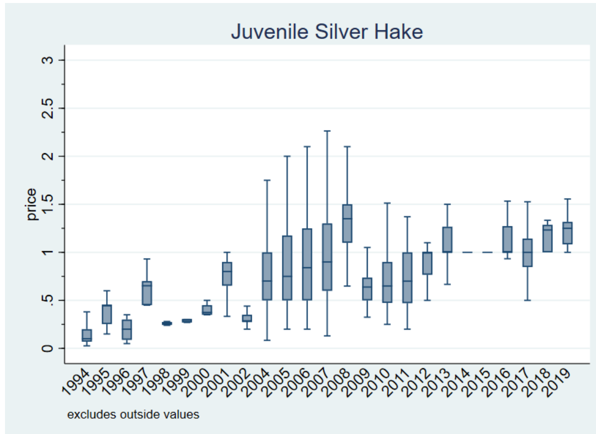

Figure 9: Juvenile Silver Hake prices

4.4 Condition and Macro

Some simple plots to look at the income variable. Secular trend up over time in income. Secular trend down in landings of silver hake over time. If the prices have a time trend, it's pretty small.

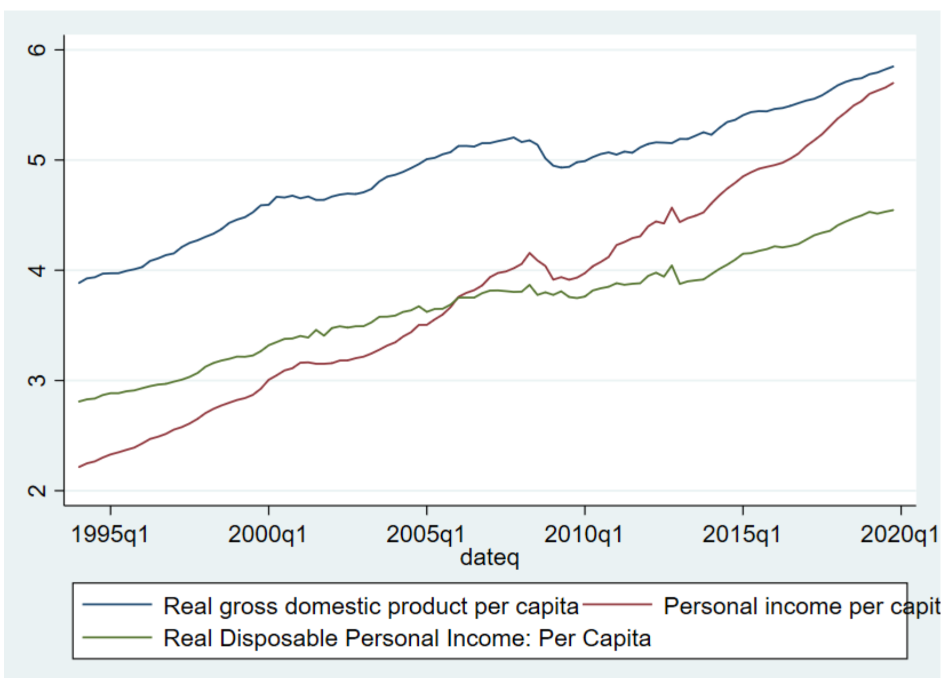

Figure 10: GDP/cap, Personal Income, Disposable Income

There isn't a massive correlation between condition and the macro variables (r=0.25 ish)

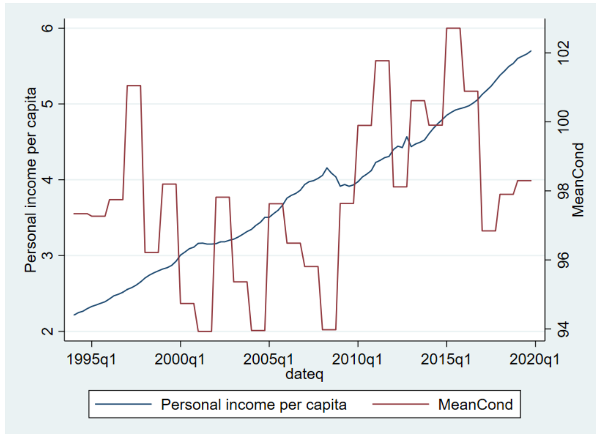

Figure 11: Condition and Personal Income

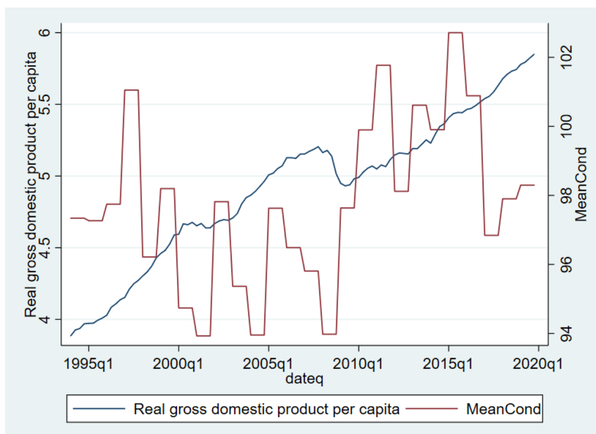

Figure 12: Condition and GDPC

Figure 13: Quarterly Income and 5090 landings

Figure 14: Quarterly Income and 5090 prices

Figure 15: Quarterly Income and 5091 landings

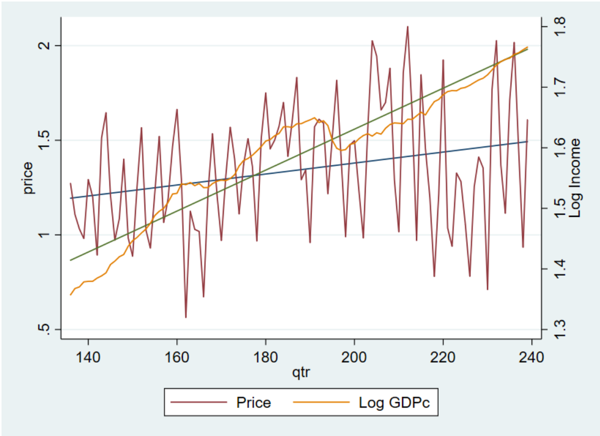

Figure 16: Quarterly Income and 5091 prices

Figure 17: Quarterly Income and 5092 landings

Figure 18: Quarterly Income and 5092 prices

5 Code and methods

Code to extract and process data is in the "/stata_code/data_extraction_processing" folder. Code to make figures is in "stata_code/analysis/silverhake." Code to do regressions is in "stata_code/analysis/silverhake/regressions"

silver_hake_01.do - this is my first set of exploratory regressions. The code runs quickly (OLS and IVs). These models not good models, but we can still learn something from them. I did not put these tables into the current doc. You can look at the sters or smcls.

silver_hake_02.do - this is my second set of exploratory regressions. The code runs slower because I used lots of Fixed Effects for permits and sometimes for dealers and fitted the models with REGHDFE and IVREGHDFE. Some of these might be candidates for an acceptable specification.You can look at the sters or smcls.

silver_hake_03.do - this is my third set of exploratory regressions. Some of these might be candidates for an acceptable specification.

silver_hake04_import_pounds.do - this is my fourth set of exploratory regressions. Some of these might be candidates for an acceptable specification. I experimented with a few things.

6 Results

6.1 OLS

I mostly put the OLS coefficients in the Appendix, but some are in body tables. I've written too much about them already.

We get expected signs on the quantity coefficient. The OLS coefficient on lnq is attenuated, as expected if we have some endogeneity in quantity supplied (positive shocks to expected prices will also lead to higher landings). King and Large whiting seem to get the same prices. Juvenile whiting also gets a higher price than medium; which is a bit unexpected. Small whiting gets a discount. So does dressed whiting, which is a little strange.

We also have a negative coefficient on income. I'm not sure if this is really an indication of an "inferior" good or increasing US income is simply correlated with decreasing world prices or increasing supply of substitutes. When we estimate models with import prices, the large negative in income stays. Same when we add quarterly landings (to see if this is driven by the downward long-run trend in whiting landings). I don't really think it's a real effect; I think we're correlated with something else.

6.2 IV

The IV models seem to fit much better. R^2 isn't meaningful for an IV. The negative R^2 should be disregarded, I'll use RMSE instead.

Takeaways from Table 2 through 4:

1. Daily landings elasticity is fairly stable -0.5 to -0.7. This is reasonable.
2. Import price effect is 0.5 to 0.77. This is reasonable and consistent with imports as substitutes. IV49, which uses import quantities has a negative sign here, also consistent with imports being substitutes.

3. The income effect is -1.1. This means that if real incomes go up by 1%, prices go down by just over 1%. This doesn't make much sense. I suspect this is correlated with something else. Not sure what. Could be a normalization issue?
    1. Income is measured quarterly and has a strong upward trend over time.

    2. All of my specifications have dummies for Years and Months.
    3. Since we have Y and M dummies, the income variable is really going in as a deviation from the Yearly and 3 month average. So we are probably getting higher values at the begininning of the year and lower at the end? This could be a spurious correlation.

1.The Fzone=offshore and Fzone=missing effects are consistent across specifications. They're not too large or too small. Ballparking it at a 4% premium and a 2% discount relative to "inshore". 1. Same with BSA (northern and southern effects are small, relative to unknown.) 1. The recession indicator means that prices are lower when we have a recession by about 2 to 5%. This is *inconsistent* with the income effect. 1. Prices are higher when the daily volume of all fish is higher. Not sure what this means. IV44 and IV45 treat daily "fishery-wide" quantities as exogenous. IV46 treats it as endogenous. Treating "fishery-wide" quantities as exogenous results in coefficients 2x larger than ones that treat it as endogenous.
1. The 'size' effects are very consistent. These are approximately the premia/discounts in percentage terms (not quite, you have to do exp(β). But close enough for now. The differences are IV47 and IV48's coefficients for "Dressed", "Medium", and "Smallx mkt_Shift" 1. The years vary a bit, I'm guessing it's because there are some specifications that leave out the macro factors (Table 3) 1. The month and dow coeffs in Table 4 also match really well (not as well as the main interesting coeffs though).

VARIABLES	(1) IV41 Log	(2) IV42 Log	(3) IV43 Log	(4) IV44 Log	(5) IV45 Log	(6) IV46 Log	(7) IV47 Log	(8) IV48 Log	(9) IV49 Log
Log Daily Landings	-0.554***	-0.575***	-0.576***	-0.680***	-0.735***	-0.639***	-0.569***	-0.569***	-0.522***
	(0.0115)	(0.0140)	(0.0141)	(0.0159)	(0.0192)	(0.0172)	(0.0120)	(0.0120)	(0.0100)
Log Real Import Price	0.638***	0.529***	0.521***	0.773***	0.666***	0.648***	0.631***	0.623***	
	(0.0603)	(0.0597)	(0.0597)	(0.0670)	(0.0689)	(0.0639)	(0.0583)	(0.0583)	
Log Real GDP cap	-1.102***	-1.006***					-1.169***		
	(0.222)	(0.226)					(0.227)		
FZONE = 3, Offshore	0.0400***	0.0421***	0.0421***	0.0457***	0.0435***	0.0417***	0.0594***	0.0595***	0.0312***
	(0.00343)	(0.00354)	(0.00354)	(0.00378)	(0.00395)	(0.00365)	(0.00341)	(0.00341)	(0.00326)
FZONE = 9, Missing	-0.0198***	-0.0194***	-0.0196***	-0.0186***	-0.0180***	-0.0190***	-0.00957**	-0.00969**	-0.0169***
	(0.00411)	(0.00417)	(0.00417)	(0.00440)	(0.00455)	(0.00428)	(0.00377)	(0.00377)	(0.00400)
BSA = 1, Northern	0.0242**	0.0271**	0.0264**	0.0335***	0.0313***	0.0271**	0.0194***	0.0190***	0.0256**
	(0.0105)	(0.0106)	(0.0106)	(0.0115)	(0.0120)	(0.0111)	(0.00730)	(0.00730)	(0.0102)
BSA = 2, Southern	-0.0403***	-0.0396***	-0.0403***	-0.0466***	-0.0445***	-0.0427***	0.0185***	0.0183***	-0.0358***
	(0.0100)	(0.0102)	(0.0102)	(0.0109)	(0.0114)	(0.0106)	(0.00680)	(0.00681)	(0.00974)
NESPP4 = 5091, HAKE,SILVER KING (ROUND)	0.599***	0.599***	0.598***	0.602***	0.609***	0.603***	0.618***	0.617***	0.594***
	(0.00461)	(0.00470)	(0.00470)	(0.00514)	(0.00548)	(0.00501)	(0.00461)	(0.00461)	(0.00439)
NESPP4 = 5092, HAKE,SILVER SMALL (ROUND)	-0.573***	-0.571***	-0.571***	-0.573***	-0.569***	-0.571***	-0.583***	-0.583***	-0.573***
	(0.00621)	(0.00630)	(0.00630)	(0.00677)	(0.00711)	(0.00659)	(0.00563)	(0.00564)	(0.00602)
NESPP4 = 5093, HAKE,SILVER DRESSED	-0.0393***	-0.0381***	-0.0380***	-0.0342***	-0.0406***	-0.0398***	-0.130***	-0.130***	-0.0454***
	(0.0105)	(0.0107)	(0.0107)	(0.0116)	(0.0122)	(0.0112)	(0.00847)	(0.00848)	(0.0101)
NESPP4 = 5094, HAKE,SILVER JUVENILE	0.218***	0.221***	0.220***	0.242***	0.260***	0.237***	0.323***	0.321***	0.210***
	(0.0127)	(0.0128)	(0.0128)	(0.0139)	(0.0146)	(0.0135)	(0.0128)	(0.0128)	(0.0123)
NESPP4 = 5095, HAKE,SILVER LARGE (ROUND)	0.508***	0.508***	0.508***	0.516***	0.520***	0.513***	0.544***	0.543***	0.502***
	(0.00489)	(0.00499)	(0.00499)	(0.00541)	(0.00574)	(0.00527)	(0.00474)	(0.00475)	(0.00468)
NESPP4 = 5096, HAKE,SILVER MEDIUM(ROUND)	-0.199***	-0.198***	-0.198***	-0.193***	-0.193***	-0.196***	-0.0558***	-0.0557***	-0.204***
	(0.00753)	(0.00767)	(0.00768)	(0.00824)	(0.00871)	(0.00803)	(0.00697)	(0.00698)	(0.00727)
5091.nespp4#0.mkt_shift	-0.130***	-0.129***	-0.129***	-0.130***	-0.136***	-0.133***	-0.130***	-0.129***	-0.127***
	(0.00569)	(0.00578)	(0.00578)	(0.00626)	(0.00660)	(0.00608)	(0.00569)	(0.00569)	(0.00548)
5092.nespp4#0.mkt_shift	0.0959***	0.0959***	0.0958***	0.0967***	0.0931***	0.0945***	0.176***	0.176***	0.0959***
	(0.00774)	(0.00785)	(0.00785)	(0.00834)	(0.00870)	(0.00813)	(0.00712)	(0.00712)	(0.00754)
5093.nespp4#0.mkt_shift	0.308	0.321	0.322	0.182	0.186	0.251	0.333	0.333	0.295
	(0.214)	(0.218)	(0.219)	(0.210)	(0.237)	(0.221)	(0.217)	(0.217)	(0.202)
5094.nespp4#0.mkt_shift	-0.994***	-0.988***	-0.987***	-1.005***	-1.046***	-1.018***	-1.049***	-1.047***	-0.986***
	(0.0424)	(0.0427)	(0.0427)	(0.0434)	(0.0438)	(0.0428)	(0.0431)	(0.0431)	(0.0425)
Recession Indicator = 1	-0.0432***	-0.0221**	-0.0215**	-0.0351***	-0.0144	-0.0296***	-0.0547***	-0.0547***	-0.00798
	(0.0100)	(0.00993)	(0.00993)	(0.0108)	(0.0113)	(0.0105)	(0.0102)	(0.0102)	(0.00899)
Log Quarterly Landings		0.140***	0.141***						
		(0.0186)	(0.0186)						
Log Aggregate NER Value				0.446***					
				(0.0118)					
Log Aggregate NER Landings					0.421***	0.196***			
					(0.0140)	(0.0149)			
Log Imports									-0.105***
									(0.0194)
Constant							7.176***	5.581***	
							(0.336)	(0.124)	
Observations	393,973	393,973	393,973	393,973	393,973	393,973	394,281	394,281	393,973
R-squared	-0.144	-0.181	-0.182	-0.355	-0.481	-0.278	-0.118	-0.119	-0.079
Model	IV	IV	IV	IV	IV	IV	IV	IV	IV
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vessel Effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Dealer Effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes

Takeaways from Table 5 through 7:

1. Coeffs held over from previous models don't change much.
2. Condition increases prices slightly. IV52 says the elasticity is .77. Std. dev of condition does not seem to affect prices.

3. IHS effects similar to ln effects, but we can also allow for variability in the effect of whiting landings on prices.
4. IHS models have a some small negative effects for std dev of condition.
5. Looks like I labeled some of the models incorrectly.

VARIABLES	(1) IV41 Log	(2) IV42 Log	(3) IV43 Log	(4) IV44 Log	(5) IV45 Log	(6) IV46 Log	(7) IV47 Log	(8) IV48 Log	(9) IV49 Log
YEAR = 1995	0.251***	0.269***	0.252***	0.240***	0.299***	0.263***	0.132***	0.116***	0.234***
	(0.0123)	(0.0129)	(0.0123)	(0.0121)	(0.0131)	(0.0124)	(0.00824)	(0.00756)	(0.0127)
YEAR = 1996	0.262***	0.263***	0.219***	0.277***	0.253***	0.232***	0.154***	0.106***	0.118***
	(0.0185)	(0.0188)	(0.0155)	(0.0166)	(0.0171)	(0.0161)	(0.0144)	(0.0108)	(0.0125)
YEAR = 1997	0.236***	0.247***	0.173***	0.200***	0.196***	0.173***	0.127***	0.0438***	0.127***
	(0.0209)	(0.0214)	(0.0131)	(0.0133)	(0.0139)	(0.0131)	(0.0175)	(0.00693)	(0.0122)
YEAR = 1998	0.280***	0.291***	0.183***	0.209***	0.200***	0.180***	0.213***	0.0915***	0.126***
	(0.0276)	(0.0282)	(0.0140)	(0.0141)	(0.0147)	(0.0139)	(0.0249)	(0.00773)	(0.0123)
YEAR = 1999	0.253***	0.276***	0.133***	0.116***	0.134***	0.114***	0.193***	0.0306***	0.0118
	(0.0349)	(0.0357)	(0.0148)	(0.0144)	(0.0151)	(0.0143)	(0.0329)	(0.00865)	(0.0134)
YEAR = 2000	0.144***	0.169***	-0.00393	-0.0415**	-0.00522	-0.0269	0.0859**	-0.112***	-0.204***
	(0.0426)	(0.0435)	(0.0184)	(0.0181)	(0.0192)	(0.0180)	(0.0408)	(0.0132)	(0.0145)
YEAR = 2001	0.128***	0.124***	-0.0502**	-0.0380	-0.0717***	-0.0669***	0.0761*	-0.122***	-0.285***
	(0.0457)	(0.0464)	(0.0230)	(0.0241)	(0.0250)	(0.0234)	(0.0436)	(0.0190)	(0.0162)
YEAR = 2002	-0.00539	0.0484	-0.133***	-0.220***	-0.282***	-0.241***	-0.0490	-0.257***	-0.457***
	(0.0461)	(0.0470)	(0.0219)	(0.0218)	(0.0229)	(0.0217)	(0.0441)	(0.0170)	(0.0223)
YEAR = 2003	0.268***	0.301***	0.0978***	0.0763***	-0.0350	0.00796	0.219***	-0.0129	-0.228***
	(0.0513)	(0.0523)	(0.0238)	(0.0242)	(0.0251)	(0.0237)	(0.0496)	(0.0192)	(0.0205)
YEAR = 2004	0.138**	0.192***	-0.0368*	-0.123***	-0.283***	-0.193***	0.114**	-0.149***	-0.300***
	(0.0555)	(0.0565)	(0.0222)	(0.0224)	(0.0243)	(0.0231)	(0.0540)	(0.0174)	(0.0169)
YEAR = 2005	0.0410	0.127**	-0.126***	-0.284***	-0.412***	-0.319***	0.0213	-0.271***	-0.437***
	(0.0605)	(0.0614)	(0.0217)	(0.0223)	(0.0252)	(0.0236)	(0.0594)	(0.0174)	(0.0234)
YEAR = 2006	-0.0773	0.0464	-0.225***	-0.441***	-0.529***	-0.447***	-0.125**	-0.437***	-0.501***
	(0.0639)	(0.0647)	(0.0211)	(0.0225)	(0.0256)	(0.0236)	(0.0633)	(0.0174)	(0.0222)
YEAR = 2007	0.0570	0.145**	-0.136***	-0.369***	-0.445***	-0.342***	0.00754	-0.316***	-0.345***
	(0.0650)	(0.0661)	(0.0190)	(0.0200)	(0.0227)	(0.0212)	(0.0644)	(0.0141)	(0.0173)
YEAR = 2008	0.0232	0.102	-0.166***	-0.400***	-0.468***	-0.363***	-0.00677	-0.315***	-0.357***
	(0.0629)	(0.0639)	(0.0191)	(0.0205)	(0.0232)	(0.0215)	(0.0623)	(0.0147)	(0.0199)
YEAR = 2009	0.0774	0.127**	-0.108***	-0.238***	-0.327***	-0.249***	0.0577	-0.212***	-0.359***
	(0.0551)	(0.0561)	(0.0176)	(0.0174)	(0.0191)	(0.0182)	(0.0538)	(0.0120)	(0.0236)
YEAR = 2010	0.0848	0.147**	-0.104***	-0.135***	-0.144***	-0.170***	0.0647	-0.224***	-0.308***
	(0.0578)	(0.0587)	(0.0162)	(0.0159)	(0.0166)	(0.0158)	(0.0571)	(0.0115)	(0.0307)
YEAR = 2011	0.141**	0.218***	-0.0411**	-0.314***	-0.289***	-0.211***	0.113*	-0.185***	-0.204***
	(0.0597)	(0.0605)	(0.0186)	(0.0221)	(0.0233)	(0.0214)	(0.0592)	(0.0149)	(0.0319)
YEAR = 2012	0.0455	0.128**	-0.147***	-0.421***	-0.400***	-0.323***	0.0115	-0.304***	-0.295***
	(0.0631)	(0.0639)	(0.0178)	(0.0217)	(0.0230)	(0.0210)	(0.0627)	(0.0145)	(0.0254)
YEAR = 2013	0.0571	0.143**	-0.143***	-0.384***	-0.375***	-0.312***	0.0113	-0.318***	-0.349***
	(0.0657)	(0.0664)	(0.0173)	(0.0207)	(0.0220)	(0.0202)	(0.0652)	(0.0141)	(0.0272)
YEAR = 2014	0.0538	0.124*	-0.181***	-0.393***	-0.381***	-0.328***	0.0312	-0.320***	-0.324***
	(0.0694)	(0.0704)	(0.0169)	(0.0194)	(0.0204)	(0.0188)	(0.0692)	(0.0128)	(0.0220)
YEAR = 2015	-0.0691	0.0223	-0.305***	-0.549***	-0.560***	-0.490***	-0.0960	-0.473***	-0.406***
	(0.0749)	(0.0756)	(0.0202)	(0.0248)	(0.0268)	(0.0245)	(0.0750)	(0.0186)	(0.0229)
YEAR = 2016	-0.0959	-0.0143	-0.352***	-0.564***	-0.584***	-0.522***	-0.129*	-0.518***	-0.489***
	(0.0768)	(0.0777)	(0.0177)	(0.0212)	(0.0231)	(0.0212)	(0.0768)	(0.0153)	(0.0198)
YEAR = 2017	-0.143*	-0.0410	-0.395***	-0.548***	-0.602***	-0.565***	-0.178**	-0.586***	-0.574***
	(0.0805)	(0.0814)	(0.0185)	(0.0204)	(0.0226)	(0.0208)	(0.0807)	(0.0160)	(0.0232)
YEAR = 2018	-0.120	-0.0120	-0.390***	-0.562***	-0.617***	-0.574***	-0.162*	-0.599***	-0.531***
	(0.0857)	(0.0867)	(0.0199)	(0.0219)	(0.0243)	(0.0223)	(0.0861)	(0.0174)	(0.0216)
YEAR = 2019	-0.00710	0.0820	-0.314***	-0.460***	-0.533***	-0.485***	-0.0562	-0.513***	-0.560***
	(0.0894)	(0.0908)	(0.0182)	(0.0178)	(0.0200)	(0.0186)	(0.0896)	(0.0129)	(0.0234)
Constant							7.176***	5.581***	
							(0.336)	(0.124)	
Observations	393,973	393,973	393,973	393,973	393,973	393,973	394,281	394,281	393,973
R-squared	-0.144	-0.181	-0.182	-0.355	-0.481	-0.278	-0.118	-0.119	-0.079
Model	IV	IV	IV	IV	IV	IV	IV	IV	IV
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vessel Effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Dealer Effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Year coeffs

VARIABLES	(1) IV41 Log	(2) IV42 Log	(3) IV43 Log	(4) IV44 Log	(5) IV45 Log	(6) IV46 Log	(7) IV47 Log	(8) IV48 Log	(9) IV49 Log
MONTH = 1	0.270***	0.309***	0.319***	0.338***	0.226***	0.255***	0.258***	0.269***	0.289***
	(0.00806)	(0.00729)	(0.00681)	(0.00755)	(0.0101)	(0.00918)	(0.00825)	(0.00787)	(0.00717)
MONTH = 2	0.297***	0.335***	0.345***	0.384***	0.251***	0.281***	0.275***	0.286***	0.231***
	(0.00674)	(0.00767)	(0.00731)	(0.00684)	(0.00787)	(0.00737)	(0.00688)	(0.00651)	(0.0124)
MONTH = 3	0.330***	0.372***	0.382***	0.423***	0.303***	0.323***	0.311***	0.322***	0.302***
	(0.00628)	(0.00833)	(0.00799)	(0.00682)	(0.00690)	(0.00646)	(0.00641)	(0.00604)	(0.00656)
MONTH = 4	0.247***	0.270***	0.274***	0.313***	0.218***	0.236***	0.236***	0.240***	0.206***
	(0.00596)	(0.00614)	(0.00609)	(0.00629)	(0.00708)	(0.00658)	(0.00607)	(0.00601)	(0.00861)
MONTH = 5	0.108***	0.129***	0.133***	0.136***	0.103***	0.108***	0.104***	0.108***	0.0677***
	(0.00634)	(0.00629)	(0.00625)	(0.00680)	(0.00730)	(0.00676)	(0.00645)	(0.00640)	(0.00777)
MONTH = 6	0.0164***	0.0447***	0.0486***	0.00913	-0.0214***	0.000855	-0.00530	-0.00118	0.0318***
	(0.00564)	(0.00595)	(0.00587)	(0.00624)	(0.00695)	(0.00641)	(0.00589)	(0.00583)	(0.00561)
MONTH = 8	0.0296***	0.0303***	0.0302***	0.0461***	0.0591***	0.0433***	0.0481***	0.0482***	0.00494
	(0.00513)	(0.00522)	(0.00522)	(0.00577)	(0.00617)	(0.00571)	(0.00537)	(0.00537)	(0.00593)
MONTH = 9	0.0951***	0.0985***	0.0985***	0.120***	0.133***	0.113***	0.120***	0.120***	0.0881***
	(0.00505)	(0.00520)	(0.00520)	(0.00569)	(0.00605)	(0.00562)	(0.00525)	(0.00525)	(0.00535)
MONTH = 10	0.0960***	0.149***	0.145***	0.117***	0.106***	0.0975***	0.113***	0.107***	0.108***
	(0.00625)	(0.00792)	(0.00791)	(0.00649)	(0.00683)	(0.00642)	(0.00621)	(0.00613)	(0.00560)
MONTH = 11	0.0394***	0.0854***	0.0809***	0.119***	0.0485***	0.0406***	0.0404***	0.0345***	0.0229***
	(0.00653)	(0.00653)	(0.00646)	(0.00608)	(0.00706)	(0.00661)	(0.00662)	(0.00652)	(0.00679)
MONTH = 12	0.108***	0.152***	0.148***	0.168***	0.132***	0.116***	0.0995***	0.0933***	0.106***
	(0.00769)	(0.00659)	(0.00649)	(0.00729)	(0.00810)	(0.00761)	(0.00792)	(0.00783)	(0.00720)
dow = 1, Monday	0.272***	0.283***	0.283***	0.105***	0.160***	0.220***	0.279***	0.280***	0.258***
	(0.00718)	(0.00827)	(0.00827)	(0.00570)	(0.00622)	(0.00665)	(0.00747)	(0.00748)	(0.00659)
dow = 2, Tuesday	0.198***	0.206***	0.206***	0.0700***	0.107***	0.155***	0.198***	0.198***	0.189***
	(0.00600)	(0.00672)	(0.00672)	(0.00540)	(0.00573)	(0.00588)	(0.00621)	(0.00621)	(0.00562)
dow = 3, Wednesday	0.277***	0.287***	0.287***	0.151***	0.194***	0.238***	0.282***	0.283***	0.264***
	(0.00682)	(0.00785)	(0.00785)	(0.00575)	(0.00631)	(0.00639)	(0.00710)	(0.00710)	(0.00629)
dow = 4, Thursday	0.297***	0.308***	0.309***	0.184***	0.223***	0.263***	0.305***	0.305***	0.282***
	(0.00728)	(0.00842)	(0.00842)	(0.00620)	(0.00686)	(0.00683)	(0.00758)	(0.00758)	(0.00666)
dow = 5, Friday	0.0376***	0.0393***	0.0394***	-0.0125**	-0.0222***	0.00978*	0.0359***	0.0361***	0.0374***
	(0.00501)	(0.00513)	(0.00513)	(0.00562)	(0.00604)	(0.00568)	(0.00521)	(0.00521)	(0.00483)
dow = 6, Saturday	-0.124***	-0.128***	-0.128***	-0.0943***	-0.138***	-0.131***	-0.139***	-0.139***	-0.115***
	(0.00645)	(0.00683)	(0.00683)	(0.00687)	(0.00782)	(0.00712)	(0.00678)	(0.00678)	(0.00604)
Constant							7.176***	5.581***	
							(0.336)	(0.124)	
Observations	393,973	393,973	393,973	393,973	393,973	393,973	394,281	394,281	393,973
R-squared	-0.144	-0.181	-0.182	-0.355	-0.481	-0.278	-0.118	-0.119	-0.079
Model	IV	IV	IV	IV	IV	IV	IV	IV	IV
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vessel Effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Dealer Effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Month and Week coeffs

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VARIABLES	(1) IV51 Log	(2) IV52 Log	(3) IV55 ihs	(4) IV55 ihs
Log Daily Landings	-0.405***	-0.405***		
	(0.00673)	(0.00672)		
Log Real Import Price	0.370***	0.370***		
	(0.0175)	(0.0175)		
Recession Indicator = 1	-0.0403***	-0.0399***	-0.00836***	-0.0135***
	(0.00447)	(0.00448)	(0.00229)	(0.00231)
FZONE = 3, Offshore	0.0272***	0.0272***	0.0161***	0.0160***
	(0.00296)	(0.00296)	(0.00150)	(0.00154)
FZONE = 9, Missing	0.0857***	0.0856***	0.0477***	0.0442***
	(0.00365)	(0.00365)	(0.00186)	(0.00190)
BSA = 1, Northern	0.133***	0.133***	0.0600***	0.0597***
	(0.00938)	(0.00938)	(0.00469)	(0.00479)
BSA = 2, Southern	0.0903***	0.0902***	0.0473***	0.0459***
	(0.00900)	(0.00901)	(0.00447)	(0.00458)
NESPP4 = 5091, HAKE,SILVER KING (ROUND)	0.527***	0.527***	0.218***	0.349***
	(0.00369)	(0.00369)	(0.00739)	(0.00211)
NESPP4 = 5092, HAKE,SILVER SMALL (ROUND)	-0.631***	-0.631***	-0.372***	-0.305***
	(0.00563)	(0.00563)	(0.00426)	(0.00274)
NESPP4 = 5093, HAKE,SILVER DRESSED	-0.0376***	-0.0377***	-0.201***	-0.0278***
	(0.00894)	(0.00894)	(0.0104)	(0.00452)
NESPP4 = 5094, HAKE,SILVER JUVENILE	0.146***	0.146***	-0.0109	0.0993***
	(0.0113)	(0.0113)	(0.00893)	(0.00680)
NESPP4 = 5095, HAKE,SILVER LARGE (ROUND)	0.401***	0.401***	0.186***	0.264***
	(0.00425)	(0.00425)	(0.00462)	(0.00238)
NESPP4 = 5096, HAKE,SILVER MEDIUM(ROUND)	-0.278***	-0.278***	-0.242***	-0.179***
	(0.00653)	(0.00652)	(0.00473)	(0.00356)
5091.nespp4#0.mkt__shift	-0.0113**	-0.0112**	-0.0292***	-0.0423***
	(0.00473)	(0.00473)	(0.00260)	(0.00267)
5092.nespp4#0.mkt__shift	0.222***	0.222***	0.137***	0.114***
	(0.00730)	(0.00730)	(0.00339)	(0.00351)
5093.nespp4#0.mkt__shift	0.278	0.278	-0.00445	0.140
	(0.192)	(0.192)	(0.0751)	(0.0932)
5094.nespp4#0.mkt__shift	-0.924***	-0.924***	-0.407***	-0.408***
	(0.0415)	(0.0415)	(0.0173)	(0.0165)
MeanCond	0.00781***			
	(0.000710)			
StdDevCond	-0.000620			
	(0.00135)			
lnmeancond__Annual		0.768***		
		(0.0698)		
lnstddevcond__Annual		-0.00864		
		(0.0149)		
ihs__ownq			-0.189***	
			(0.00373)	
ihs__other__landings			-0.136***	
			(0.00575)	
ihsprice__allIMP__R__GDPDEF			0.193***	0.229***
			(0.0120)	(0.0118)
ihsmeancond__Annual			0.399***	0.463***
			(0.0361)	(0.0368)
ihsstddevcond__Annual			0.0176**	0.00173
			(0.00757)	(0.00780)
ihsq				-0.200***
				(0.00362)
Observations	393,973	393,973	395,453	395,453
R-squared	0.081	0.081	0.203	0.169
Model	IV	IV	IV	IV
Year effects	No	No	No	No
Month Effects	Yes	Yes	Yes	Yes
Vessel Effects	Yes	Yes	Yes	Yes
Dealer Effects	Yes	Yes	Yes	Yes
ll	-355747	-355726	-91438	-99511
rmse	0.598	0.598	0.306	0.312

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Coefficents when we include condition factor coeffs

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	IV51 Log	IV52 Log	OLS51 Log	OLS52 Lin	IV52 Lin	IV54 Log
Log Daily Landings	-0.521***	-0.532***	-0.0657***			-0.467***
	(0.0100)	(0.0103)	(0.000933)			(0.00807)
Log Imports	-0.105***	-0.136***	-0.00392*			-0.0472***
	(0.0194)	(0.0179)	(0.00226)			(0.00582)
Log Real GDP cap	-0.869***	-1.034***	-1.207***			-1.872***
	(0.214)	(0.220)	(0.163)			(0.0327)
FZONE = 3, Offshore	0.0312***	0.0484***	0.00860***	0.0139***	0.152***	0.0162***
	(0.00325)	(0.00316)	(0.00247)	(0.00188)	(0.0203)	(0.00305)
FZONE = 9, Missing	-0.0167***	-0.00686*	-0.00422	0.00196	-0.135***	0.0177***
	(0.00400)	(0.00367)	(0.00323)	(0.00238)	(0.0262)	(0.00378)
BSA = 1, Northern	0.0263***	0.0130*	0.0243***	0.00826	0.136***	0.0702***
	(0.0102)	(0.00712)	(0.00782)	(0.00564)	(0.0352)	(0.00964)
BSA = 2, Southern	-0.0351***	0.0175***	-0.0243***	-0.0118**	-0.0338	0.0273***
	(0.00973)	(0.00659)	(0.00761)	(0.00551)	(0.0318)	(0.00921)
NESPP4 = 5091, HAKE,SILVER KING (ROUND)	0.594***	0.612***	0.564***	0.556***	0.601***	0.607***
	(0.00439)	(0.00437)	(0.00307)	(0.00300)	(0.0104)	(0.00386)
NESPP4 = 5092, HAKE,SILVER SMALL (ROUND)	-0.573***	-0.582***	-0.554***	-0.346***	-0.380***	-0.559***
	(0.00602)	(0.00544)	(0.00480)	(0.00327)	(0.0113)	(0.00560)
NESPP4 = 5093, HAKE,SILVER DRESSED	-0.0456***	-0.125***	-0.0479***	-0.0488***	-0.0587***	-0.00659
	(0.0101)	(0.00825)	(0.00731)	(0.00511)	(0.0190)	(0.00941)
NESPP4 = 5094, HAKE,SILVER JUVENILE	0.211***	0.313***	0.186***	0.168***	0.104***	0.194***
	(0.0123)	(0.0124)	(0.00997)	(0.00970)	(0.0273)	(0.0116)
NESPP4 = 5095, HAKE,SILVER LARGE (ROUND)	0.502***	0.535***	0.491***	0.444***	0.461***	0.513***
	(0.00468)	(0.00453)	(0.00347)	(0.00319)	(0.00980)	(0.00426)
NESPP4 = 5096, HAKE,SILVER MEDIUM(ROUND)	-0.204***	-0.0666***	-0.189***	-0.233***	-0.252***	-0.174***
	(0.00727)	(0.00675)	(0.00541)	(0.00472)	(0.0162)	(0.00674)
5091.nespp4#0.mkt__shift	-0.127***	-0.127***	-0.0998***	-0.149***	-0.150***	-0.149***
	(0.00548)	(0.00546)	(0.00401)	(0.00372)	(0.0189)	(0.00468)
5092.nespp4#0.mkt__shift	0.0960***	0.173***	0.0680***	0.0705***	0.104***	0.0767***
	(0.00754)	(0.00692)	(0.00625)	(0.00400)	(0.0222)	(0.00700)
5093.nespp4#0.mkt__shift	0.294	0.295	-0.000582	0.0855	6.129***	0.221
	(0.202)	(0.201)	(0.144)	(0.0963)	(2.247)	(0.198)
5094.nespp4#0.mkt__shift	-0.987***	-1.055***	-1.049***	-0.587***	-0.0417	-1.006***
	(0.0426)	(0.0433)	(0.0401)	(0.0204)	(0.253)	(0.0424)
Recession Indicator = 1	-0.00789					
	(0.00898)					
Daily Landings 000s				-0.000589***	-0.0389***	
				(1.65e-05)	(0.00429)	
Real GDP cap				-0.453***	-2.232***	
				(0.0272)	(0.248)	
Import Quantity				-2.68e-06*	0.000545***	
				(1.61e-06)	(0.000111)	
MeanCond						0.0170***
						(0.000546)
StdDevCond						-0.0244***
						(0.00154)
lnmeancond__Annual						
lnstddevcond__Annual						
Constant		7.827***	1.747***	2.440***		
		(0.349)	(0.225)	(0.108)		
Observations	393,973	394,281	395,462	395,462	395,453	393,973
R-squared	-0.078	-0.053	0.418	0.450	-18.221	0.005
Model	IV	IV	OLS	OLS	IV	IV
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Month Effects	Yes	Yes	Yes	Yes	Yes	Yes
Vessel Effects	Yes	No	Yes	Yes	Yes	Yes
Dealer Effects	Yes	No	Yes	Yes	Yes	Yes
ll	-387093	-407827	-291909	-189067	-864839	-371303
rmse	0.648	0.681	0.507	0.391	2.160	0.622

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Coefficents when we use import quantities as a RHS variable

VARIABLES	(1) IV56 IHS	(2) IV56 IHS	(3) IV57 IHS	(4) IV58 IHS Price	(5) IV59 IHS Price
ihs_ownq	-0.234***	-0.234***	-0.214***	-0.210***	-0.207***
	(0.00498)	(0.00498)	(0.00422)	(0.00415)	(0.00408)
ihs_other_landings	-0.178***	-0.178***	-0.155***	-0.152***	-0.149***
	(0.00686)	(0.00686)	(0.00615)	(0.00608)	(0.00599)
IHS Import Quantity	-0.0590***	-0.0590***	-0.0304***	-0.0327***	-0.0261***
	(0.00935)	(0.00935)	(0.00295)	(0.00298)	(0.00295)
ihsrGDPcapita	-0.620***	-0.620***	-0.920***		
	(0.110)	(0.110)	(0.0164)		
NESPP4 = 5091, HAKE,SILVER KING (ROUND)	0.244***	0.244***	0.243***	0.243***	0.244***
	(0.00809)	(0.00809)	(0.00776)	(0.00771)	(0.00766)
NESPP4 = 5092, HAKE,SILVER SMALL (ROUND)	-0.346***	-0.346***	-0.344***	-0.346***	-0.344***
	(0.00461)	(0.00461)	(0.00447)	(0.00444)	(0.00441)
NESPP4 = 5093, HAKE,SILVER DRESSED	-0.215***	-0.215***	-0.204***	-0.202***	-0.196***
	(0.0113)	(0.0113)	(0.0108)	(0.0108)	(0.0107)
NESPP4 = 5094, HAKE,SILVER JUVENILE	0.0189**	0.0189**	0.00255	-0.00360	-0.00586
	(0.00947)	(0.00947)	(0.00910)	(0.00905)	(0.00900)
NESPP4 = 5095, HAKE,SILVER LARGE (ROUND)	0.230***	0.230***	0.232***	0.233***	0.233***
	(0.00510)	(0.00510)	(0.00493)	(0.00490)	(0.00487)
NESPP4 = 5096, HAKE,SILVER MEDIUM(ROUND)	-0.210***	-0.210***	-0.199***	-0.197***	-0.194***
	(0.00518)	(0.00518)	(0.00503)	(0.00501)	(0.00498)
5091.nespp4#0.mkt_shift	-0.0853***	-0.0853***	-0.0923***	-0.0917***	-0.0922***
	(0.00289)	(0.00289)	(0.00261)	(0.00260)	(0.00260)
5092.nespp4#0.mkt_shift	0.0752***	0.0752***	0.0703***	0.0722***	0.0712***
	(0.00352)	(0.00352)	(0.00330)	(0.00329)	(0.00328)
5093.nespp4#0.mkt_shift	-0.0151	-0.0151	-0.0475	-0.0426	-0.0455
	(0.0771)	(0.0771)	(0.0766)	(0.0764)	(0.0762)
5094.nespp4#0.mkt_shift	-0.446***	-0.446***	-0.449***	-0.443***	-0.440***
	(0.0180)	(0.0180)	(0.0179)	(0.0178)	(0.0177)
FZONE = 3, Offshore	0.0194***	0.0194***	0.0110***	0.00999***	0.00882***
	(0.00160)	(0.00160)	(0.00152)	(0.00151)	(0.00151)
FZONE = 9, Missing	-0.00376*	-0.00376*	0.0151***	0.0176***	0.0220***
	(0.00199)	(0.00199)	(0.00190)	(0.00189)	(0.00188)
BSA = 1, Northern	0.00524	0.00524	0.0284***	0.0295***	0.0337***
	(0.00497)	(0.00497)	(0.00478)	(0.00476)	(0.00474)
BSA = 2, Southern	-0.0161***	-0.0161***	0.0157***	0.0168***	0.0223***
	(0.00473)	(0.00473)	(0.00454)	(0.00452)	(0.00450)
ihsmeancond_Annual			0.670***	0.712***	0.924***
			(0.0287)	(0.0286)	(0.0286)
ihsstddevcond_Annual			-0.114***	-0.0759***	-0.0673***
			(0.00864)	(0.00859)	(0.00856)
ihsrealDPIcapita				-0.740***	
				(0.0134)	
ihspersonal_income_capita					-0.345***
					(0.00652)
Observations	395,453	395,453	395,453	395,453	395,453
R-squared	0.119	0.119	0.162	0.168	0.176
Model	IV	IV	IV	IV	IV
Year effects	No	Yes	No	No	No
Month Effects	Yes	Yes	Yes	Yes	Yes
Vessel Effects	Yes	Yes	Yes	Yes	Yes
Dealer Effects	Yes	Yes	Yes	Yes	Yes
ll	-111164	-111164	-101264	-99718	-97950
rmse	0.321	0.321	0.313	0.312	0.311

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Coefficents when we use import quantities as a RHS variable and the IHS transform

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8 Appendix

8.1 An incomplete list of specification and data issues that I'm worried about

Along with a rating about how worried I am (1-10; 10 will make the paper unpublishable)

1. Changes in market category definitions over time (5) - handled.
2. Changes in market category definitions over space (4?) - don't know why I'm less worried, since we'd need state*category interactions.
3. Heterogenity due to Broad Stock Areas(3) this is probably more of a fishing time issue than an intrinsic quality issue.
4. Misreporting (3)
5. Definition of imports (2)
6. Outliers (1) -I just have to do this
7. Proper disaggregation of q_s – too fancy will have people ask why we aren't estimating an inverse demand system like in Sjöberg (2015). No good answer, except I don't want to.
8. Proper standard errors for year-level rhs variables (7): I just need to be 100% sure that cluster(year) is fine for some variables and cluster(date) or cluster(blah) is fine for others. Or we could just bootstrap it.
9. There's not much variation in fish condition from year to year. Less than the Std dev. Problem?
10. I'm getting unrealistic "income effects" – an elasticity of -1. This number goes way up (to -2) when I drop out the yearly dummies in order to add in condition. There's something funny going on here, but I'm not sure what. The realDPI/capita coeff is smaller in magnitude than the GDP/cap coefficient. The personal income (nominal) is even smaller. How do we justify one or the other? Correlation between fish condition and GDP, income, disposable income is ~0.2 to 0.3
11. Import Pounds or import prices on the RHS. Both are endogenous. Both IV coefficents are in the "right direction" compared to the OLS coefficients.
12. The elasticity of price wrt condition is modest in magnitude... Somewhere around the 0.5 to 1.0 range, depending on the specification. However, this translates into a very small effect. Mean prices are about \$1. And the condition factor is around 100 +/- 5. So a 1 unit increase in the condition factor is approxiamtely a 1% change. This produces a \$0.01 change in silver hake prices.
13. Weighting observations by pounds in that transaction. Yea or Nay.

8.2 Weighting observations

Dumouchel and Duncan (1983) describes a test that looks like a Durbin-Wu-Hausman test for the applicability of Weighted OLS versus OLS. For observations $i = 1, \ldots, n$ the weight matrix W is a diagonal elements w_i. They describe a sampling weight setup where weights are proportional to the $\frac{\pi_j}{n_j}$, where π_j is proportion of the population is in group j and n_j are the number of individuals sampled randomly from group j. Dumouchel and Duncan (1983) advocates for OLS when OLS is approrpriate (duh, it's BLUE). They suggest using weighted OLS if OLS does not pass diagnostics.

> if the sample sizes of the strata, n_j, are not proportional to the population proportions \$pi_j\$ (i.e., the w_i do not approach equality), then $\hat{\beta}$ need not approach β^*

The specification test looks like a Durbin-Wu-Hausman style test. Starting with a model of

```
regress y x
regress y  x Wx
```

and then test all the Wx for significance (don't forget that x contains a constant, so Wx contains W). I suppose you could also do an nR^2 style χ^2 test. Dumouchel and Duncan (1983) illustrates a bunch of ways to do this (that were important when there wasn't much computing power). The writing is a little sloppy, but I think it involves

```
regress x Wx
predict res1, residuals
regress y x res1
```

There's a really nice walk though about how to diagnose/interpret your findings when you get significant coefficients on the Wx variables. For example, the significant Wx variables in their regression are mothers education, county unemployment, race, and sex. They test specifications of the form (i.sex##c.mothers income) but those are not statistically significant. They find that (i.sex##c.county_unemployment) increase model fit. After doing that, they find that there are still some signfiicant Wx variables, so they continue experimenting with the specifications.

Winship and Radbill (1994) basically state that OLS is BLUE. Anything that weights the observations by a positive number will increase the variance of the error term.

> Many individuals' intuition would probably suggest that weighted data should also be used for the estimation of regression models. After all, using the weighted

> data will give covariance and variance estimates that are unbiased and consistent estimates of the quanttiies in the population. Thus the regression estimates should also be unbiased and consistent estimates of the regression model for the entire population.

Winship and Radbill (1994) this is a mistake for three reasons 1. If the original equation was homoskedastic, the new equation will be heteroskedastic. 1. Canned software produces the wrong standard errors 1. The variance is higher.

IMHO, 1 and 2 aren't really big deals anymore.

Diewert (2003) advocates pretty strenuously for weighting by value (compared to quantity or not weighting at all).

> Usually, discussions of how to use quantity or expenditure weights in a hedonic regression are centered around discussions on how to reduce the heteroskedasticity of error terms. In this section, we attempt a somewhat different approach based on the idea that the regression model should be representative. In other words, if model k sold q_{kt} times in period t, then perhaps model k should be repeated in the period t hedonic regression q_{kt} times so that the period t regression is representative of the sales that actually occurred during the period.
>
> Thus our representative approach follows along the lines of Theil's (1967; 136-138) stochastic approach to index number theory, which is also pursued by Rao (2002). The use of weights that reflect the economic importance of models was recommended by Griliches (1971b; 8): "But even here, we should use a weighted regression approach, since we are interested in an estimate of a weighted average of the pure price change, rather than just an unweighted average over all possible models, no matter how peculiar or rare." However, he did not make any explicit weighting suggestions
>
> The problem with quantity weighting is this: it will tend to give too little weight tomodels that have high prices and too much weight to cheap models that have low amounts of useful characteristics. Hence it appears to us that value weighting is clearly preferable. Thus we are taking the point of view that the main purpose of the period t hedonic regression is to enable us to decompose the market value of each model sold, $p_{kt}q_{kt}$, into the product of a period t price for a quality adjusted unit of the hedonic commodity, say P_t, times a constant utility total quantity for model k, Q_{kt}.

However, the context of Diewert is pretty narrow: constructing of a price index. This feels like a direct rebuttal to Winship and Radbill (1994) and Dumouchel and Duncan (1983).

Stata offers probability, importance, analytic, and frequency weights. p-weights are related to sampling design and are not relevant. iweights are a hack. fweights are for duplicate observations (say 1 observation represents 10 sales, or something like that). aweights are similar, but normalize by total N. So each observation can be treated as an average.

8.3 Some misspecified models

VARIABLES	(1) OLS00 Lin	(2) OLS01 Lin	(3) OLS02 Lin	(4) OLS03 Lin	(5) IV01 Lin	(6) IV02 Lin
Log Daily Landings	-0.0573***	-0.0412***	-0.0449***	-0.0488***	-0.417***	-0.340***
	(0.000773)	(0.000748)	(0.000783)	(0.000764)	(0.00612)	(0.00661)
Real GDP cap	-1.551***	-0.370***	-0.373***	-0.416***	-1.734***	-0.302***
	(0.0205)	(0.0287)	(0.0287)	(0.0278)	(0.0266)	(0.0357)
NESPP4 = 5091, HAKE,SILVER KING (ROUND)	0.487***	0.494***	0.494***	0.475***	0.522***	0.514***
	(0.00195)	(0.00181)	(0.00181)	(0.00184)	(0.00247)	(0.00221)
NESPP4 = 5092, HAKE,SILVER SMALL (ROUND)	-0.263***	-0.265***	-0.264***	-0.304***	-0.287***	-0.283***
	(0.00167)	(0.00169)	(0.00169)	(0.00198)	(0.00231)	(0.00213)
NESPP4 = 5093, HAKE,SILVER DRESSED	-0.177***	-0.116***	-0.116***	-0.0820***	-0.194***	-0.144***
	(0.00400)	(0.00402)	(0.00403)	(0.00480)	(0.00624)	(0.00563)
NESPP4 = 5094, HAKE,SILVER JUVENILE	0.161***	0.163***	0.161***	0.104***	0.262***	0.239***
	(0.00891)	(0.00896)	(0.00894)	(0.00928)	(0.0107)	(0.0101)
NESPP4 = 5095, HAKE,SILVER LARGE (ROUND)	0.501***	0.474***	0.474***	0.444***	0.542***	0.512***
	(0.00301)	(0.00278)	(0.00278)	(0.00290)	(0.00376)	(0.00342)
NESPP4 = 5096, HAKE,SILVER MEDIUM(ROUND)	-0.0748***	-0.120***	-0.121***	-0.182***	-0.0413***	-0.0796***
	(0.00380)	(0.00378)	(0.00378)	(0.00410)	(0.00507)	(0.00470)
NESPP4 = 5097, omitted					-	-
Constant	7.496***	2.922***	2.958***	2.771***	12.24***	5.773***
	(0.0817)	(0.112)	(0.112)	(0.110)	(0.133)	(0.156)
Observations	395,770	395,770	395,770	395,770	394,281	394,281
R-squared	0.324	0.379	0.380	0.428		0.099
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Month Effects	No	Yes	Yes	Yes	No	Yes
Day of week effects	No	No	Yes		No	No
Vessel Effects	No	No	No	Yes		
Model	OLS	OLS	OLS	OLS	IV	IV
ll	-230229	-213268	-213012	-197215		
rmse	0.433	0.415	0.415	0.399	0.551	0.499

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: First set of econometrics from silver_hake01.do

8.4 Elasticities

From Bellemare and Wichman (2019):

$$\tilde{x} = arcinh(x) = ln(x + \sqrt{x^2 + 1}) \tag{2}$$

and the derivative of this wrt x is: $\frac{1}{\sqrt{x^2+1}}$

For

$$y = \alpha + \beta \tilde{x} + \varepsilon, \tag{3}$$

the elasticity is:

$$\eta = \frac{\hat{\beta}}{y} \frac{x}{\sqrt{x^2 + 1}} \tag{4}$$

For

$$\tilde{y} = \alpha + \beta x + \varepsilon, \tag{5}$$

the elasticity is:

$$\eta = \hat{\beta} x * \frac{\sqrt{y^2 + 1}}{y} \tag{6}$$

For

$$\tilde{y} = \alpha + \beta D + \varepsilon, \tag{7}$$

the "elasticity" is:

$$\eta = \frac{sinh(\alpha + \beta + \varepsilon)}{sinh(\alpha + \varepsilon)} - 1 \tag{8}$$

Note, you need to have all of the RHS variables and estimated coefficients in the elasticity formula.

For

$$\tilde{y} = \alpha + \beta \tilde{x} + \varepsilon, \tag{9}$$

the elasticity is:

$$\eta = \hat{\beta} \frac{\sqrt{y^2 + 1}}{y} \frac{x}{\sqrt{x^2 + 1}} \tag{10}$$

Note that some of the elasticities are undefined when $y = 0$. Bellemare and Wichman (2019) illustrates computing at means of the data; since we don't have any $y = 0$ in our dataset, we can also sample enumerate.

VARIABLES	(1) IV13 IHS	(2) IV14 IHS	(3) IV32 IHS	(4) IV34 IHS
ihs_ownq	-0.299***	-0.216***	-0.290***	-0.231***
	(0.0206)	(0.0162)	(0.0189)	(0.0187)
ihs_other_landings	-0.254***	-0.165***	-0.239***	-0.186***
	(0.0261)	(0.0210)	(0.0250)	(0.0241)
ihsrGDPcapita	-5.154***	-0.636***	-0.964***	-0.722***
	(0.442)	(0.0529)	(0.0629)	(0.0627)
NESPP4 = 5091, HAKE,SILVER KING (ROUND)	0.253***	0.226***	0.237***	0.242***
	(0.0215)	(0.0171)	(0.0218)	(0.0187)
NESPP4 = 5092, HAKE,SILVER SMALL (ROUND)	-0.271***	-0.277***	-0.281***	-0.272***
	(0.0103)	(0.00838)	(0.0104)	(0.00888)
NESPP4 = 5093, HAKE,SILVER DRESSED	-0.281***	-0.250***	-0.286***	-0.235***
	(0.0306)	(0.0245)	(0.0312)	(0.0259)
NESPP4 = 5094, HAKE,SILVER JUVENILE	0.0786***	0.0336**	0.0553***	0.0596***
	(0.0214)	(0.0170)	(0.0213)	(0.0190)
NESPP4 = 5095, HAKE,SILVER LARGE (ROUND)	0.305***	0.274***	0.295***	0.277***
	(0.0135)	(0.0115)	(0.0138)	(0.0121)
NESPP4 = 5096, HAKE,SILVER MEDIUM(ROUND)	-0.0732***	-0.0926***	-0.0686***	-0.0972***
	(0.0116)	(0.0106)	(0.0120)	(0.0107)
NESPP4 = 5097, omitted	-	-	-	-
MeanCond			0.00701***	0.00302*
			(0.00155)	(0.00154)
StdDevCond			0.00622*	0.00371
			(0.00355)	(0.00307)
Real Import Price			0.0118	
			(0.0176)	
ihsprice_allIMP_R_GDPDEF				0.193***
				(0.0472)
Constant	14.81***	4.543***	5.302***	4.354***
	(0.976)	(0.291)	(0.346)	(0.349)
Observations	395,761	395,761	395,761	395,761
R-squared		0.165		0.133
Year effects	Yes	No	No	No
Month Effects	No	Yes	no	Yes
Day of week effects	Yes	Yes	Yes	Yes
Vessel Effects	No	No	No	No
Model	IV	IV	IV	IV
rmse	0.377	0.333	0.377	0.340

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Second set of econometrics also from silver_hake01.do

VARIABLES	(1) IV31 Log	(2) IV32 Log	(3) OLS32 Log	(4) OLS33 Lin	(5) IV33 Lin
Log Daily Landings	-0.553***	-0.565***	-0.0653***		
	(0.0113)	(0.0118)	(0.000934)		
Log Real Import Price	0.611***	0.594***	-0.150***		
	(0.0568)	(0.0558)	(0.00819)		
NESPP4 = 5091, HAKE,SILVER KING (ROUND)	0.599***	0.622***	0.564***	0.556***	0.620***
	(0.00458)	(0.00459)	(0.00306)	(0.00300)	(0.0120)
NESPP4 = 5092, HAKE,SILVER SMALL (ROUND)	-0.571***	-0.576***	-0.552***	-0.344***	-0.390***
	(0.00620)	(0.00547)	(0.00479)	(0.00326)	(0.0123)
NESPP4 = 5093, HAKE,SILVER DRESSED	-0.0372***	-0.139***	-0.0481***	-0.0497***	-0.000159
	(0.0105)	(0.00842)	(0.00734)	(0.00513)	(0.0223)
NESPP4 = 5094, HAKE,SILVER JUVENILE	0.202***	0.346***	0.168***	0.155***	0.157***
	(0.0127)	(0.0130)	(0.00995)	(0.00963)	(0.0310)
NESPP4 = 5095, HAKE,SILVER LARGE (ROUND)	0.509***	0.556***	0.491***	0.445***	0.469***
	(0.00487)	(0.00471)	(0.00346)	(0.00318)	(0.0106)
NESPP4 = 5096, HAKE,SILVER MEDIUM(ROUND)	-0.199***	-0.0529***	-0.190***	-0.233***	-0.250***
	(0.00752)	(0.00694)	(0.00541)	(0.00471)	(0.0172)
5090b.nespp4#0.mkt_shift	0.896***	0.977***	0.956***	0.521***	-0.0345
	(0.0440)	(0.0457)	(0.0406)	(0.0214)	(0.281)
5091.nespp4#0.mkt_shift	0.767***	0.877***	0.858***	0.373***	-0.217
	(0.0441)	(0.0458)	(0.0406)	(0.0215)	(0.281)
5092.nespp4#0.mkt_shift	0.997***	1.187***	1.029***	0.594***	0.0606
	(0.0443)	(0.0460)	(0.0408)	(0.0215)	(0.280)
Log Real GDP cap	-1.158***	-1.137***	-1.189***		
	(0.221)	(0.227)	(0.164)		
FZONE = 3, Offshore	0.0400***	0.0546***	0.00728***	0.0128***	0.169***
	(0.00340)	(0.00342)	(0.00246)	(0.00188)	(0.0206)
FZONE = 9, Missing	-0.0220***	-0.00154	-0.00598*	0.00171	-0.161***
	(0.00410)	(0.00367)	(0.00323)	(0.00238)	(0.0274)
BSA = 1, Northern	0.0269***	0.0252***	0.0272***	0.0105*	0.0999***
	(0.0104)	(0.00663)	(0.00779)	(0.00562)	(0.0350)
BSA = 2, Southern	-0.0466***	0.0460***	-0.0288***	-0.0134**	-0.0422
	(0.00997)	(0.00645)	(0.00758)	(0.00546)	(0.0338)
Daily Landings 000s				-0.000589***	-0.0406***
				(1.62e-05)	(0.00427)
Real GDP cap				-0.425***	-2.538***
				(0.0274)	(0.265)
Real Import Price				-0.126***	1.601***
				(0.00462)	(0.293)
Constant		5.935***	0.842***	2.001***	
		(0.337)	(0.228)	(0.109)	
Observations	393,973	394,281	395,462	395,462	395,453
R-squared	-0.141	-0.118	0.417	0.450	-20.023
Model	IV	IV	OLS	OLS	IV
Year effects	Yes	Yes	Yes	Yes	Yes
Month Effects	Yes	Yes	Yes	Yes	Yes
Vessel Effects	Yes	No	Yes	Yes	Yes
Dealer Effects	Yes	No	Yes	Yes	Yes
ll	-398299	-419689	-292051	-188932	-882556
rmse	0.667	0.702	0.508	0.391	2.259

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Third set of econometrics from silver_hake02.do

VARIABLES	(1) IV34 Log	(2) IV35 Log
Log Daily Landings	-0.513***	-0.513***
	(0.00941)	(0.00941)
Log Real Import Price	0.558***	0.561***
	(0.0216)	(0.0216)
NESPP4 = 5091, HAKE,SILVER KING (ROUND)	0.601***	0.601***
	(0.00439)	(0.00439)
NESPP4 = 5092, HAKE,SILVER SMALL (ROUND)	-0.565***	-0.564***
	(0.00600)	(0.00601)
NESPP4 = 5093, HAKE,SILVER DRESSED	-0.0185*	-0.0184*
	(0.00992)	(0.00992)
NESPP4 = 5094, HAKE,SILVER JUVENILE	0.103***	0.103***
	(0.0128)	(0.0128)
NESPP4 = 5095, HAKE,SILVER LARGE (ROUND)	0.503***	0.503***
	(0.00467)	(0.00467)
NESPP4 = 5096, HAKE,SILVER MEDIUM(ROUND)	-0.191***	-0.191***
	(0.00719)	(0.00719)
5090b.nespp4#0.mkt_shift	0.0354***	0.0364***
	(0.00717)	(0.00718)
5091.nespp4#0.mkt_shift	-0.0981***	-0.0971***
	(0.00696)	(0.00697)
5092.nespp4#0.mkt_shift	0.131***	0.132***
	(0.00899)	(0.00900)
Log Real GDP cap	-1.877***	-1.874***
	(0.0330)	(0.0330)
FZONE = 3, Offshore	0.0361***	0.0362***
	(0.00325)	(0.00325)
FZONE = 9, Missing	-0.0171***	-0.0174***
	(0.00395)	(0.00395)
BSA = 1, Northern	0.0365***	0.0363***
	(0.0100)	(0.0100)
BSA = 2, Southern	-0.0183*	-0.0185*
	(0.00956)	(0.00956)
MeanCond	0.00624***	
	(0.000667)	
StdDevCond	-0.0212***	
	(0.00137)	
lnmeancond_Annual		0.620***
		(0.0653)
lnstddevcond_Annual		-0.235***
		(0.0151)
Observations	393,973	393,973
R-squared	-0.077	-0.078
Model	IV	IV
Year effects	No	No
Month Effects	Yes	Yes
Vessel Effects	Yes	Yes
Dealer Effects	Yes	Yes
ll	-386980	-387066
rmse	0.648	0.648

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: set of econometrics from silver_hake02.do