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THE DIFFERENTIATED IMPACT OF SEA LICE TREATMENTS ON SALMON CENTERS UNIT PRODUCTION COSTS.

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MOTIVATION

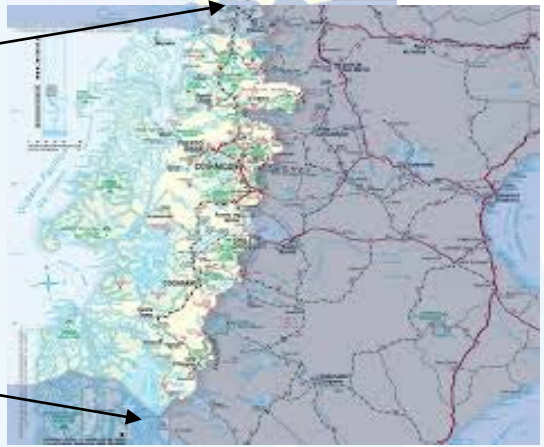
a. Uniform regulatory design might have differentiated impacts on competitiveness when environmental conditions differ between different economic units.

b. One case is the control and prevention of disease in the salmon growing centers.

c. We evaluate the impact of sanitary regulations on unit production costs for a heterogeneous sample of salmon production centers in Southern Chile.

Los Lagos Region

Aysen Region



SOME BACKGROUND

a. In 2007 a disease outbreak (the so called ISA virus) affected the Chilean salmon industry. Up to that point the industry was very cost competitive in world markets.
b. The disease has a large impact on production, employment, and financial stability of the salmon firms.
c. To prevent future events, a new sanitary and environmental regulatory framework was launched by 2009.
d. One of the pillars of the new regulatory framework is a system that compels centers to treat different types of pathogens once these surpass certain pre-established abundancy levels.

SOME BACKGROUND

e. This system has helped to control sanitary conditions, but contributed to increase production costs, jeopardizing the Chilean firms external competitiveness.

Production cost per kg of Atlantic salmon, HOG, Fob

	2005	2015
Norway	2,23	3,45
Chile	1,94	4,51
Great Britain	2,89	4,15
Faroe islands	3,19	3,3

Source: Marine Harvest

Sea lice *Caligus rogercresseyi*

A major parasite of concern on salmon farms in Chile

Two types of treatment: Feed treatment in the first months of the cycle and bath treatment along the cycle

SUMMARY OF ANALYTICAL APPROACH

a. We develop a simultaneous growth model for salmon and for sea lice level over a production cycle.
b. Within this model we explore the way sea lice and sea lice treatment affects salmon growth.
c. We identify different potential channels for the interaction of sea lice and sea lice treatment on salmon growth:
    a. The presence of sea lice affects directly salmon growth capacity
    b. The presence of sea-lice can also affect the dietary need of salmon along the cycle
    c. The reaction of the producer to sea lice, by applying treatments, might affect directly the growth of salmon
    d. Indirect treatment effect through sea lice evolution

ANALYTICAL APPROACH, cont

d. We estimate the model and identify the impact of different exogenous factors on salmon production (feeding, water temperature, fish age, fish density, sea lice abundance, seasonal factors, treatment variables, and interactive variables) and sea lice abundance.
e. We parametrize the salmon production growth function with costs parameters to obtain unit production costs.
f. We assess a discounted cost model for a complete growth cycle to calculate the impact of treatments on unitary cost of salmon production (US$/kg)
g. We simulate several scenarios to obtain information of how sensible unit costs are to different conditions.

DATA AND ESTIMATION APPROACH.

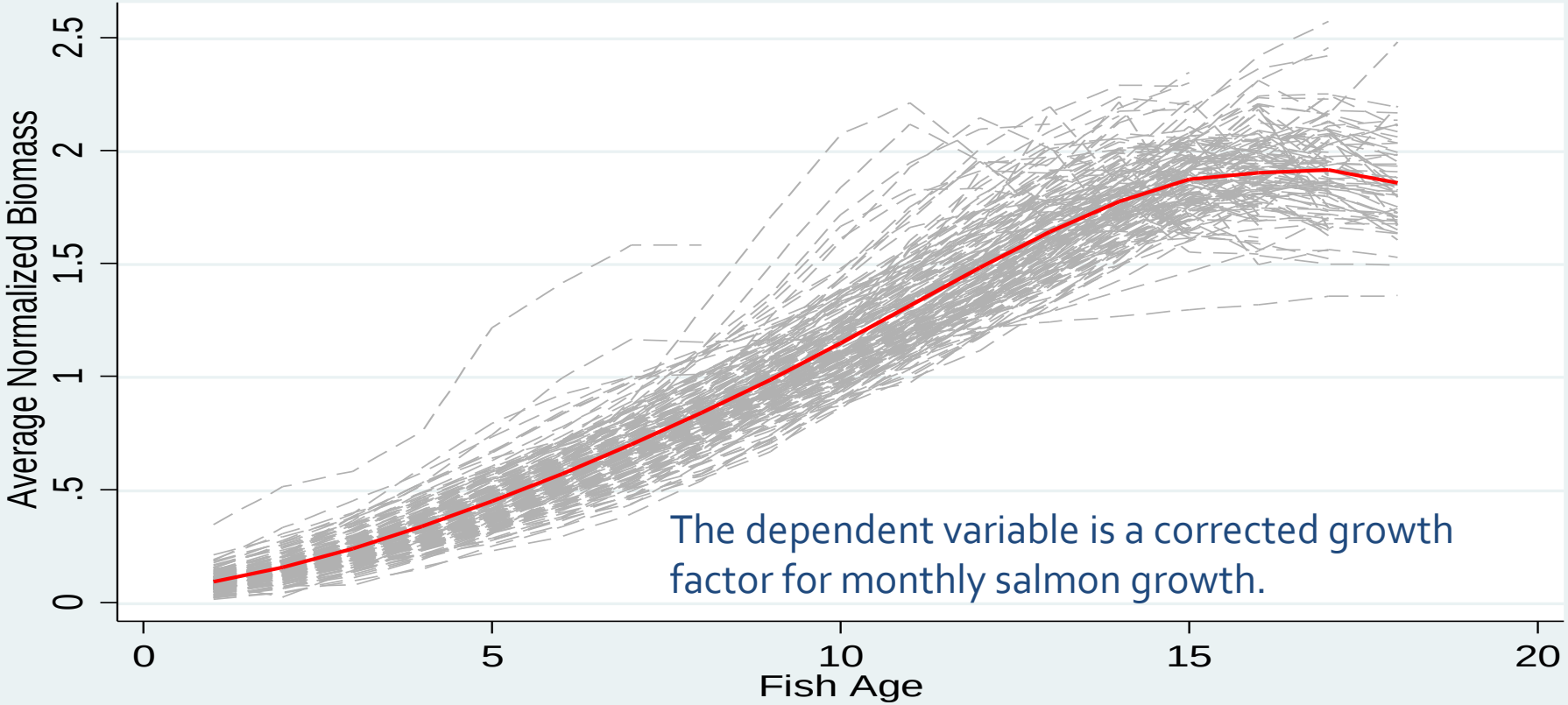
a The data is a duration data sample. Time is relative to the initiation of the production cycle and measured in months, where t=1,…, T. Thus time t=1 is the first month in the cycle, and t=T is the harvest month in the cycle. We have 4,267 observations (month – cycle) over the period 2011-2014.

b We estimated a panel fix effects model for a sample of complete (maximum) 18 – months production cycles. A sample of 1,975 observations and 128 complete cycles is used.

c We estimated the model for subsamples of centers by region, by year, and by location (marine and estuarine centers)

Biomass corrected (All mortalities) v/s Fish age

Only cycles with a maximum duration of 18 months



Some results for the base estimation model

Feed	.0003595***
Fish Age^2	.0017803***
Fish Age # Feed	-4.09e-06
L.Temperature10	-.0137239*
L.Temperature10^2	-.0006521
L.Density	-.0053892***
Fish Age # Bath Dummy	.0025486**
Bath Dummy	-.022287*
Lice (Adult Mobile)	-.0026407***
N of feed treatment	.0148838**
Fish Age	-.061026***
Constant	.599685***
N	1975
R^2	.828201

Notes: *** significance at the 1%, ** significance at the 5%, * significance at the 10%

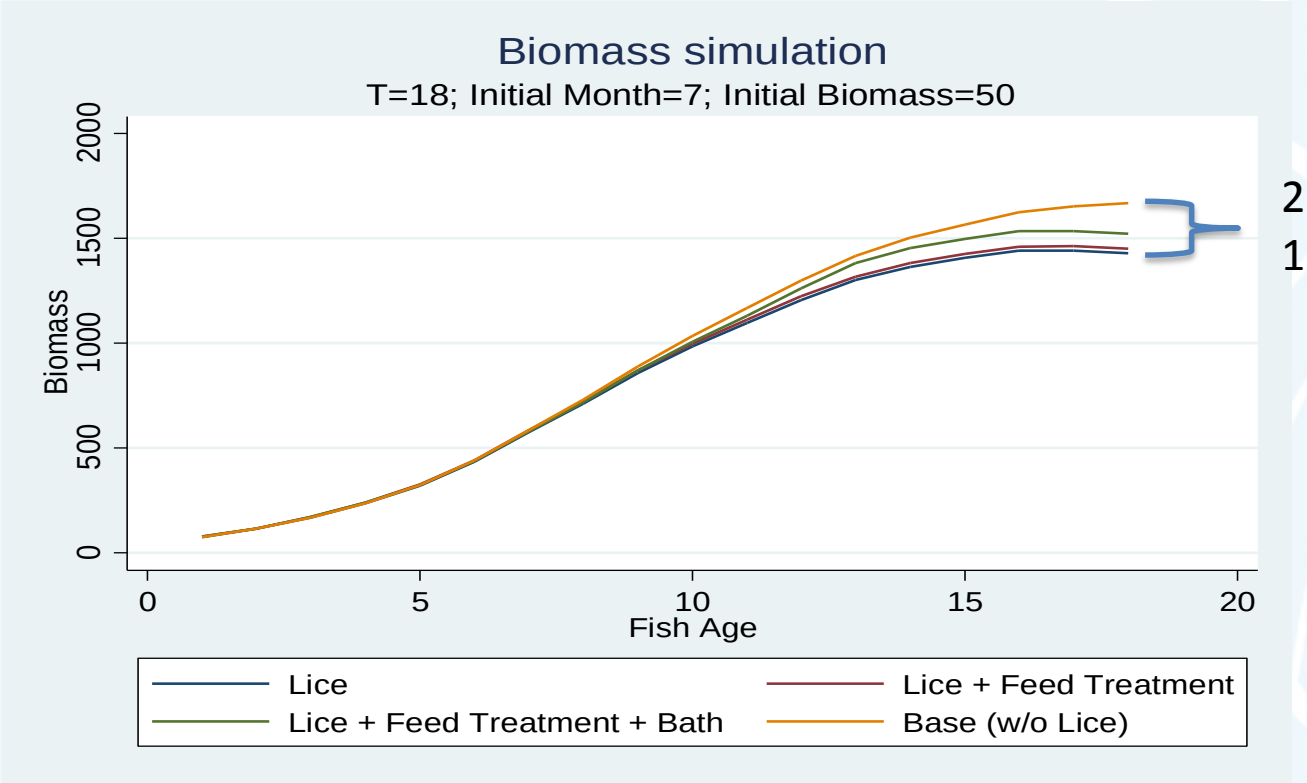
The model also includes 11 monthly seasonal variables and 11 interactive variables “season - fish age”.

Reduced negative effect with fishage

Negative as expected

- We used the estimated model to simulate the effect of different scenarios on biomass growth and consequently on unitary cost of production of salmon.
  - A base scenario without sea lice and treatment costs
  - A scenario with sea lice
  - A scenario with sea lice and feed treatment (first three months)
  - A scenario with sea lice, feed treatment, and bath treatment
- We simulate these scenarios for all the sample, and for subsamples (by region and by marine – estuarine location of the center for both biomass growth and unitary production costs.

The effect of sea lice and treatment on biomass growth



270 tons!
15.1%

The effect of sea lice and treatment on unitary costs

Table. Estimated cost (USD) per harvested kilo

Scenario	All	Sub-samples			
		X Region	XI Region	Marine	Estuarine
Lice	2.268	2.428	2.135	2.188	2.000
Lice and feed treatment	2.237	2.381	2.144	2.158	1.959
Lice, feed treatment and bath	2.433	2.564	2.342	2.281	2.753
Base	1.926	1.619	1.808	1.843	1.957

Note: The estimated cost includes only feed and treatment costs in the salmon fatting industry.

Preliminary conclusions

- Sea lice and treatments have a significant impact on unitary production costs for Chilean salmon centers. The estimated impact on average is 0.5 US$ per kg.
- The most important cost effect is produced by sea lice itself. According to our estimates the cost per kg salmon is aprox. 34 cents of US$, in our base scenario. This extra cost is produced by the direct negative effect that sea lice has on salmon growth.
- Bath treatment is effective in increasing biomass volume at the end of the cycle, relative to a situation with lice and without bath treatment. However, the treatment is so expensive that the higher biomass gains are impaired by higher treatment costs, leaving the unitary production costs similar to or even higher than in the situation without bath treatment.

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Thank you for your attention!

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The effect of sea lice and treatment on estimated biomass

Table. Estimated biomass at fish age of 18 month

Scenario	All	Sub-samples			
		X Region	XI Region	Marine	Estuarine
Lice	1524.4	1502.8	1459.7	1495.2	2163.1
Lice and feed treatment	1545.3	1533.0	1453.9	1515.9	2208.5
Lice, feed treatment and bath	1622.8	1615.2	1533.3	1672.6	1754.7
Base	1794.7	2253.6	1724.0	1775.3	2210.4