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# Price premiums for providing eco-labelled seafood

-A case study of the Swedish MSC-certified cod fishery in the Eastern Baltic Sea



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## Abstract

*Eco-labelled seafood is an important tool to promote sustainable development in fisheries. A price premium on eco-labelled seafood signals a return on investment in sustainable fishing methods, providing an incentive for fishers to adapt such methods. This paper addresses whether Swedish fishermen gain a price premium from participating in the MSC-certified Swedish Eastern Baltic cod fishery in the period 2011-2012. Using a detailed dataset of landing tickets and log books, we apply a quasi-experimental identification strategy to estimate the MSC price premium.*

## 1. Introduction

The worldwide depletion of fish stocks is well documented (FAO 2012; Myers and Worm 2003) and the economic cost of this has been calculated to \$ 50 billion annually (World Bank 2009). Despite this, current management regimes have not been able to successfully address the issue. As a response, eco-label programs for sustainable fishing practices have been developed. In general, these programs evaluate the fishing practices with regard to environmental standards set by a third party. If a fishery meets these standards, seafood products are eligible to bear the eco-label. The world's leading standard for sustainable fishing and seafood traceability is the Marine Stewardship Council (MSC), which provides a certification program that contains over 22 000 eco-labelled consumer products ([www.msc.org](http://www.msc.org)).

A main objective of eco-labeling programs in fisheries, such as the MSC label, is to provide market-based incentives to improve sustainable fishing practices. Eco-labels can reassure consumers about the sustainability of a fishery, allowing them to make informed purchase decisions. The premise is that environmentally concerned consumers will shift their demand towards eco-labelled fish which, in turn, generates a price premium for eco-labelled fish over non-labelled fish (e.g. Guðmundsson and

Wessells 2000; Sedjo and Swallow 2002). In this way, producers are rewarded for fishing in a sustainable way. However, certification is costly, and there is surprisingly little evidence on the existence, and extent, of price premiums at the producer level.

The purpose of this study is to analyze the price premium achieved by fishermen for providing eco-labelled seafood. As an empirical example we use the Swedish MSC-certified cod fishery in the Eastern Baltic Sea. A prerequisite for price premiums at the producer level is that consumers have a willingness to pay for eco-labelled fish products. There is ample evidence from stated preference surveys and field experiments showing that consumers express a preference for eco-labelled seafood (e.g. Johnston et al. 2001; Jaffry et al. 2004; Johnston and Roheim 2006; Brécard et al. 2009; Uchida et al. 2013). In addition, studies estimating hedonic price models confirm the existence of price premiums in the retail market for eco-labelled fish products in the United Kingdom (Roheim et al. 2011; Sogn-Grundvåg et al. 2013; Asche et al. 2013; Sogn-Grundvåg et al. 2014). As we show in the paper, there is also a price premium for eco-labelled fish in the Swedish retail market. The question then becomes whether the price premium at the retail level transmits back to the fish production level.

The Swedish Eastern Baltic cod fishery provides us with an ideal experiment for testing the MSC price premium at the producer level. This is because not all fishers were qualified for MSC certification. More specifically, we make use of the fact that only the gears demersal trawl, longline and fish trap were certified according to the MSC standards. The gill-net component of the fishery, which did not fulfill the criteria, is used as a control group, and the price premium is operationalized as price differences between the two groups in a panel data difference-in-difference model. The quasi-experimental setup makes it possible to control for biases in the post-MSC period comparisons that may result from unobserved heterogeneity and common time trends such as fluctuations in supply and demand that affect the price for all fishers. As such, the paper provides a methodological discussion on how to perform an *ex-post* analysis of price premiums of eco-labeling programs.

The rest of the paper is organized as follows. The next section gives a brief background on the MSC and seafood eco-labelling, as well as a motivation for focusing on the Swedish cod market. Section 3 investigates whether there is a price premium for eco-labelled cod in the Swedish retail market. In section 4, we examine if Swedish fishers receive a price premium from participating in the MSC-certified Swedish Eastern Baltic cod fishery. We close the paper with some concluding remarks.

## **2. Background**

In 1996, in an attempt to reverse the downward trend for the world's marine fish stocks, the World Wildlife Fund (WWF) teamed up with the global corporation Unilever, which at the time was the largest purchaser of frozen fish, and established the MSC eco-label. The idea was to create market

based incentives for sustainable fishing practices (Sutton, 1996). To do so, MSC developed an on-pack label that informs seafood consumers that they are supporting sustainable and well-managed fisheries. To strengthen its credibility, in 1998 the MSC established itself as a fully independent non-profit organization. Nowadays the MSC is the leading eco-label in terms of the number of fisheries certified and volume of seafood certified (Parkes et al. 2010). In 2014, more than 200 fisheries and 8 % of global wild-capture fishery tonnage is certified ([www.msc.org](http://www.msc.org)). As the number of fisheries in the MSC program continues to grow, so is the number of MSC-labelled products. In the beginning of 2014, more than 22 000 seafood products bear the blue MSC label.

Being a voluntary, market-based instrument, fisheries must perceive that the benefits of the MSC certification are large enough to offset the costs of certification. Indeed, MSC certification is costly, ranging from \$ 35 000 for small-scale fisheries to almost \$ 350 000 for large industrial fisheries (Ponte 2006). There are also additional costs for pre-assessment, annual audits, and costs associated with the implementation of improvements to address the conditions placed on the fishery during the certification process. Whether fishers receive market benefits from participating in MSC certified fisheries is therefore one important indicator of the effectiveness of the program. Market benefits may not only include a price premium, but may also include gaining (or maintaining) market access, securing sustainable fish stocks, etc. However, compared to these, price premiums are more directly measurable and therefore the main focus of this paper.

While there is evidence of price premiums in the retail market for MSC labelled fish products (Roheim et al. 2011; Sogn-Grundvåg et al. 2013; Asche et al. 2013; Sogn-Grundvåg et al. 2014), there are very few studies examining the existence of price premiums at the producer level.<sup>1</sup> Closest to our study are the works of Chang (2012) and Wakamatsu (2014). Chang examines the extent to which eco-labels affect the income of aquaculture producers in Taiwan. The author finds that producers participating in the Taiwan Good Aquaculture Practices (TGAP) have significantly higher incomes than non-participating producers. It is not clear, however, if this is a result of a price premium, larger quantities sold, or both. Wakamatsu (2014) examines ex-vessel prices for MSC certified and non-certified flounder in three Japanese fish markets and finds no evidence of a price premium. However, this result may be questioned as monthly aggregate prices from only three different markets are used to identify the potential price premium. In contrast, the current paper makes use of a rich dataset of ex-vessel prices that is acquired from individual log-books and landing tickets. As such, it facilitates a more precise test of the MSC price premium.

### **3. Potential for market differentiation of eco-labelled seafood in Sweden**

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<sup>1</sup> Some anecdotal evidence of price premiums at the fish production level is discussed in MSC's publication, *Net Benefits* (MSC, 2009). However, as noted in the first independent assessment of the MSC programme (MRAG 2011), data have not been available to analyze the price effects of MSC certification.

In this paper we focus on price premiums of eco-labelled cod in Sweden. Focusing on Sweden is interesting for several reasons. First, consumer recognition of the MSC eco-label is relatively high in Sweden. According to a survey in 2012, around 40 % of Swedish consumers who bought fish at least once every two months, were aware of the MSC eco-label (MSC 2013a). This may be compared to the average of 30 % (which was the average across ten countries).<sup>2</sup> This is important, as the success of eco-labelling programs depends heavily on consumer awareness and recognition of the label.

Furthermore, in Sweden there is potential for market differentiation for eco-labelled seafood as Swedes seem to be environmentally concerned consumers who have high demand for eco-labelled food products. Indeed, between the years 2004 and 2012 the sales of eco-labelled food in Sweden, measured as share of total food sales, increased with 95 percent (Statistics Sweden, [www.scb.se](http://www.scb.se)). The largest increase is for seafood products, which constituted less than 1 percent of total sales of eco-labelled food in 2004, but has increased to about 13 percent in 2012. In addition, in a choice experiment on a random sample of Swedish consumers, Kling and Laitila (2008) found that their respondents put high value on eco-labelled cod from the Baltic. Their point estimate suggests that the respondents' willingness to pay for eco-labelled cod from the Baltic is 69 SEK per kilo (1 EUR  $\approx$  9 SEK) compared to non-labelled cod (which implies a price premium of 69 %).

A necessary condition for price premiums at the producer level is market differentiation at the retail level. While there are good reasons to expect price premiums, we would ideally like to determine the existence of actual price premiums in the Swedish retail market for eco-labelled fish products. To examine this question, we collect data from a comprehensive price survey conducted by PRO (Pensionärernas Riksorganisation, [www.pro.se](http://www.pro.se)). The data were collected by around 2 000 volunteers who registered prices of 79 goods of which 15 were eco-labelled. The survey was conducted in 1 068 Swedish retail stores in October 2012, and the prices were published online in December 2012.<sup>3</sup> The date of the survey was kept confidential in order to avoid that retail managers would strategically lower their prices. In addition, to check the reliability of the prices, a second price survey was conducted at a number of stores some days after the main survey to see if prices were dramatically changed. In this step, two retailers were excluded from the survey.

Interestingly, price data were collected for both eco-labelled and conventional frozen cod fillets of 400 kilogram. It is thus possible to examine whether there exists a price premium for eco-labelled cod in the Swedish retail market. To make the relevant price comparisons, we excluded all stores where price data for any of the two goods were missing, which leave us with 657 stores. Table 1 shows the mean, standard deviation, and 95 % confidence interval of the two price series. As can be seen, there is a

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<sup>2</sup> The other countries included: Germany, Netherlands, Denmark, United Kingdom, France, United States, Canada, Japan, and Australia.

<sup>3</sup> Data and more information about the survey are available at:  
<http://old.pro.se/Konsumentmakt/Prisundersokning/Prisundersokning-2012/>

price premium of 3.59 SEK (around 10 %) for eco-labelled frozen cod fillets. A paired-sample *t*-test gives a *t*-statistic of 11.57. With 656 degrees of freedom this gives a two-tailed *p*-value of 0.00; thus the price premium is statistically significant at any conventional significance level.

**Table 1**

Means, standard errors, standard deviations and 95 % confidence intervals for frozen cod fillets

	Mean	Standard error	Standard deviation	95 % CI
Eco-labelled cod fillets	39.268	0.314	8.045	(38.652 : 39.885)
Cod fillets	35.675	0.096	2.471	(35.486 : 35.864)
Difference	3.593	0.311	7.964	(2.983 : 4.204)

It is, however, important to note that the data do not allow us to separate between different seafood eco-labels. In Sweden, there are two main eco-labels for cod; MSC and KRAV. Since both are quite common in Swedish retail stores, we should not interpret the estimated price premium as a “MSC price premium”, but rather as a general “eco-label price premium”. However, the estimated price premium is well in line with Asche et al. (2013), Roheim et al. (2011), Sogn-Grundvåg et al. (2013), and Sogn-Grundvåg et al. (2014) who found a price premium in the range of 10-15 % for MSC certified salmon, alaska pollock, cod, and haddock in the United Kingdom. With this result in mind, it is interesting to examine whether Swedish cod fishers benefit from the demonstrated price premium. This is the focus of the next section.

#### **4. Price premiums at the fish production level**

##### *4.1. Background on the Swedish Baltic cod fishery and the MSC certification process*

The Baltic Cod Fishery is one of the most important fisheries in Sweden. In the year 2012, the landings of cod constituted around 17 percent of the total catch value of fish and seafood in Sweden (Swedish Agency of Marine and Water Management, [www.havochvatten.se](http://www.havochvatten.se)). The cod is mostly landed along the south coast of Sweden and the ports of Simrishamn and Karlskrona account for the majority of the landings. The fishery targets two different stocks: the Eastern and Western Baltic cod stocks. In total, 50 972 tons of cod was landed from the Eastern Baltic in 2012, of which 20 percent was landed by Swedish vessels (ICES 2013). The fishery from the Western Baltic stock is smaller; 17 072 tons of cod from the Western Baltic stock was landed in 2012, of which Swedish vessels landed 13 percent (ICES 2013).

Regarding the MSC certification, the assessment process for the Eastern Baltic cod fishery started in

January 2010 and concluded in June 2011. The Western Baltic cod fishery was not evaluated for certification. The assessment covered all Swedish fishing vessels holding licenses to fish for the Eastern Baltic cod with the following gear types: trawl, longline, fish trap, and gill-net. In 2011, the assessment team concluded that only the trawl, longline and fish trap components of the fishery should be certified according to the MSC principles for sustainable fisheries (Food Certification International 2011). The date of certification was set to 16:th of June 2011. The gill-net fishery, on the other hand, was not certified. The reason was that the fishery employs methods known to be associated with harbour porpoise bycatch, a species that according to the MSC protocol belongs to the list of endangered, threatened or protected (ETP) species.<sup>4</sup>

Before the MSC eco-label can be used on fish products, an assessment must take place at each step in the supply chain. This is to guarantee that the product originates from a fishery certified to the MSC's principles for sustainable fishing. More specifically, in order for processors to label fish products as MSC-certified, they must be certified against the MSC's chain of custody standard. Thus, for a fish product to be certified, both the seller (vessel) and the buyer (processor) must be certified. More about MSC assessment methodology is described in detail by MSC (2013b).

#### *4.2. Data*

To answer the question whether there is a price premium for MSC-caught fish we need detailed landing data. Ideally, we would like to compare the price per kilogram of cod from a MSC certified fishery to the price of cod from a non-certified fishery, holding constant all other factors that affect the price. In other words, a suitable control group is needed to identify the price premium. In order to accomplish this, we make use of two databases provided by the Swedish Agency for Marine and Water Management (SwAM). The first database consists of sales notes and includes information about prices, buyers and sellers, landing ports, and size and quality of the cod. The sales notes are sent from fish receivers to SwAM.<sup>5</sup> Information about which vessels and buyers are MSC certified was obtained from Fiskbranschen ([www.certifieratfiske.se](http://www.certifieratfiske.se)) and MSC ([www.msc.org](http://www.msc.org)), respectively.<sup>6</sup> This information was then matched to the sale notes, which made it possible to separate the "treatment group" (landings where both the fisher and buyer are certified) from the "control group" (landings where at least one of the fisher and buyer are not certified).

From the landing tickets, there is no way of knowing whether the cod were caught in the MSC certified eastern Baltic, or in the non-certified western Baltic. To acquire this information, log-book

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<sup>4</sup> To score well on the MSC assessment, a fishery must be conducted in a manner that ensures ETP impacts fall within acceptable limits. For the gill-net fishery, the assessment concluded that it is likely that too many harbour porpoise would be by-caught, and therefore, the fishery failed the MSC certification (Food Certification International 2011, pp.131).

<sup>5</sup> All Swedish receivers of fish are required to report the sale notes to SwAM (European Commission 2009).

<sup>6</sup> For all qualified fishers, the date of certification is 16.06.2011. When it comes to the chain of custody certification, however, the dates of certification differ across buyers.

data with information about the geographical position for each fishing trip were matched to the landing tickets. From this information, we created a MSC variable taking the value one if a certified buyer purchased cod from a certified vessel, and the cod was caught from the MSC certified eastern Baltic cod stock. In all other cases, the MSC variable is set to zero.

In addition to the MSC variable, information was gathered on catch method (trawl, longline, gill-net, trap), quality rating of the fish and size class of the fish. Size classes and quality ratings are defined by the European Commission (European Commission 1996). The size classes are: 0.3 to 1 kilo (very small), 1 to 2 kilos (small), 2 to 4 kilos (medium), 4 to 7 kilos (large) and more than 7 kilos (very large). The quality classes are determined on the basis of the freshness of the fish and include three categories: E (highest quality), A (medium quality) and B (lowest quality). Daily observations from January 1th 2011 to December 31th 2012 give a total of 38 971 observations.<sup>7</sup> Descriptive statistics for the variables are shown in Table 2.

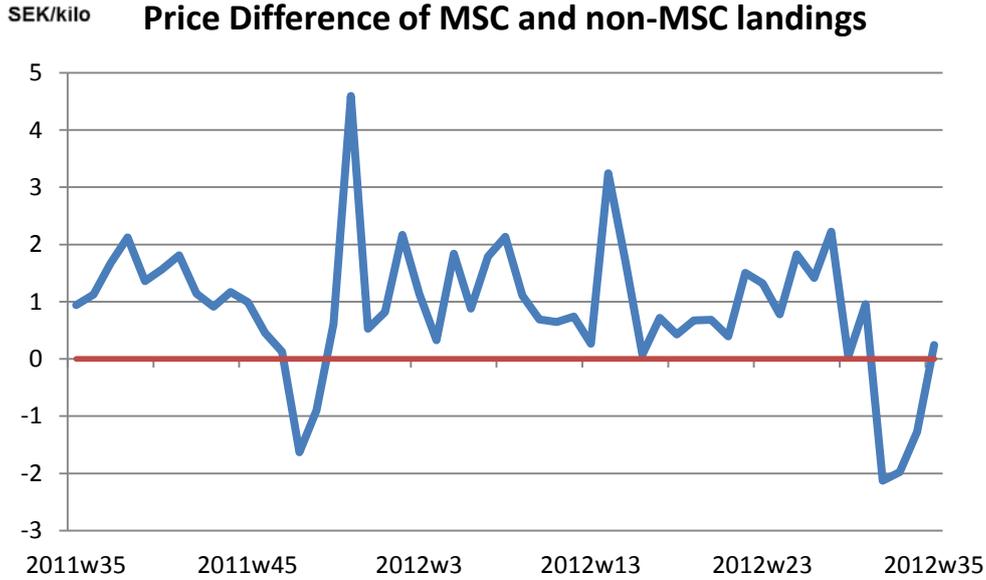
**Table 2**  
Variables and descriptive statistics

Variable	Description	Mean	St.Dev
Price	SEK per kilogram	14.562	3.790
Very large (>7 kg)	1 if very small, 0 otherwise	0.010	
Large (4-7 kg)	1 if size small, 0 otherwise	0.047	
Medium (2-4 kg)	1 if medium, 0 otherwise	0.171	
Small (1-2 kg)	1 if size large, 0 otherwise	0.390	
Very small (0.3-1 kg)	1 if very large, 0 otherwise	0.382	
QualityE	1 if quality E, 0 otherwise	0.159	
QualityA	1 if quality A, 0 otherwise	0.839	
QualityB	1 if quality B, 0 otherwise	0.002	
Trawl	1 if caught by trawl, 0 otherwise	0.290	
Net	1 if caught by gill-net, 0 otherwise	0.540	
Line	1 if caught by longline, 0 otherwise	0.164	
Trap	1 if caught by fish trap, 0 otherwise	0.006	
Eastern Baltic	1 if caught in eastern Baltic, 0 otherwise	0.650	
MSC-certified	1 if MSC-certified, 0 otherwise	0.162	

*Notes:* Standard errors are not reported for dummy variables. For the dummy variables, the mean indicates the proportions of observations with a certain characteristic.

<sup>7</sup> The original dataset contained 39 030 observations but because of missing data 41 observations were excluded. In addition, there seems to be some misreported landings where the reported price is either exceptionally low or exceptionally high. The observations where the price per kilogram is either below 2 SEK or above 100 SEK are defined as outliers and therefore excluded from the dataset (18 observations, <0.1% of the total).

To get a feeling of the size of the possible price premium, Figure 1 plots the weekly average price difference between MSC and non-MSC landings in the year following MSC certification. If fishers receive a price premium, we expect the price difference to be positive, which is also confirmed by the figure. The mean difference over the time period is 0.90 SEK, or about 6 %, and is statistically different from zero. While Figure 1 suggests a price premium, we need to control for other factors that affect the price and that may be correlated with the MSC variable. This is the focus of the next section.



#### 4.3. Model specification

To examine whether fishers receive a price premium for participating in a MSC certified fishery, our starting point is the hedonic price model (Rosen 1974). In this model, the price of a product is specified as a function of its attributes. The product we consider is fresh gutted cod with head on. The most general form of the model can be written as

$$p_{ibt} = f(s_1, \dots, s_n), \quad (1)$$

where  $p_{ibt}$  is the price per kilogram of landing  $i$  sold to buyer  $b$  at day  $t$ , and the vector of attributes,  $s_1, \dots, s_n$ , determines the price of the product. It is common in the literature to specify  $f$  as a linear function. In this case, the hedonic price model can be written as

$$p_{ibt} = \alpha + \sum_{j=1}^m \beta_j s_{j,ibt} + \varepsilon_{ibt}, \quad (2)$$

where the  $m$  attributes represented by the explanatory variables  $s_{j,ibt}$  are listed in Table 1. The model in (2) is standard when estimating the marginal value of attributes of fish products (e.g. Carroll et al. 2001; Roheim et al. 2011; Sogn-Grundvåg et al. 2014). We are also concerned about possible

unobserved buyer heterogeneity that may be correlated with the explanatory variables.<sup>8</sup> For the MSC-variable we are particularly concerned about buyer self-selection problems. That is, buyers who choose to join the MSC chain of custody certification are by definition different from those who choose not to join. These differences, if they influence the ex-vessel price, would invalidate the interpretation of the MSC-variable. An important feature of our study is that we are able to control for self-selection issues by including buyer-specific fixed effects in the model. More specifically, the error term  $\varepsilon_{ibt}$  can be written as

$$\varepsilon_{ibt} = \lambda_t + \gamma_b + \eta_{ibt}, \quad (3)$$

where  $\lambda_t$  is a fixed time effect and  $\gamma_b$  is a buyer-specific fixed effect.<sup>9</sup> In addition to the buyer-specific effect,  $\lambda_t$  is included to control for common time trends (e.g. demand and supply fluctuations). The error term  $\eta_{ibt}$  is assumed to be a stationary mean zero random variable.

Note also that each segment (trawl, longline, fish trap and gill-net) is allowed to have a different intercept term that captures unobserved heterogeneity (see Table 1). This is necessary since selection into the MSC program depends on the method of harvest. Thus, these dummy variables ensure that we remove permanent price differences between vessels with different gears that have nothing to do with the MSC certification. As such, the fixed effects model in (2) and (3) improves upon the standard hedonic price model by controlling for additional confounding factors such as supply and demand fluctuations and unobserved buyer heterogeneity that may be correlated with the MSC variable.

When including a constant in (2), the parameters  $\beta_j$  should be interpreted as the price deviations (in SEK) from a base-line product with a given set of attributes. In our model, the base-line is cod of very small size (0.3-1 kilo) and medium quality (Quality A), caught by a vessel using gill-net, and non-MSC certified. By testing the hypothesis that  $\beta_j = 0$ , we can examine whether the marginal values of the attributes in Table 1 differs from the base-line. In all regressions, we follow the suggestion by Bertrand et al. (2004) and use Arellano (1987) clustered covariance matrix estimator, which allows for both serial correlation and heteroskedasticity in the errors.<sup>10</sup>

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<sup>8</sup> The importance of accounting for unobserved heterogeneity when examining price effects of eco-labels has been highlighted by Hallstein and Villas-Boas (2013).

<sup>9</sup> Clearly, a more efficient estimator could be obtained if  $\lambda_t$  and/or  $\gamma_b$  are specified as random effects. Note, however, that the random effects estimator is not consistent in presence of buyer self-selection (because of the necessary assumption that the composite error term is uncorrelated with the explanatory variables). A Hausman test strongly rejects the null hypothesis that the random effects estimator provides consistent estimates ( $p$ -value = 0.000). We therefore continue with the fixed effects specification.

<sup>10</sup> If serial correlation is present, Bertrand et al. (2004) show that conventional standard errors perform poorly in the context of difference-in-difference estimators. To guard against biased standard errors we use clustered standard errors at the buyer level, which allow the errors for a particular buyer to be arbitrary correlated (see Arellano, 1987).

#### 4.4. Empirical results

Model I in Table 3 shows the results from the baseline model in equations (2) and (3). The first thing to notice is that size and quality are important attributes. Compared to the price of very small cod (0.3-1 kg) of medium quality (quality A), the price is 3.5-4.0 SEK (30-35 %) higher for cod in the other size classes. Similarly, cod with quality A is almost 4 SEK less expensive than cod with quality E, whereas cod of quality B generates significantly lower prices. While we expected the price premium to increase with size class, Model I shows that the largest size premium is for small cod (1-2 kg). This is somewhat surprising and to explore this result in more detail we added interaction terms between quality and size dummies. More specifically, in Model II we included size dummies interacted with the high quality dummy. As can be seen from these results the coefficient on the quality E variable drops to about 2 SEK. We also see that buyers pay an additional price premium for large *and* high quality (quality E) cod. For example, compared to very small cod of quality E, the price premium is 4.0 SEK for small cod of quality E (since the interaction term is insignificant), but 5.3 SEK for medium sized cod of quality E. In other words, compared to cod of small size, fishers receive a price premium for larger cod only if it is of high quality. Regarding different gear types, the price differences are small and statistically insignificant except for trawls.

The focus of this paper is whether or not fishers receive a price premium for participating in a MSC-certified fishery. The results in Models I and II suggest that fishers do not receive a price premium. This result contrasts with earlier studies of the MSC-price premium at the retail level. Interestingly, it is also in contrast to Figure 1, which indicated a significantly positive price premium. In an attempt to explain the difference between Figure 1 and the regression results, in Model III we examine the importance of unobserved heterogeneity by excluding the buyer-specific fixed effects from the model. As can be seen, the coefficient on the MSC variable is now positive and highly significant indicating a price premium of 1 SEK (around 7 %). To test Model III against the Model II, we perform an *F*-test for the significance of the buyer-specific fixed effects. The test statistic is  $F(55, 38189) = 330.6$  which is statistically significant. This suggests that the buyer-specific dummies are jointly significant and that Model III suffers from an omission variable problem rendering the coefficient estimates biased and inconsistent.

Another way of illustrating the importance of accounting for unobserved buyer heterogeneity is to examine the average price difference for MSC and non-MSC buyers before and after the MSC certification. If self-selection problems are present, we expect a price difference in the pre-MSC period between those buyers that are about to become certified and those that are not. Looking at Table 4, this is exactly what we find. While MSC certified buyers pay a higher price than non-certified buyers, this was also the case before the MSC certification. The average price difference for MSC and non-MSC

buyers before and after the MSC certification, the so-called difference-in-difference measure, is only 0.16 SEK and is not significantly different from zero at the 5 % significance level. In other words,

**Table 3**

Variable	Model I	Model II	Model III
	Coefficient estimate <i>Robust SE</i>	Coefficient estimate <i>Robust SE</i>	Coefficient estimate <i>Robust SE</i>
Intercept	9.677*** 0.530	9.683*** 0.536	10.139*** 0.527
MSC-landing	-0.011 0.099	-0.003 0.099	1.003*** 0.364
Very large (>7 kg)	3.470*** 0.535	3.371** 1.585	3.641** 1.555
Large (4-7 kg)	3.809*** 0.498	3.260*** 0.9718	3.684*** 1.076
Medium (2-4 kg)	3.597*** 0.308	3.419*** 0.216	3.580*** 0.333
Small (1-2 kg)	4.043*** 0.258	4.039*** 0.275	4.043*** 0.275
QualityE	3.758*** 0.525	2.136*** 0.369	-0.237 0.470
QualityB	-7.494*** 0.893	-7.559*** 0.851	-8.337*** 0.617
Trawl	0.279*** 0.030	0.272*** 0.031	0.379** 0.150
Line	-0.058 0.089	-0.066 0.089	-0.054 0.142
Trap	0.376 0.358	0.353 0.360	-0.313 0.221
Eastern	-0.141 0.110	-0.139 0.112	-1.168** 0.438
Very large*QualityE		1.600 1.819	3.670* 2.072
Large*QualityE		2.221** 1.038	4.323*** 1.398
Medium*QualityE		1.843*** 0.391	3.828*** 0.826
Small*QualityE		0.607 0.425	1.000 0.605
No. Obs	38971	38971	38971

Notes: \*\*\*, \*\*, and \* indicates significance at  $p < 0.01$ ,  $p < 0.05$ , and  $p < 0.1$ , respectively. The standard errors are computed using Arellano (1987) clustered covariance matrix estimator.

permanent price differences between MSC and non-MSC buyers seem to explain the price differences in Figure 1, not the MSC certification itself.

**Table 4**

Average price difference between MSC and non-MSC buyers

	Before certification	After certification	Difference
Non-MSC buyer	13.386	14.012	0.626
MSC buyer	14.274	15.058	0.783
Difference-in-difference			0.157
(95% confidence interval)			(-0.232 : 0.338)

## 5. Summary and conclusions

Eco-labels are an increasingly popular tool to facilitate movement towards more environmentally friendly consumption patterns. The increase of eco-label products has been particularly evident in fisheries. The leading eco-label, the MSC label, can be found on more than 22 000 seafood products worldwide and more than 200 fisheries are certified ([www.msc.org](http://www.msc.org)). In light of the importance of eco-label use, a number of studies have analyzed consumers' preferences for eco-labelled fish products, where most studies find that consumers are willing to pay a price premium for eco-labelled seafood. While consumer interest is a prerequisite for the success of eco-labelled fish products, the profitability of eco-label adoption for fishers is a crucial condition for its spreading. Indeed, an often stated goal of MSC certification is to reward sustainable fishing practices through price premiums and/or market access for eco-labelled seafood that would not be otherwise available to the fishery (MSC 2011). While there is evidence of price premiums in the retail market for MSC labelled fish products (Roheim et al. 2011; Sogn-Grundvåg et al. 2013; Asche et al. 2013; Sogn-Grundvåg et al. 2014), there are very few studies examining the existence of price premiums at the producer level.

In this paper, we show that there exists a price premium in the Swedish retail market for eco-labelled cod. With this result in mind, we analyze the price premium achieved by Swedish fishermen for providing eco-labelled seafood. For this purpose, the MSC-certified Swedish Eastern Baltic cod fishery is used as case study. The fishery provides us with an ideal experiment for testing the MSC price premium. This is because not all fishers were qualified for certification. Hence, the gill-net component of the fishery, which did not fulfill the criteria, can be used as a control group in a panel data difference-in-difference model. This quasi-experimental methodology makes it possible to control for unobserved heterogeneity and common time trends that may otherwise bias the estimated price premium. The conclusion from the analysis is that we find no evidence of a price premium for MSC-certified landings for the fishermen involved in the cod fishery.

Our results demonstrate that a price premium at the retail level does not necessarily transmit back to the fishers. In this regard, the results are in line with the statement by Washington (2008) and Washington and Ababouch (2011) that there is no firm evidence of a MSC price premium at the fish production level. There could be several reasons explaining this result. A first is the structure of the Swedish retail and processing industries for food, which are both characterized by large firms with market power (Olofsdotter et. al, 2011). Firms with market power will be able to get the price premium paid by consumers for eco-labelled fish products at a low cost, thereby having large mark-ups for these products. This industry structure is not specific for Sweden, but part of a global development (Sexton, 2013). A second reason is the import of both labelled and other fish products. Our study consists of two data sets, and we have no information whether the cod bought by Swedish consumers are indeed provided by the Swedish fishery or if it is imported. Thus, the price premiums at the retail level may be transmitted not to the Swedish fishing sector, but to other producers. However, as pointed out by Nielsen (2005), the European first-hand cod market is highly integrated between countries. This implies that we expect the price of MSC certified cod to be similar across countries.

This study is the first to explore price premiums for MSC certified seafood at the fish production level using individual-level landing data and a quasi-experimental methodology. It would be interesting to replicate the study to see whether the results could be generalized to other fisheries. It would also be interesting to explore in more detail how the price premium is distributed along the supply chain and to what extent this influence future investment decisions. Indeed, the costs of certification are generally borne by the fish producers, who are increasingly demanding proof of market benefits to justify the costs of certification.

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