



UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Economic Effects from Covid-19 Pandemic on Swedish Shrimp Fishers

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Were revenues for Swedish shrimp fishers reduced due to the Covid-19 pandemic?

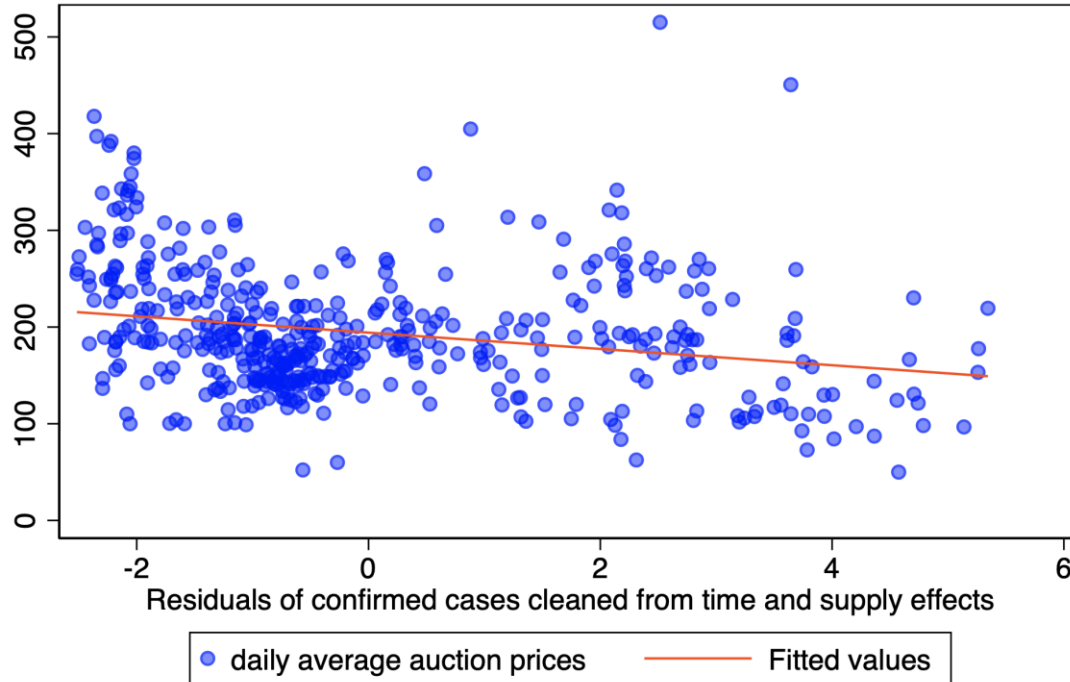
- A majority of the Swedish shrimp fishers themselves claim they suffered from reduced prices due to the Pandemic.
- This paper aims to find whether governmental aid to fishers was justified.
- Our findings support the shrimp fishers and indicate a revenue loss of 20 SEK/kg (-9.60 %) for boiled shrimp.

Relation between price and demand

- We wish to examine a shift in demand based on auction prices
- Auction of fresh commodities creates daily clearance
- To observe changes in demand, supply must be controlled for.
- Since supply is likely to be endogenous, we use predicted values for supply based on weather observations

Was there a correlation between shrimp prices and Swedish covid-19 cases

Relation between auction prices and confirmed cases of Covid-19 in Sweden
march 2020-dec 2021



- y-axis - auction prices
- X-axis - residuals of confirmed Covid-19 cases cleaned from time and supply effects

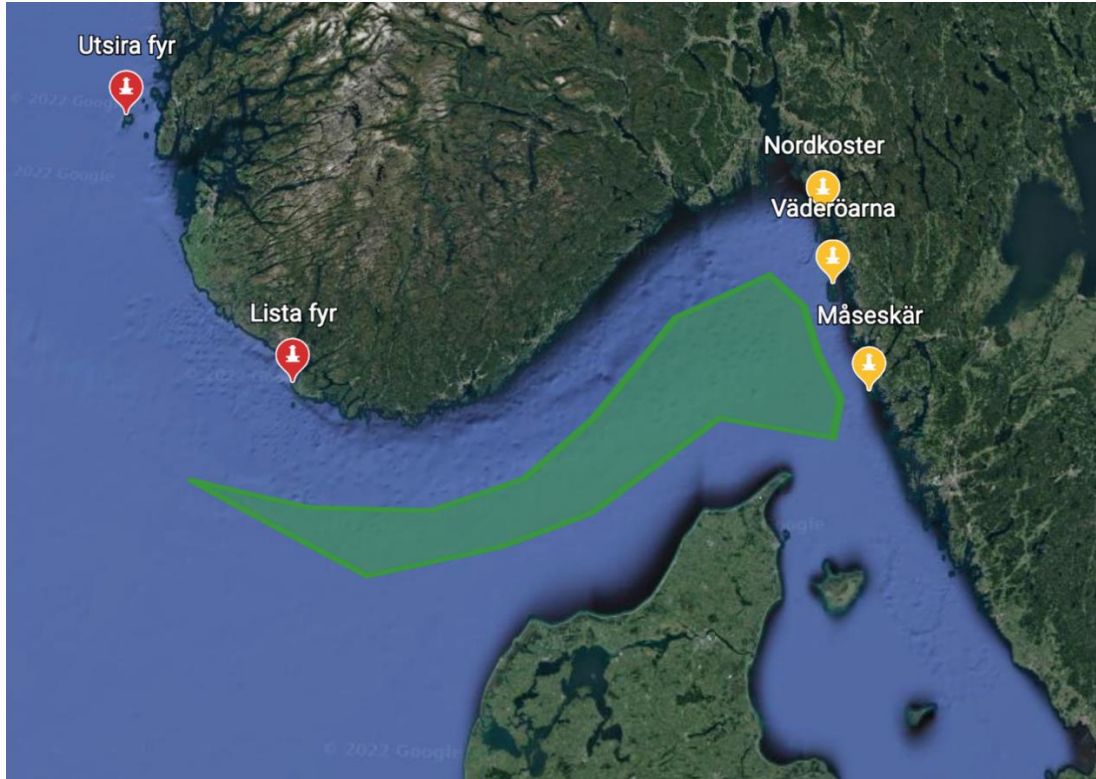
Structure of the presentation

- Swedish Shrimp fishery – a quick overview
- Brief introduction to previous research
- Short description of data used
- Empirical model
- Results
- Conclusion

Swedish shrimp fishery – a quick review

- Swedish shrimp fishery is regulated by a TAC (Total allowable Catch) system with annual quotas decided by EU in collaboration with Norway.
- From this TAC, Sweden has 14 %, Denmark 26% and Norway 60%
- On top of Sweden's quota, Swedish shrimp fisher also have access to 123 tons of the Norwegian quota.
- The majority of Swedish shrimp fishery is done in Skagerrak, close to the Swedish coastline and in the eastern part of the Norwegian trench.

Where do Sweden fish shrimp ?



- Close to the west coast
- Norwegian trench
- Some fishing also in Kattegat
- Väderöarna and Lista fyr
- The other weather stations?
- Map is based on Björk(2016)

Swedish shrimp fishery – a quick review

- The quotas are for all landed shrimp, but only those larger than 160 shrimps/kg are boiled on board and later sold as boiled shrimp.
- Smaller shrimp are also landed, but sold at a much lower price, going to the food industry.
- This do result in some high grading. Even though since 2009 forbidden ICES (2021) suggests 10 % for 2018-2020
- Swedish shrimp represent about 1 percent of landed weight in Sweden, but the value represents up to 20 percent of Swedish landings

Swedish shrimp fishery – a quick review

- Boiled shrimp are sold at auctions in Gothenburg and Smögen at an average price of 182 SEK/kg with big price differences depending on weekday and time of the year. On rare occasions as high as 650 SEK/kg.
- The auctions are held in the style of an English auction where the highest bidder buys the lot at that bid.
- This type of fresh commodity auction creates daily market clearance (We come back to the importance of this)

Theoretical framework – why Covid-19 could affect prices

- If an activity is related with a **perceived risk**, the decisionmaker is likely to protect themselves. This could in our case mean avoiding restaurants.
- **Consumption substitution** occurs because of both economic and behavioural effects --> Shift from superior good (restaurants) to inferior alternative (frozen fish)

Literature Review

- Janssen et al (2021) --> Study of Denmark, Germany, Slovenia, Covid 19 cause reduction in how often people engage in shopping for food (stores instead of restaurants, buying in bulk), and shift of consumption from fresh food to frozen food and non-perishables. The study suggests shift in consumption because of fear of catching the virus.
- FAO (Food and Agriculture Organization of the United Nations, 2020) Demand for frozen and packaged aquatic products increased, demand for fresh fish decreased. Where Covid-19 hit hard economically, demand for canned mackerel, sardines and tuna went up, whilst demand for luxury sea-food like lobster went down

Data

- Data on daily landed weights as well as daily average auction prices for boiled shrimp for time period 2018-2021 was collected by Swedish Agency for Marine and Water Management (SWAM)
- Data on wind gusts from two different weather stations was collected from Swedish Meteorological and Hydrological Institute (SMHI) and Norwegian Centre for Climate Services (NCCS)
- Data on confirmed Swedish Covid-19 cases were collected from Public Health Agency of Sweden. From this data a moving average over seven days for confirmed cases in thousands was created.

Data

Variable	Obs	Mean	Std. Dev.	Min	Max
price day	1093	181.70	59.49	22.37	515.11
weight date	1093	2228	1899	3.0	14705
gust Väderöarna	1092	10.26	4.22	2.22	25.57
gust Lista fyr	1050	14.59	4.94	4.40	33.10
cases 1000	490	1.909	1.951	.044	7.442

- Price per day → 182 SEK average (2018-2021)
- Weight → Big SD with an average of 2228 Kg
- Wind gusts → gust is defined as a temporary increase in wind not lasting longer than 20 secs.
- Confirmed Covid Cases → big variation over time with an average of 1909 new cases per day over the period. (mid March 2020 – dec 2021)

Empirical approach - comments

- Since we have reasons to believe that landed weights are endogenous, landed weights are instead predicted based on measured wind gusts at weather stations Väderöarna and Lista lighthouse.
- This predicted value for landed weight is then used to control for variances in supply.

Empirical approach

$$p_t = \beta_0 + \beta_1 * Cases_{t-2} + \beta_2 * Cases_{t-2}^2 + \beta_3 * \widehat{weight}_t + \beta_4 * timeeffects_t + \varepsilon_t$$

- $p_t \rightarrow$ measure for daily average auction prices for boiled shrimp at Swedish fish auctions
- $Cases_{t-2} \rightarrow$ measure for daily confirmed Swedish cases of Covid-19 (Smoothed over 7 days with a 2 lag)
- Since the effect from confirmed cases is likely to be diminishing, squared values are included
- $\widehat{weight}_t \rightarrow$ measure for landed weights to control for supply of boiled shrimp
- $timeeffects_t \rightarrow$ Controlling for day of the week as well as year.
- $\varepsilon_t \rightarrow$ stochastic error term

Empirical approach – predicted landed weights

$$\widehat{weight}_t = \alpha_0 + \alpha_1 * gust_Väderöarna_{t-1} + \alpha_2 * gust_Lista_fyr_{t-1} + \alpha_3 * time_effects_t + \gamma_t$$

- $gust_xy_{t-1} \rightarrow$ measure for daily highest wind gust at our two observed weather stations with a one-day lag.
- $time_effects_t \rightarrow$ Controlling for day of the week as well as year.
- $\gamma_t \rightarrow$ stochastic error term

Estimator

- OLS is the Best Linear Unbiased Estimator
 - The dependent variable is linearly dependent on the independent variables, who are of full rank.
 - With the help of instrumental variables exogeneity assumption holds
 - Heteroscedastic error terms can't be ruled out, therefore robust standard errors are being used

Results

VARIABLES	Pandemic
cases_1000	-15.1395** (6.3733)
c.cases_1000#c.cases_1000	1.1713 (0.9954)
weight_instrument	-0.0457*** (0.0102)
Constant	231.8420*** (19.6063)

i.day	yes
i.year	yes
Observations	460
R-squared	0.2388

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

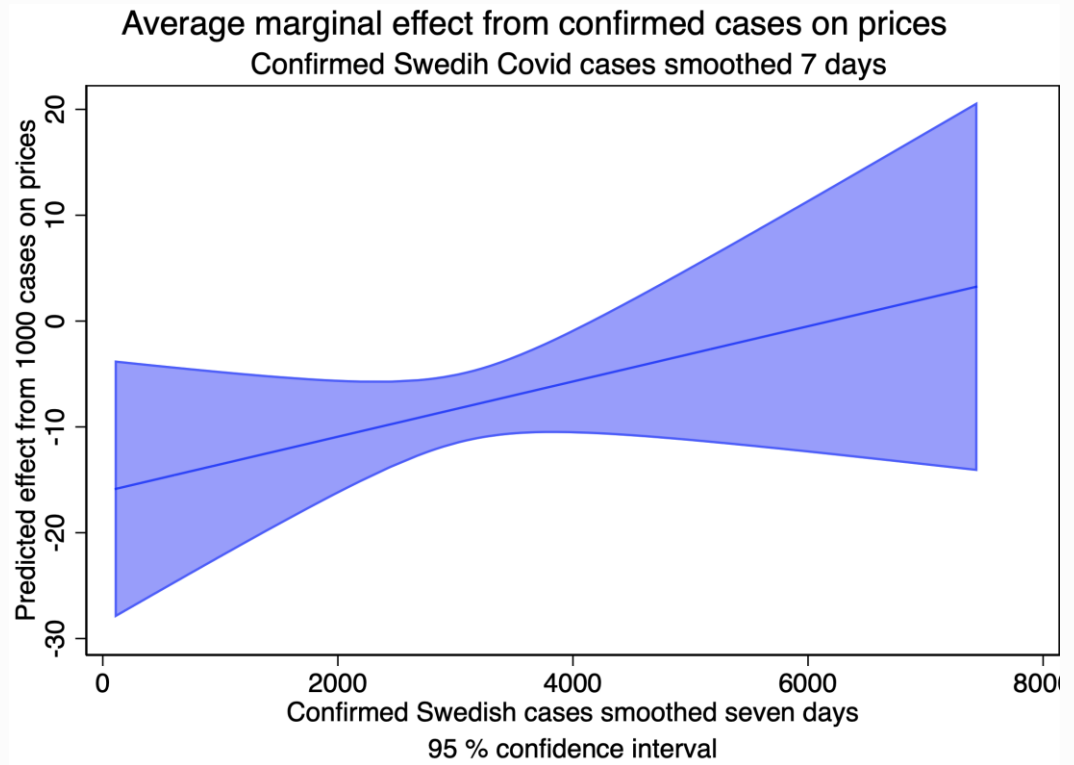
- Dependent variable is daily average price
- Negative and significant marginal effect from cases on prices
- Positive effect from squared values of cases; the more cases the weaker the effect.
- Predicted weight is negative and significant, Increase in landed weights > price goes down

Results

- Negative but diminishing effect from cases on prices.
- At the average value of confirmed new cases per day (1909) the effect is - 20.37 SEK/Kg (-9.60%)
- This represents a total loss of 22.1 MSEK (during March 2020 until dec 2021)
- Divided by about 50 shrimp boats, resulting in an average loss of 440 000 SEK/boat

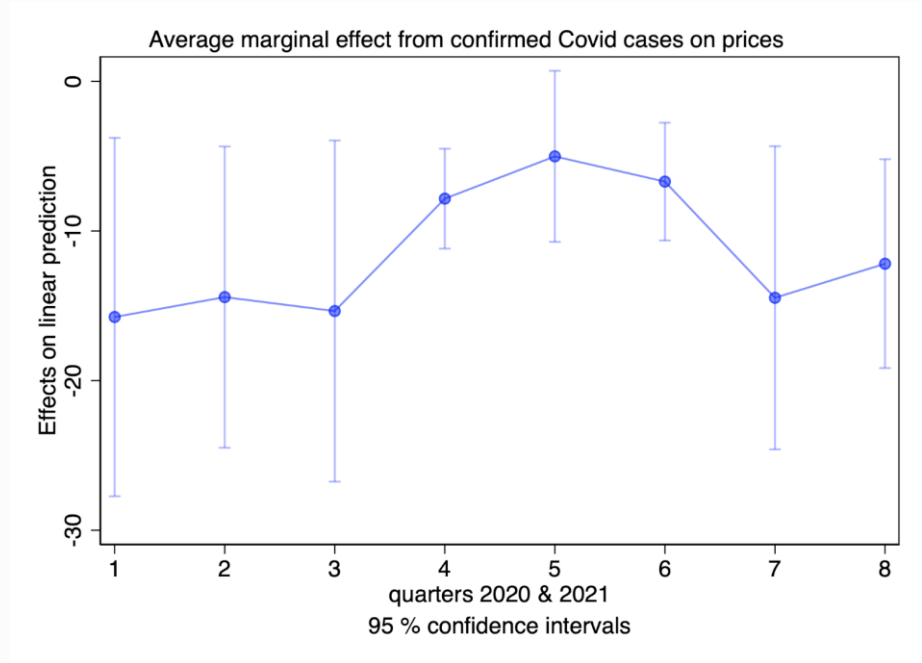
Diminishing effect

- The predicted marginal effect from confirmed cases on prices is diminishing.



Predicted marginal effects over quarters 2020 & 2021

- Predicted marginal effect from confirmed Covid cases on prices.
- The effect cannot be said to be different from 0 in quarter 5. This is because of the diminishing effect of each case on shrimp prices when covid-19 cases were high.



Conclusions

- Swedish shrimp fishers lost about 22.1 MSEK in revenues due to decreased prices caused by the Covid-19 Pandemic during March 2020 until December 2021.
- Since regulations in Sweden were fairly relaxed, a big part of the effect is due to a perceived risk of being infected rather than upon regulations
- If Swedish authorities are to follow EU-recommendations the shrimp fishers should be compensated accordingly. Since landed volumes differ for different operators perhaps compensations should be related to landed weights

Further comments

- To proceed, it would be interesting to compare these results with the effect from Covid-19 on prices for cray fish and perhaps also for cod.
- We know that there is also a strong seasonal effect on demand for shrimp. We fail to control for this effect since this would also catch the seasonal effect from the Covid-19.



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A different approach

- 2021 Chen, Quian & Wen presented:

The Impact of the COVID-19 Pandemic on Consumption: Learning from High Frequency Transaction Data

- They used a diff in diff approach with a previous year as control period

A different approach

- $p_t = \beta_0 + \beta_1 * pandemic_t + \beta_2 * \widehat{weight}_t + \beta_3 * time_t + \epsilon_t$
- This method indicates a loss of 20.84 SEK/kg
- Consistent with OLS result

VARIABLES	2018-2021
pandemic	-20.8365** (8.6662)
weight_instrument_2	-0.1030*** (0.0099)
Constant	361.2113*** (24.4406)
i.day	yes
i.month	yes
i.year	yes
Observations	1050
R-squared	0.3498

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

Data

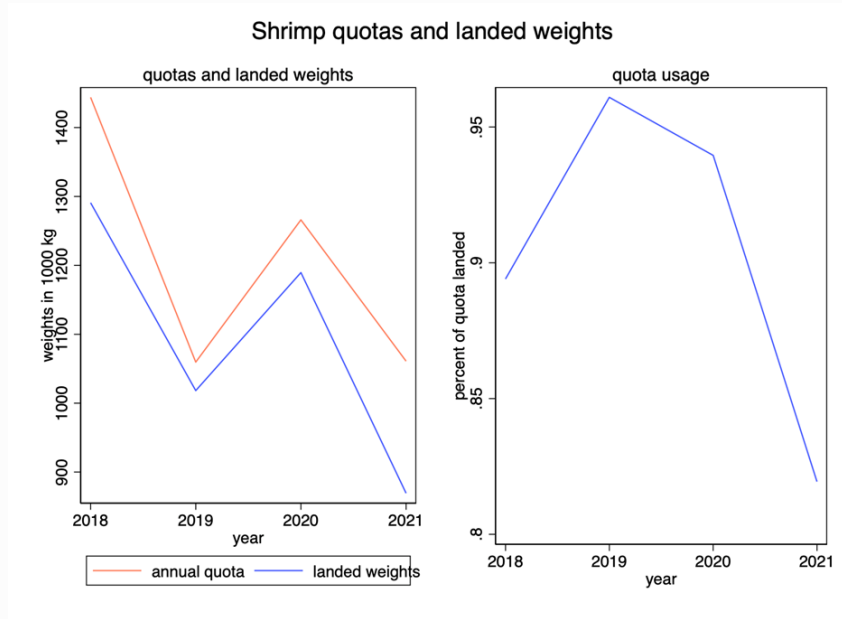
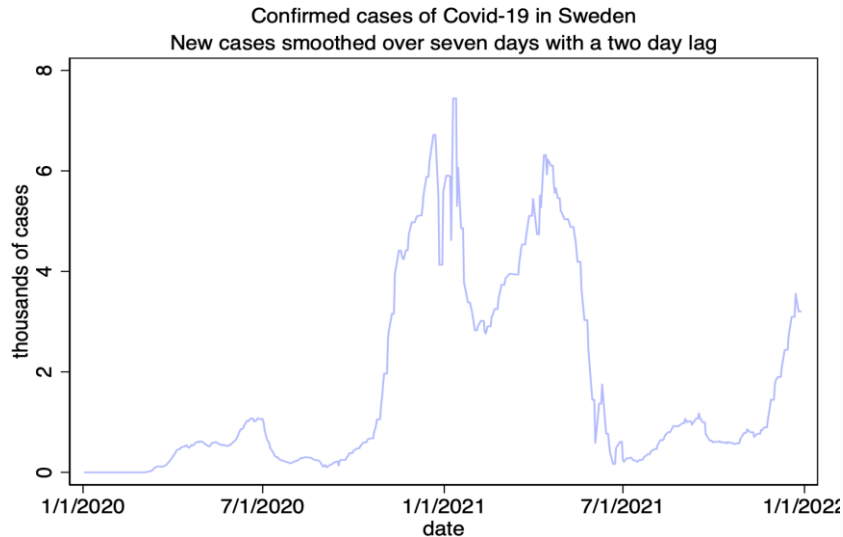


Figure 1 – Orange line
→ Quota available, Blue
line → Quota that was
used

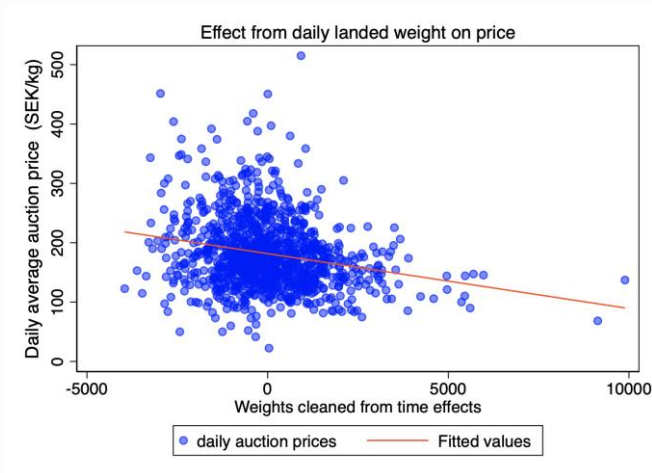
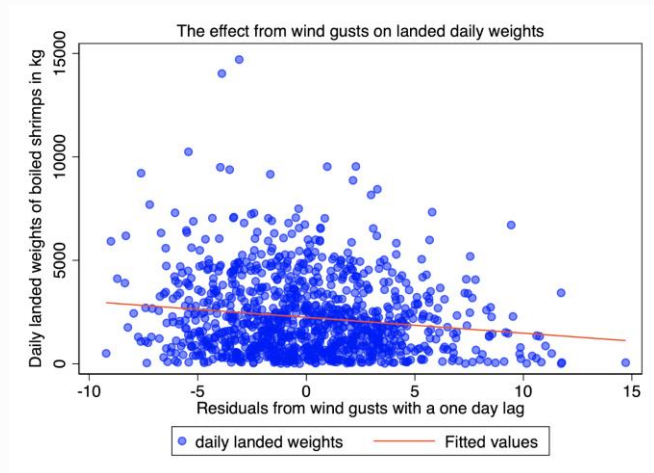
Figure 2 – Quota usage
in percent lower in 2021
than previous years.

Pattern of confirmed Covid-19 cases in Sweden.



- Confirmed cases of Covid-19 Smoothed over 7 days (to account for days where there was no reporting) and two day lag to account for knowledge of the spread
- Little observations middle 2020. We theorize because of little testing
- 3 main spikes, one at end of 2020, one in spring 2021, and one at the end of 2021.

Weight on wind gusts and price on landed weight



The expected result was that higher level of wind gusts means less landed weights, resulting in higher prices. This expectations are confirmed by the graphs