

The effect of eco-certification on demand

- The case of MSC-certified Norway lobster



The effect of eco-certification on demand: the case of MSC-certified Norway lobster

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Abstract

We investigate if Marine Stewardship Council (MSC) certified Norway lobster fishing vessels in Sweden got higher prices and sold larger quantities after certification was introduced in 2015. Using detailed daily panel data and exploiting the fact that the same fishing water contains both certified and non-certified vessels, we use a difference-in-difference model for analysing demand effects of MSC-certification. We find a price premium the first months after the launch of the certification scheme for the initial adopters. However, this price premium dissipates over time and is mainly found for trawler vessels. For trawlers, we also find a negative effect on sold quantities the first months after certification but a positive effect a few years after certification. Creelers, on the other hand, got a positive effect on quantities sold both immediately after certification and after a few years. No general effect of MSC certification is found on neither prices nor quantities when the entire period January 2012 – January 2018 is investigated.

Keywords: Marine Stewardship Council, price premium, Norway lobster, difference-in-difference

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1. Introduction

The overexploitation of resources and lack of sustainable management is well documented in the fishery sector (Worm et al., 2009; FAO, 2020; Arnason et al., 2009). Although regulatory responses have attempted to address the sustainability issues, and that some progress has been made, the actions taken so far has not been enough to reverse the global trend of overfished stocks (FAO, 2020). As an alternative to mandatory regulation, eco-certification has been developed as a market-based response to the overexploitation of natural resources.

The idea behind eco-certification is to give producers an opportunity to signal sustainability to consumers. Eco-certification programmes evaluate production practices and if these meet certain environmental criteria, producers can become certified. Eco-labelling can then inform consumers about product characteristics that otherwise would have been impossible to detect. Given that there exists a demand for sustainable products, producers can be motivated to use eco-certification as a differentiation strategy that results in economic benefits in the form of price premiums or increased sales. Hence, in theory eco-certification has both environmental and economic benefits.

In practice, the benefits of eco-certification are more unclear. Certification generally comes at a cost for the producer. For example, production practices need to be adapted to the eco-standard criteria and the certification process entails both fixed and variable costs. When costs are high in relation to the benefits there is a risk that eco-certification is not a viable option for many producers, which in turn limits the possible environmental benefits. For example, it has been shown that producers already meeting certification criteria (Blackman and Rivera, 2011), and larger and more wealthy producers that more easily can cover fixed costs of certification (Kilian et al., 2006) are more prone to obtain certification.

To date, the empirical evidence on producer benefits of eco-certification in the fishery sector is very limited. The literature has instead focused on the consumer side and found that consumers have preferences for sustainable seafood and could be willing to pay premiums for sustainable products (e.g. Johnston et al., 2001; Jaffry et al., 2004; Johnston and Roheim, 2006; Brécard et al., 2009; Uchida et al., 2013; Vitale et al., 2017). It has also been shown that retailers try to take advantage of these preferences by charging a higher price for MSC-certified fish products (Roheim et al., 2011; Asche et al., 2015; Sogn-Grundvåg et al., 2013, 2014; Asche and Bronnmann, 2017). When it comes to producer-level effects of eco-certified seafood, existing studies have focused on whether the price premium at retailer level trickles down to producers (Chang, 2012; Wakamatsu, 2014; Blomquist et al. 2015a; Stemle et al., 2016; Blomquist et al., 2020). The results on producer-level effects have been mixed and there are still areas that have been unexplored by the literature.

The aim of this study is to investigate the economic producer-level benefits of eco-certification in the fishery sector. Specifically, using a difference-in-difference model with vessel and date fixed effects we analyse if Marine Stewardship Council (MSC) certified Norway lobster (*Nephrops norvegicus*, hereafter referred to as *Nephrops*) fishers in Sweden get higher prices and sell larger quantities after certification was introduced in 2015. Hence, in comparison to previous literature we do not only focus on possible price premiums. We believe that it is possible that increased sales can compensate for a lack of price premiums, which could help explain why fishers that do not receive a price premium choose to get eco-certified. By choosing to analyse *Nephrops* we also focus on a luxury product that may exhibit different demand effects than previously analysed non-luxury fish products such as cod (Blomquist et al., 2015; Blomquist et al., 2020) and salmon (Stemle et al., 2016). In contrast to other species on the Swedish market for fish, *Nephrops* are sold on a market with many buyers (mainly in auctions). Hence, there might be limited buyer power in the value chain and mark-ups from certification could be higher than on markets with few buyers, such as the market for cod in southern Sweden (Blomquist et al. 2015b).

The introduction of MSC-certification in the Nephrops fishery serves as an excellent example for analysing producer-level effects as certification is individual instead of general. This means that vessels fishing in the certified waters must actively choose to get MSC certified. The fact that both certified and non-certified vessels were active in the same waters gives us the possibility to use a control group that is very comparable to the treated (certified) group and this makes our study different from most previous studies in this field. Our study focuses on the initial adopters of certification, i.e. vessels that chose to get MSC-certified at the start of the certification program in 2015, and we follow these from 2012 to 2018. We are therefore able to analyse effects of MSC certification over time. Specifically, we investigate if short- and long-term effects of MSC certification differ. This is important, as there is an evident risk that price premiums decrease as the supply of certified products increase. In addition, we analyse how two varieties of Nephrops are affected by MSC certification. Consumers regard creel-fished Nephrops as being of higher quality than trawled Nephrops and we therefore investigate if the effect of MSC certification differs between the two varieties.

Our results show no general effects on neither prices nor quantities when the entire time period is investigated. However, we find that the short-term and long-term effects of MSC certification may differ and that effects differ between trawled and creel-fished Nephrops. The lack of long-term effects suggests that the motivation for fishers to become MSC certified is to sustain market access on a market with market power of downstream actors in the value chain.

The rest of the paper is organised as follows. Section 2 gives a background to MSC certification and describes how producer-level effects of MSC certification have been analysed in previous studies. Section 3 presents the Nephrops fishery in Sweden and the introduction of MSC certification. In section 4, we describe the empirical estimation strategy and the data used. Section 5 presents the results of the empirical estimations and in Section 6 we conclude the paper.

2. MSC certification and producer-level effects

2.1 Background³

Unilever and the World Wildlife Fund (WWF) launched MSC in 1996. The aim was to create an independent non-profit non-governmental membership body working to ensure the long-term viability of fish populations and the health of the marine ecosystems. To achieve this aim, MSC decided to set standards for sustainable fishing that fishers could certify to and to label certified products with the MSC logo.

Certification to MSC is voluntary and open to all wild-capture fisheries. Third-party certifiers assess the fishery to determine if the MSC standard demands are satisfied. Once certification is approved, it lasts up to 5 years but annual audits are mandatory. If the product is to carry the MSC label, it must be sold to a buyer that is chain of custody certified. Since the first fisheries became certified in 2000, development has been fast. In 2020, there were 409 certified fisheries in 53 countries and more than 18,000 MSC-labelled products available to consumers (MSC, 2020).

2.2 Producer-level effects

In the case of eco-certified seafood, there is very little previous research on ex-vessel price premiums or other producer-level effects of eco-certification. Chang (2012) uses survey data to investigate the effects of the Taiwan Good Agriculture Practices Program on the income of aquaculture producers. A positive income effect of eco-label use is found but it is more pronounced for producers at the higher percentile range of the income distribution. Wakamatsu (2014) shows that the market for Japanese

³ Information for section 2.1 is gathered from www.msc.org if not stated otherwise.

flounder becomes more segmented after MSC certification, meaning that certified fishers face fewer competitors. Blomquist et al. (2015) use a difference-in-difference approach to estimate the price effect of MSC certification of the Swedish Baltic cod fishery. They find no evidence of a producer-level price premium after certification. Also using a difference-in-difference approach, Stemle et al. (2016) find a price premium of MSC certification for three out of seven species on the first-hand market for Alaskan salmon, Alaskan halibut and Kyoto flat-head flounder. Bellchambers et al. (2016) suggest that MSC certification has helped the Australian lobster fishery to access the European market and to cut the European Union (EU) tariff on seafood. Blomquist et al. (2020) estimate the ex-vessel price effect of the suspension of the MSC certification for the Swedish Baltic Sea cod fishery. Using a difference-in-difference approach, they find a price premium of about 11% for small-size cod prior to the suspension.

Based on the limited empirical evidence, it is difficult to draw any general conclusions on the effect of MSC certification on producers. It is clear that a price premium at retailer level need not be transmitted to producers. In cases where there is a documented price premium at the producer level, it appears to vary between species and markets but also between qualities of the same species. The difficulty of finding a price premium at producer level when it exists at retailer level has been attributed to buyer-driven value chains that make producers price takers (Carlson and Palmer, 2016). Previous research also shows that a large supply of certified products could decrease prices (Rotherham, 2005; Ankamah-Yeboah et al., 2019). Evidence of additional producer-level benefits, apart from price, is mainly anecdotal. Still, benefits such as less competition (Wakamatsu, 2014) or access to new markets (Bellchambers et al., 2016) are interesting as they show that price may not be the only decisive factor behind the decision to certify. Reports of retailers controlling market access also exist. For example, major seafood buyers such as Unilever and Wal-Mart have decided to source their fish from MSC-certified fisheries (Carlson and Palmer, 2016). Demands on sustainability are generally high also on the Swedish market for seafood. The two major retailer chains, ICA and Coop, both aim to sell sustainably sourced seafood only (ICA, 2021; Coop, 2021). For example, Coop demands MSC-certification for frozen Nephrops but accepts non-MSC-certified fresh Nephrops if they are creel or fished with a selective trawl in certain waters (Coop, 2020). A representative of a producer organization of Swedish fishers confirms that it has become increasingly important to be certified to access all parts of the market (Malin Skog, personal communication, May 29, 2018).

3. The Swedish Nephrops fishery and MSC certification

The Nephrops fishery is one of the most important fisheries in Sweden as it accounts for about 15% of the value of total first-hand sales from Swedish commercial fisheries and around 50% of the value of the shellfish market (Hammarlund et al., 2019). Fishing takes place in the waters between Sweden and Denmark, also known as Skagerrak and Kattegat, see Figure 1.

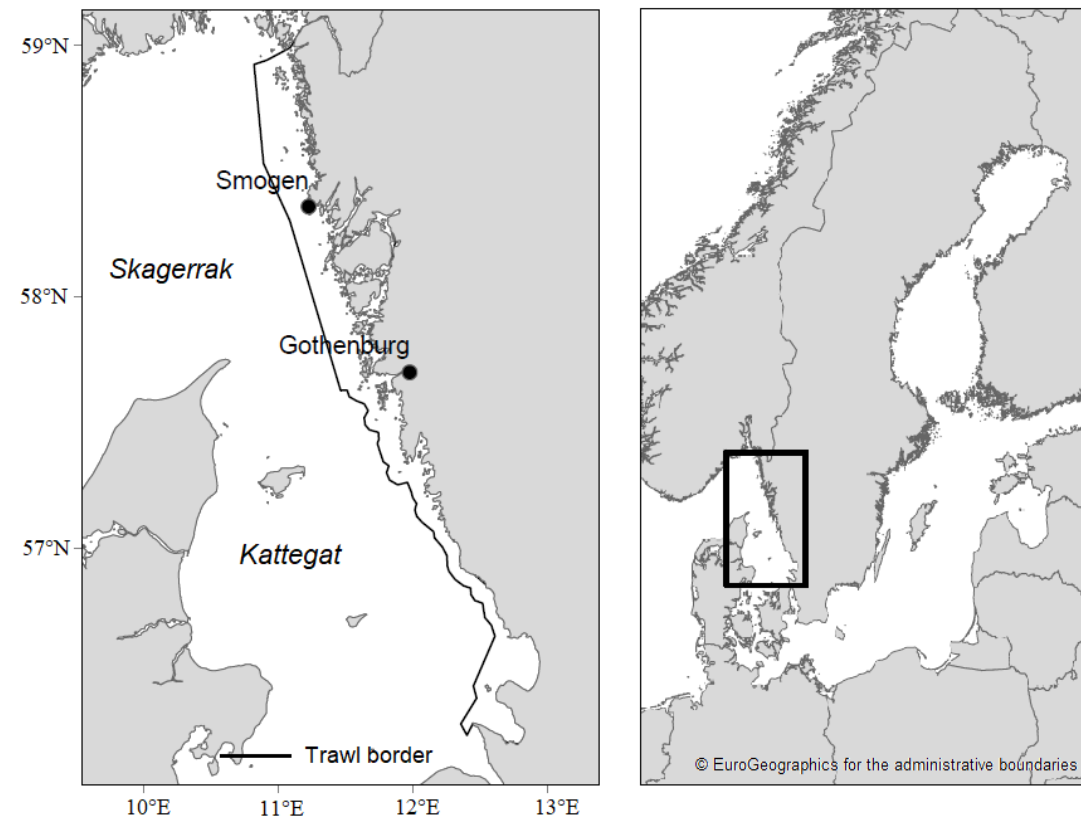
Landings of Nephrops by Swedish vessels have been relatively constant since the mid-1980s (SwAM, 2018). An increase in landings in recent years is related to the lowering of the minimum landing size in 2016 that was part of the implementation of the landing obligation in the European Union (Hornborg et al. 2017). To increase transparency, the quota was also changed from a landings quota to a catch quota, i.e. from 2016 the quota also includes discards (ICES, 2017). The result of the new policies was that landings of small Nephrops increased causing total landings to increase. Table 1 shows the total Swedish Nephrops quota, landings and the share of quota in landings from 2012 to 2018.

Table 1: The Swedish Nephrops quota, landings and share of quota in landings 2012-2018.

	2012	2013	2014	2015	2016	2017	2018
Swedish quota (TAC) in tons	1578	1367	1320	1398	2893	3343	3087
Landings in tons	1360	1134	1268	1132	1350	1404	1823

Share of quota in landings	86%	83%	96%	81%	47%	42%	59%
Sources: SwaM (2021a,b)							

Figure 1. Map of the Swedish west coast where fishing for Nephrops take place



Source: Hammarlund et al. 2019.

In 2017 weekly quotas were replaced by a system with yearly quotas. Under the new system, vessel owners get a yearly quota in the beginning of each year and can lease or transfer quotas between each other in each calendar year (SwaM, 2016b).

Commercial fishing for Nephrops requires a fishing license and a special permit for either trawl or creel fishing (SwaM, 2016b). The number of creels per fisher is restricted and creel fishing is only taking place between the Swedish coastline and the trawl border, see Figure 1. (Hornborg et al. 2017). The use of different gears results in two different varieties of Nephrops on the market: trawled and creeled. Creeled Nephrops are perceived by many consumers to be of higher quality as they are larger and less damaged than trawled Nephrops (Hornborg et.al., 2017, Eriksson 2016, Ilona Miglavs, personal communication, February 8, 2021). Creeled Nephrops therefore have higher prices on average (Hornborg et.al. 2017). A buyer at the fish auction also tell that creel-fished Nephrops are sold to a specific part of the market with restaurant owners and small fish traders (Mikael Sjövall, personal communication, February 4, 2021).

The Nephrops fishery was MSC certified on 27 January 2015 after a 2-year assessment period. Compared to other fisheries (such as the eastern Baltic cod fishery) the certification is individual rather than general meaning that the MSC certification covers only participating vessels. Certified vessel are allowed to fish with creels, grid trawls or seltra trawls (a selective trawl used by multi-species fisheries) (FCI, 2015). To cover the initial certification, a fee of 2500 SEK per vessel was charged. Later, the

producer organization (SFPO) paid back the fee and charged 1 SEK per kilo sold (Robert Skymne, personal communication, May 29, 2018). In addition to these direct costs, fishers have indirect costs of certification, as they were required to fill in bycatch diaries (SFR, personal communication, November 15, 2012).

MSC managed the register of vessels that joined the certification in the beginning but the register was taken over by the SFPO in the second half of 2015. Vessel lists from the first half of 2015 are available on the MSC webpage (MSC, 2021) and show that 69 vessels chose to join the certification scheme on 27 January 2015 and by 2 July 2015, 80 vessels had joined. After 2 July 2015 there are no more available vessel lists of participation, although the dates of vessels joining in 2016-2018 are available at the producer organization in notification letters from fishers. Unfortunately, some of the documents are incomplete making it difficult to get exact participation dates for all vessels that joined the scheme. A participation list from the producer organization on 23 January 2018 shows that 123 vessels had joined at this date.

4. Empirical estimation

4.1 Data

We use daily sales-note data from the Swedish Agency for Marine and Water Management (SwAM). The data contain observations of sales from different vessels on a trading day. For our main analysis we use a period that covers 1 January 2012 - 23 January 2018, meaning that our data period starts around three years before the first vessels joined the scheme and ends about three years after certification was introduced.

Quality indicators are provided in the sales-note data and are complemented with information about gear type (creel or trawl) from logbook data provided by the SwAM. Quality indicators show if the Nephrops were alive when sold and whether they were whole or if only the tail was sold. Size measures are not given as such but we have information on the number of Nephrops per kilo sold. Sales of less than 20 Nephrops per kilo are the most common in our data set (82% of all observations). As discussed above, the minimum landing size was lowered in the beginning of 2016, which affected prices and sales. When examining the price data we see a clear price drop for the smaller Nephrops, i.e. sales of more than 20 per kilo, in 2016. As the change in landing sizes makes comparison of prices and sales of the smaller individuals difficult during the studied period, 2012-2018, we focus our analysis on sales of less than 20 Nephrops per kilo, i.e. the largest individuals in our data set.

We focus on the initial adopters of the certification scheme, i.e. vessels that joined when the scheme on 27 January 2015 and compare these to vessels that did not join the scheme during our studied period, i.e. vessels that are not registered as MSC certified on 23 January 2018. There are two main reasons why we focus on the initial adopters. First and most importantly, we know on which date these vessels joined the scheme but we do not know the exact date for when many of the other vessels joined. Second, by focusing on the initial adopters we are able to investigate how the effects of MSC certification evolves over time. After cleaning the data (see the Online Appendix for a full description), we find 65 vessels in the initial adopters group and 56 vessels in the control group (the non-adopters). Hence, our sample contains 121 vessels in total. During the investigated time period these vessels catch just over 50% of the total Swedish Nephrops catches.

In Table 2 we present basic statistics for our sample. We focus on the number of vessels, landed quantities and prices received for initial adopters versus non-adopters. Noticeable is that the initial adopting trawlers have larger landings after 27 January 2015, i.e. after certification was introduced, whereas non-adopting trawlers have smaller landings. For creelers we find the opposite pattern, smaller landings for adopters and higher landings for non-adopters. Table 2 also shows that the price increase

for creelers is similar for initial adopters and non-adopters. For trawlers the price increase is somewhat higher for non-adopters.

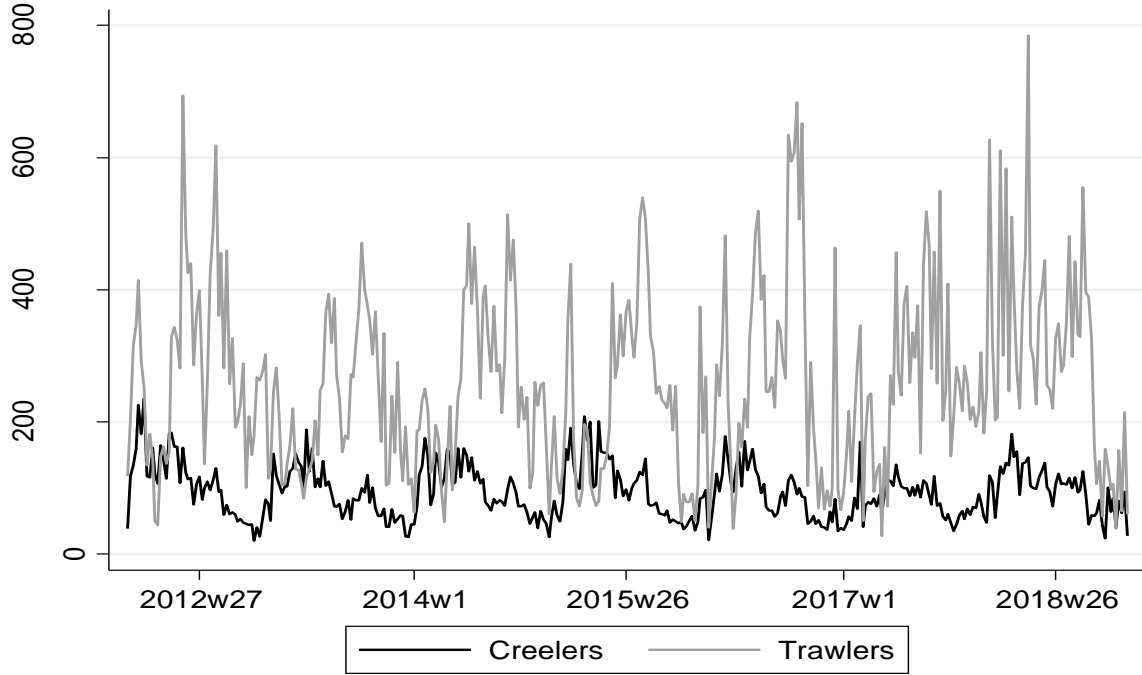
Table 2 Initial adopters versus non-adopters

	Initial adopters		Non-adopters	
	Creel	Trawl	Creel	Trawl
Number of vessels*	13	51	33	19
Total quantity (tons) before 27 January 2015	81	1527	314	231
Total quantity (tons) after 27 January 2015	72	1712	356	215
Average price/kilo (SEK) before 27 January 2015	126	100	125	97
Average price/kilo (SEK) after 27 January 2015	147	108	148	111

* Note that five vessels in our sample are defined as using both gears, these vessels are excluded from the Table.

We also investigate landed quantities per week for our sample and relate this to how vessels use their quota. As described above, the Nephrops fishery was regulated by weekly quotas until 2017 when yearly quotas were introduced. Figure 2 shows that for an average vessel (trawler or creeler) landed quantities vary substantially over the year.

Figure 2: Mean quantity in kilos caught per vessel and week for creelers and trawlers.



For an average vessel, the weekly quotas were rarely filled. For creelers, the quota was 1200 kilos per week in 2012-2016 and 3200 kilos per week in 2016 (3000 from 12 September) (SwAM, 2011; 2015; 2016c). As seen in Figure 2, the weekly catch per creeler only occasionally reaches above 200 kilos, which is substantially below the weekly quota limits. For trawlers, quotas differ depending on whether a grid trawl or another trawl is used. The majority of our vessels use the grid trawl and the weekly quotas for this type of trawl varied between 1400 and 4000 kilos per week during the period with weekly quotas (i.e. until 2017) (SwAM 2011; 2013; 2015; 2016c). As can be seen in Figure 2, the average trawler rarely catch more than 600 kilos per week, which is considerably below the quota limits. We also check if the quota ceiling was exceeded by the vessel that had the largest catch each week. For creelers, we find only one week were the vessel with the largest catch exceed 1200 kilos. Similarly, for trawlers, it is very unusual to exceed quota limits. In sum, we conclude that the average vessel did not get close to the weekly quotas limits in the period when weekly quotas were used and that it is in fact unusual that any vessel exceed the quota. Although other limitations (number of creels and area limitations for trawl fishing) or weather conditions may affect the amount of catch that is landed each week, we believe that there is scope for fishers to adjust landings depending on market demand.

4.2 Method

Our aim is to investigate if MSC-certification affects ex-vessel prices and quantities sold. We therefore estimate the differential effect of MSC-certification on the treated group (MSC-certified vessels) compared to a control group (vessels that are not certified). To do so we use a generalized difference-in-difference (DID) design that is analysed by estimating a two-way fixed effects regression model:

$$Y_{id} = \alpha + \delta MSC_{id} + \beta \theta_{id} + \mu_i + \tau_d + \epsilon_{id} \quad (1)$$

Our outcome variable, Y_{id} , is the ex-vessel price per kilo or sold weight of Nephrops from vessel i on day d . MSC_{id} is a dummy variable taking the value 1 if vessel i is MSC-certified on day d , and zero otherwise. θ_{id} is a vector of control variables. Our control variables are dummy variables for different quality characteristics ($Alive_{id}$ and $Tail_{id}$) and for the two main landing harbours (Gtb_{id} and Smo_{id}). We also have vessel fixed effects, μ_i , and date fixed effects, τ_d . Lastly, ϵ_{id} is an idiosyncratic error term.

The date fixed effects control for common time variations for all vessels such as seasonality or business cycles while the vessel effects control for vessel-specific time-invariant effects such as abilities of captain and crew and gear type.

We investigate how prices and sales are affected over time by estimating the following equation:

$$Y_{id} = \alpha + \delta MSC_{id} + \sum_s \gamma_s MSC_{i,d+s} + \beta \theta_{id} + \mu_i + \tau_d + \epsilon_{id} \quad (2)$$

In Equation 2, δ captures the immediate effect of certification while γ_s measures additional effects of certification s periods after a certain vessel was certified. All other variables in Equation 2 are defined as above. We examine four different time periods that we call very short run, short run, medium run and long run (see Table 3).

Table 3 Time periods examined

	Start	End
Very short run	27 January 2015	30 June 2015
Short run	1 July 2015	31 December 2015
Medium run	1 January 2016	31 December 2016
Long run	1 January 2017	23 January 2018

As mentioned previously, creeled Nephrops are often perceived to be of higher quality than trawled Nephrops. Hence, it is interesting to investigate if the effects of certification are different for the two varieties of Nephrops (creeled and trawled). Thus, we interact the MSC-dummy with a dummy for creeled Nephrops.

5. Results

We use two outcome variables: the mean price per kilo on a particular day sold by a particular vessel and the quantity sold by a particular vessel on a particular day. First, we investigate average effects of MSC certification over the entire studied period (Jan2012-Jan2018). Columns 1 and 2 in Table 4 show results for prices and quantities, respectively. As can be seen, there are no significant effects of MSC certification on neither prices nor quantities sold for the vessels that initially adopted the MSC certification. However, all control variables are highly statistically significant and behave as expected. Only selling the tail has a negative effect on both price and quantity sold, while the other controls (Alive, Gtb and Smo) have positive effects on the outcome variables.

Table 4 Effect on price and sold quantity of MSC certification

	1	2	3	4
	Price	Quantity	Price	Quantity
MSC	1.037 (3.311)	4.173 (2.723)		
MSC1			16.329*** (4.086)	-8.331* (4.879)
MSC2			-10.513** (4.555)	4.624 (4.324)
MSC3			3.671 (3.648)	4.350 (3.707)

MSC4			-0.779 (3.653)	8.414** (3.399)
Alive	7.465** (2.868)	13.877*** (3.796)	7.282** (2.934)	14.220*** (3.884)
Tail	-29.503*** (3.140)	-110.410*** (8.090)	-29.802*** (3.140)	-110.040*** (8.093)
Gtb	21.908*** (5.567)	30.609*** (5.239)	22.060*** (5.569)	30.398*** (5.194)
Smo	15.592*** (5.174)	27.570*** (6.951)	15.558*** (5.146)	27.588*** (6.921)
Constant	117.134*** (25.035)	-19.148 (22.368)	117.333*** (25.119)	-19.416 (22.469)
Daily effects	Yes	Yes	Yes	Yes
Vessel effects	Yes	Yes	Yes	Yes
N	48,618	48,618	48,618	48,618
R ²	0.63	0.45	0.63	0.45

Note: Standard errors are clustered on vessels. * p<0.10, ** p<0.05, *** p<0.01

Columns 3 and 4 in Table 4 show how the effect of MSC certification evolves over time. MSC1 - MSC4 are effects of MSC certification in the four different time periods defined in Table 3, where MSC1 is the effect in the very short run, MSC2 is the effect in the short run, MSC3 is the effect in the medium run, and MSC4 is the effect in the long run. As regards prices, results in column 3, there is now evidence of a statistically significant price premium in the very short run, i.e. the period just after certification was introduced. In the second period, the short run, we instead find a negative effect on prices meaning that the price premium dissipates over time as more vessels join the labelling scheme. The price drop is, however, not as large as the price increase in the previous period. In the medium and long run there is no longer a price difference between adopters and non-adopters. When it comes to quantities, column 4 in Table 4 shows a negative effect of MSC certification in the very short run but a positive effect in the long run. No significant effect is found in the short run or the medium run. Coefficients on control variables in columns 3 and 4 are very similar to those in columns 1 and 2.

Table 5: The different effects of MSC certification for trawl and creel fishers

	1	2	3	4
	Price	Quantity	Price	Quantity
MSC	1.650 (3.667)	4.438 (3.063)		
MSC*creel	-4.536 (3.996)	2.092 (4.613)		
MSC1			24.056*** (4.625)	-17.199*** (4.460)
MSC1*creel			-23.860***	28.165***

			(5.547)	(10.296)
MSC2			-10.895**	4.661
			(4.827)	(4.699)
MSC2*creel			-0.776	-0.266
			(6.930)	(5.004)
MSC3			4.825	4.712
			(4.000)	(4.247)
MSC3*creel			-3.162	1.521
			(4.188)	(5.523)
MSC4			-0.929	10.379***
			(4.039)	(3.766)
MSC4*creel			-4.057	-5.760
			(5.489)	(3.744)
Alive	7.524**	14.484***	7.274**	14.965***
	(3.034)	(4.015)	(3.119)	(4.118)
Tail	-29.481***	-110.221***	-29.999***	-109.535***
	(3.189)	(8.110)	(3.181)	(8.102)
Gtb	20.478***	30.940***	20.727***	30.518***
	(6.059)	(5.760)	(6.068)	(5.700)
Smo	14.793***	27.817***	14.763***	27.762***
	(5.409)	(7.232)	(5.386)	(7.171)
Constant	117.675***	-19.403	117.839***	-19.736
	(25.355)	(22.560)	(25.446)	(22.669)
Daily effects	Yes	Yes	Yes	Yes
Vessel effects	Yes	Yes	Yes	Yes
N	46250	46250	46250	46250
R2	0.63	0.45	0.63	0.45

Note: Standard errors are clustered on vessels. * p<0.10, ** p<0.05, *** p<0.01

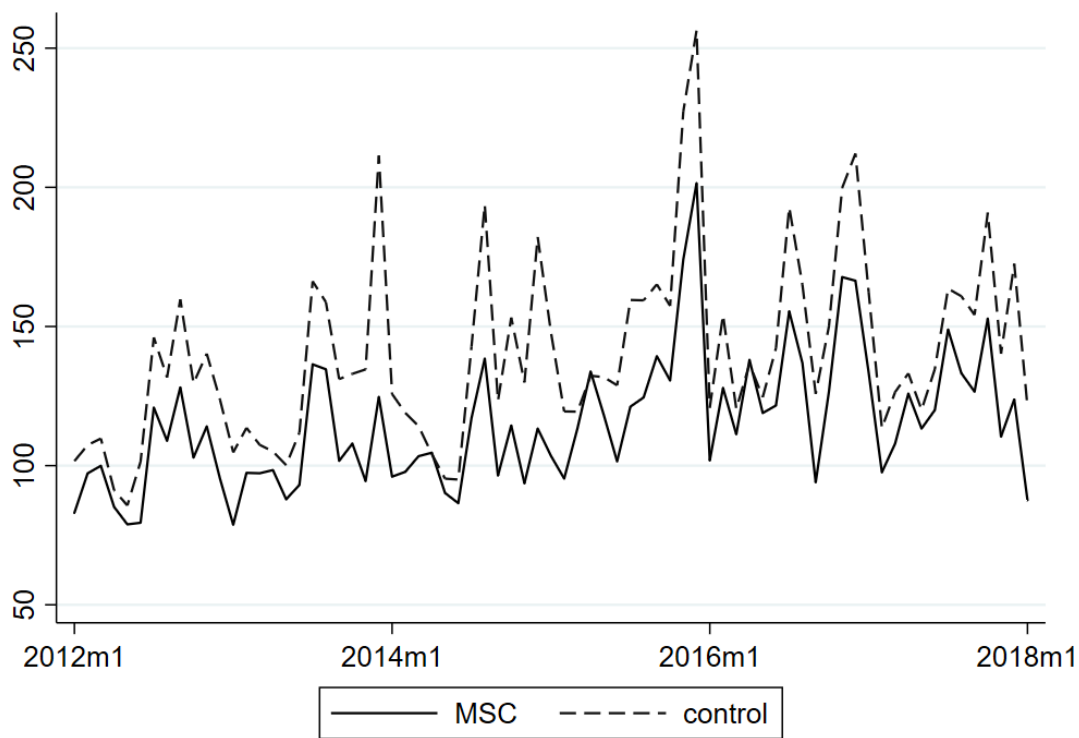
Table 5 shows the effect of MSC certification for creelers and trawlers. Trawlers are the baseline category and the interaction terms (e.g. MSC1*creel) show the additional effect for creelers. There are no significant effects of MSC certification neither for trawlers or creelers when the whole time period is examined (columns 1 and 2). When different time periods are examined separately in columns 3 and 4, effects are found on both price and quantity. The most interesting time period is the very short run where effects are different for trawlers and creelers. In the very short run, trawlers get a relatively large price premium while creelers only get a small one. Trawlers also get a negative effect on quantities sold while creelers get a positive effect on quantities sold in the very short run. There are no differences in

estimated effects for trawlers and creelers in the other time periods. For both vessel groups, we see a negative effect on prices in the short run and a positive effect on quantities in the long run.

5.1 Sensitivity

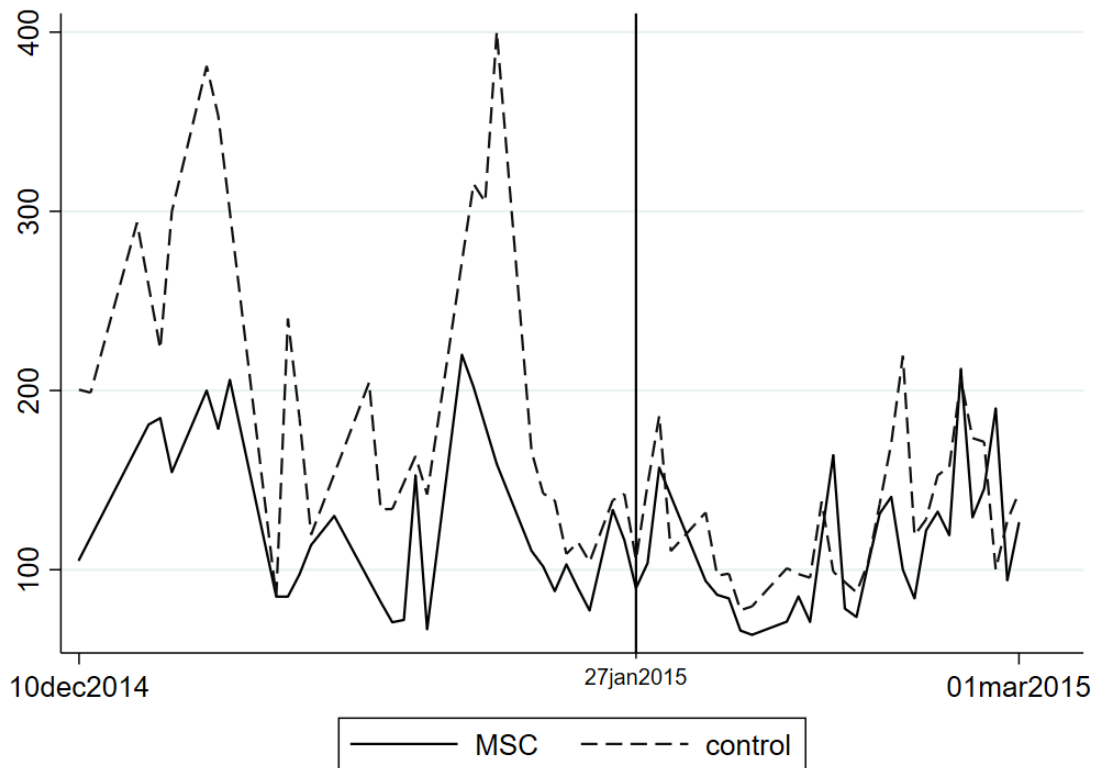
The difference-in-difference methodology relies on the common trends assumption, i.e. the outcome variable should follow the same time trend for the treated and the control group in absence of MSC certification. One way to check this assumption is to graphically examine price trends for initial adopters (treated group) and non-adopters (control group). If the two groups do not follow the same trend, the non-adopters are not a credible control group and the estimates presented above may be biased. Figure 3 shows the monthly average prices (in SEK) received by MSC-certified vessels (initial adopters) and the non-certified control group for the period January 2012 – January 2018. The MSC-certified vessels and the control group appear to follow the same trend during the studied period. This also holds when examining quantities, see Figure A1 in the Online appendix. This is reassuring since it indicates that the common trends assumption holds.

Figure 3 Monthly average prices (price/kilo in SEK) January 2012 – Jan 2018



In Figure 4 we examine daily prices around the introduction of the MSC certification. The vertical line marks the introduction of MSC certification on 27 January 2015. After certification is introduced there is clearly less variation in prices than before and the difference between the control group and the MSC-certified vessels becomes smaller. Some days the price received by the MSC-certified vessels are even higher than the price received by the control group. This supports the findings of a price premium in the very short run (see Table 4). Figure 3 also shows that demand for Nephrops is high in December due to Christmas and New Year's Eve. A price drop in January is expected and is not related to MSC certification.

Figure 4 Daily group average prices (price/kilo in SEK) for the treated group and the control group around the introduction of the MSC-certification



The main estimation results are based on a data sample that only contains sales of 20 or less Nephrops per kilo due to the change of regulation concerning the minimum landing size in 2016 mentioned above. We perform a robustness check to see if including other size categories would change our main results. Including all size categories in the sample gives us a dataset of 60,598 observations in contrast to the previous 48,618 observations. We also introduce a dummy variable ($Small = 1$) to control for the smaller size categories and an interaction term between $Small$ and years 2016-2018 to control for the effect of the lowering of the minimum landing size. In order to save space, estimation results can be found in Table A1 in the Online appendix. We conclude that including all sizes does not change the main results in Table 4 but the size of coefficients of interest tend to be smaller.

All our above estimations use vessels that do not get certified during our examined period as the control group. As a robustness test of our results, we change the control group by including vessels that get certified between July 2015 and January 2018. Although we do not know the exact date of certification of all vessels that are not initial adopters, we know which vessels were certified at some specific points in time. Therefore, we are able to estimate the MSC effects for the initial adopters over time using a control group that includes different vessels depending on the time period examined. For example, when estimating the MSC effect in the very short run we include all vessels that are not certified in the very short run in the control group. Note that this means that we are not able to change the control group when the entire time period is examined as only the original control group remains uncertified in the long run. Obviously, progressively changing the control group has drawbacks when it comes to comparability but this exercise solely aims to investigate if our main results for the initial adopters hold when using all available data. We find that the main results from Table 4 still hold but coefficients change somewhat, which could be expected since the control group is not the same. Estimation results can be found in Table A2 in the Online appendix.

6. Concluding discussion

This paper investigates the effects of MSC certification on two producer-level outcomes: ex-vessel prices and quantities sold. Using detailed daily data on Swedish Nephrops fishing vessels we examine if the introduction of MSC certification on 27 January 2015 resulted in price premiums or increased sales for the MSC-certified vessels relative to the non-certified vessels active in the same fishery. Our analysis focuses on the initial adopters of certification and follow these vessels and a control group three years before and three years after certification was introduced (January 2012 - January 2018). Price and quantity effects are estimated using a difference-in-difference approach. The results show that no general effect of MSC certification can be found on either prices or quantities. However, when examining how effects of MSC certification evolve over time we find a price premium the first months after the launch of the certification scheme. This price premium dissipates over time and is mainly found for trawler vessels. For trawlers, we also find a negative effect on sold quantities the first months after certification but a positive effect a few years after certification. Creelers, on the other hand, got a positive effect on quantities sold both immediately after certification and after a few years.

In order for it to pay to be certified, producers must get benefits of certification that outweigh the costs. The most obvious benefit is the price premium. Previous literature on MSC certification have shown that certification does not necessarily result in price premiums at the producer-level and for Swedish Nephrops this seems to be the case. Price premiums may also change over time. Rotherham (2005) and Ankamah-Yeboah et.al. (2019) suggest that price premiums may disappear over time as the supply of certified products increase. Our results are in line with this as we see a price premium in the first months after certification but not in the following periods when more vessels join the scheme. With a large amount of certified Nephrops on the market and low substitutability between certified and non-certified Nephrops, it is more likely that the price will drop.

If there are no long-run benefits in terms of higher prices, we would then perhaps see that fishers are leaving the scheme after the initial period. However, more vessels join the certification scheme after the initial months, and continue to do so during the following three years that we study. It is therefore unlikely that a potential price premium is the driving force for certification.

The literature points to benefits from MSC certification such as maintaining access to markets or finding new markets. With buyer-driven value-chains where producers are price takers there might not be a price-premium of MSC certification at the producer level (Carlson and Palmer, 2016). To gain access to large wholesalers it may be necessary for fishers to be certified. Wholesalers in turn must adapt to large buyers in the private and public sector that often have procurement policies including commitments to buy environmentally friendly seafood. An MSC representative confirm that procurement policies put pressure on wholesalers to buy MSC certified seafood (Louise Valentin, August 12, 2021). This, in turn, put pressure on fishers to get MSC certified. Producer organisations as well as first-hand buyers therefore regard market access as the most important reason for fishers to obtain MSC certification (Malin Skog, personal communication, May 29, 2018; Ilona Miglavs, personal communication, February 8, 2021).

It is possible that there is a link between the benefits of market access and the quantity effects in our study. Large grocery stores and wholesalers usually require large quantities. If market access to larger buyers requires certification, it is more likely that fishers that supply large quantities are certified. We see some evidence of this; over time certified vessels supply larger quantities than non-certified vessels. In particular, we see that creelers that, on average, supply smaller quantities sell larger quantities when certified.

Despite the benefits of gaining access to the market for certified Nephrops there are fishers that chose not to become certified. In fact, prices are in general higher for non-certified Nephrops since these are more often fished with creels and buyers and consumers find them to be of higher quality. Creelers

Nephrops, especially if they are large, are often sold directly to restaurants. Stakeholders confirm that some creel fishers are known for their superior quality (Ilona Miglavs, February 8, 2021, Peter Ronelöv Olsson, personal communication, June 21, 2021), that the supply of larger individuals is limited and that the price of these is often very high regardless of MSC certification (Mikael Sjövall, personal communication, February 4, 2021).

Thus, there appears to be two quite different markets for Nephrops in Sweden. One for trawled Nephrops that are mainly sold in large quantities to wholesalers where MSC certification is becoming increasingly important for market access. Then, there is another market for creel caught high quality Nephrops that are mainly sold to smaller buyers where MSC certification is less important. This segmented market could explain why it was mainly trawlers that joined the certification scheme when it was first introduced (80% of the initial adopters were trawlers). It could possibly also explain why, contrary to suggestions from the literature, the lower-quality trawled Nephrops got a higher price premium from certification in the very short run. Our results are, on the other hand, in line with Blomquist et. al. (2020) who show that small-sized cod on the Swedish market receive a price premium from MSC certification whereas large-sized cod does not.

Finally, it is possible that there are differences in certification costs for vessels affecting the will to certify. Although variable costs are the same it may be easier for larger vessels (trawlers) to spread fixed costs of certification, e.g. for learning how to fill in by-catch diaries, over more units. This might also be the case if a fisher owns more than one vessel. However, the costs of certification are mainly variable so any fixed costs might be of less importance in our case.

In theory, eco-certification can have both environmental and economic benefits. However, our example shows that economic benefits might not be easy to detect and in some cases, it may not pay off to certify despite supplying a sustainable product.

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