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**A REDUCTION IN THE QUOTA FOR  
NORTHEAST ARCTIC COD AND  
THE INCOME EFFECT ON THE  
NORWEGIAN FISHING FLEET**

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# A Reduction in the Quota for the Northeast Arctic Cod and the Income Effect on the Norwegian Fishing Fleet

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## Abstract

The paper analyses the economic effect a change in TAC (Total Allowable Catch) will have on the Norwegian fishing industry. For the coming year ICES (International Council for the Exploration of the Sea) has recommended a low total quota (TAC) of Northeast Arctic cod. The background for the restrictive TAC is years with unregistered over fishing, and ICES wants to rebuild and strenghten the stock. The quota of Northeast Arctic cod is shared between Norway, Russia and third countries which get a smaller part. A reduction in the TAC will have economic consequences for the fishing fleet and processing industry in Norway. The analysis shows that the recommended quota for 2007 will reduce the gross income in the Norwegian fishing fleet by about 1 billion NOK compared to the 2006 level.

**JEL classification number: Q01, Q22, Q28, Q34**

**Keywords: Northeast Arctic cod, quota, income, fishing fleet**

## 1 Background and problem definition

The Northeast Arctic cod is a highly valuable fish which is shared between Norway, Russia and EU-countries. Norway exported cod and cod products for about 5 billion NOK in 2005 (Seafood from Norway 2006). The activity and the employment in the fish processing industry in Northern Norway are highly dependent on landings of Northeast Atlantic cod. A preliminary statistical analysis shows that a 1% change in the landings of cod by Norwegian and foreign vessels changes the employment in the fish processing industry

by 0.12% (standard deviation 0.044). It is Norway and Russia which finally decide the yearly total quota (TAC). The third countries' share of TAC is 13.5%, and the remaining part is shared equally between Norway and Russia. During the last years the Norwegian coastguard has detected systematic overfishing and under-reporting of catches of cod in the Barents Sea. ICES (International Council for the Exploration of the Sea) and the sub group ACFM (Advisory Committee on Fishery Management) recommend that the TAC should be reduced by about 35% in order to compensate for the overfishing (ICES 2006). ICES states that the stock is overexploited and argues that (1) the fishing mortality is too high in relation to the agreed level and (2) the fishing mortality is too high relation to highest possible yield. ICES explains the situation in the following way:

“Lack of enforcement of the management plan has resulted in overexploitation above the level intended in the management plan. Estimates of non-reported landings were 90.000-117.000 tons for 2002-2004 and 166.000 tons for 2005. The main mechanism used for avoiding quota control seems to be trans-shipping of fish from the Barents Sea.....Actions are needed to stop the unreported fishing” (ICES 2006).

The recommendation will induce negative reaction among law-abiding fishermen (Fiskaren, 7. and 12. June 06).

The main objective of this study is to analyze the price and revenue effect a reduction in the quota will have on the Norwegian fishing fleet. The estimation is based on historical figures of landed fish in Norway by Norwegian vessels. The paper is structured as follows. The first part is descriptive and shows the volume and the price of cod landed in Norway during 1918-2005. We work through statistical tests in order to identify the data generating process behind the univariate time series applied in the analysis. The section also tests out whether the variables are cointegrated. The second part estimates the relationship between price and quantity. The third part is a scenario analysis and the objective is to quantify the revenue effect of a reduction in the Norwegian part of the total quota. The fourth part concludes.

## 2 Descriptive statistics

Figure 1 shows respectively quantity of landed cod (Northeast Arctic cod) in Norway by Norwegian vessels, unit price of cod and the total first hand value (gross revenue) for the period 1918-2005. The price is measured in Norwegian kroner adjusted to the 2006-price level.

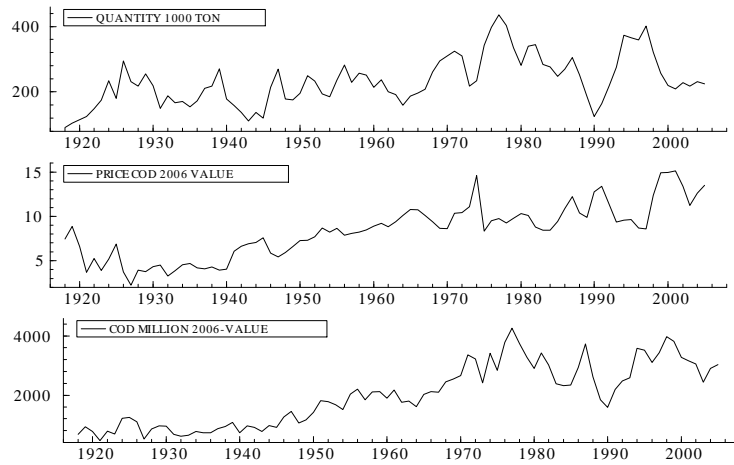


Figure 1: Quantity, price and gross revenue for landed cod 1918-2005.  
Source: Statistics Norway

Figure 1 shows that price and quantity have fluctuated during the period, and especially volatility has increased from the beginning of the 1970s. The price has increased, but it is not quite clear whether the quantity landed has increased during the same time interval. There is some suggestion that there may be a weak positive trend. The volatility of the price seems to be lower compared to the variation in quantity. The gross revenue has increased during especially 1930-1975, thereafter the value has levelled off. The average landed quantity during the period is 233.2 thousand tons and the average price is 8.3 NOK per kilogram. During the period 1995-2005 the average landed quantity is 275.6 thousand tons per year and the average price is 12.3 NOK per kilogram.

### 3 Test for stationarity and DGP

Before estimation of the relationship between price and quantity it is necessary to analyze what kind of data generating process (DGP) characterized the time series. Augmented Dickey-Fuller test (ADF) and Phillips-Perron test (PP) were applied in the testing for unit root and stationarity. If the total sample is applied, the ADF-test rejects the hypothesis of a unit root. The applied lag order is the highest significant lag order from either the autocorrelation function (SACF) or the partial autocorrelation function (PACF) of the first differenced series. The analysis is based on the data for the period 1930-2005. The results of the ADF and Phillips-Perron test are in table 1.

Table 1: Test statistics for quantity 1930-2005

VARIABLE	PP-TEST	PP-TEST	ADF	ADF
	Constant	Constant and trend	Constant	Constant and trend
Quantity	-3.11	-3.65	-1.40	-1.73
Critical value	-2.86	-3.41	-2.86	-3.41

The tests are based on 5% significance level. The results of the tests show that Phillips-Perron test rejects the hypothesis that landed quantity has a unit root. The hypothesis cannot be rejected if the test is based on 1% significance level. On the other hand, the ADF test shows that the hypothesis of a unit root can not be rejected. Both Phillips-Perron and ADF test shows that the time series are made stationary by differentiating. We conclude that quantity of landed cod is a non stationary, integrated time series of order one, i.e.  $q_t \sim I(1)$ . Table 2 shows the results from testing the price variable for unit root.

Table 2: Test statistics for price 1930-2005

VARIABLE	PP-TEST	PP-TEST	ADF	ADF
	Constant	Constant and trend	Constant	Constant and trend
Price	-1.91	-3.52	-1.58	-3.00
Critical value	-2.86	-3.41	-2.18	-3.41

The Phillips-Perron test which includes a constant cannot reject the hypothesis of unit root, given a significance level of 1%. The ADF-test indicates also that it is a unit root process. ADF and Phillips-Perron test shows that the the time series are stationary if they are differenciated. We conclude that price and quantity are non stationary processes and integrated of first order, i.e.  $p_t, q_t \sim I(1)$ .

## 4 Estimation of model

In the previous section we concluded that both variables are non stationary and that they are integrated of order one, i.e.  $q_t, p_t \sim I(1)$ . We tested whether there exists a long run relationship between landed quantity and price. If a longrun relationship exists, the variables are cointegrated. An ADF and Phillips-Perron test shows that the variables are not cointegrated. The PP-test which includes a constant gives the following result:  $T$ -test = -2.65 and critical value (10% significant level),  $T^c = -3.04$ . The results from

the ADF-test is as follows:  $T$ -test = -1.67 and critical value  $T^c = -3.04$ . The conclusion is that there exists no long-run stationary relationship between landed quantity and price of cod. The variables are difference stationary (DS) processes and need to be differenced before they can be applied in a regression. We estimated the following theoretical model.

$$\Delta p_t = \beta \Delta q_t + \varepsilon_t$$

where  $\Delta p_t = \log(P_t) - \log(P_{t-1})$ ,  $\Delta q_t = \log(Q_t) - \log(Q_{t-1})$ ,  $\beta$  constant and  $\varepsilon_t$  is the stochastic residual which has white noise properties, i.e.  $\varepsilon_t \sim IN(0, \sigma_\varepsilon^2)$ .  $P_t$  and  $Q_t$  are respectively price and quantity at year  $t$ . Table 3 shows the result of the estimation.

Table 3: Estimated coefficients

Variable Name	Estimated Coefficient	Standard Error	T-Ratio	p-Value 72 DF	Partial Correlation	Standardised Coefficient	Elasticity at Means
$\Delta q_t$	-0.22105	0.0614	-3.600	0.001	-0.391	-0.3125	0.0224
D1	-0.48037	0.1037	-4.634	0.000	-0.479	-0.3953	-0.3760
D2	0.37310	0.1012	3.685	0.000	0.398	0.3070	0.2920
D3	0.31785	0.1019	3.119	0.003	0.345	0.2615	0.2488

The table shows that the variables in the model are significant. The model also includes dummy variables  $D1$ ,  $D2$  and  $D3$ . The dummies are integrated in the model for absorbing abnormal shocks or irregularities which are detected by analyzing the residuals.  $D1 = 1$  for 1975,  $D2 = 1$  for 1941 and  $D3 = 1$  for 1998. The LM-test shows no indication of autocorrelation ( $\chi_{23}^2 = 23.2$ , given the critical value  $\chi_{24}^2 = 33.2$  and 10% significance level). Durbin-Watson  $DW = 1.89$  and it indicates no first order autocorrelation, and the residuals are normal distributed. Hansen test shows stable variance (10% level).  $F_{(4,74)} = 18.26$  and  $\bar{R}^2 = 0.47$ . The regression model shows that a 1 percent increase in quantity (per thousand tons) landed reduces the average price by 0.22 percent. By applying the standard error of the estimate, we can construct the 95% confidence interval for the  $\beta$  coefficient. According to the regression model, there is a probability of 95% that the  $\beta$  exists in the following closed interval  $\beta \in [-0.34, -0.10]$ .

## 5 Scenario analysis

This section analyses how changes in TAC affect the gross revenue realized by the Norwegian fishing fleet. The model can be applied in a one step ahead prediction of the price. We have estimated the following model:  $\Delta p_t =$

$-0.22\Delta q_t - 0.48D1 + 0.37D2 + 0.31D3$ . It follows that the price at  $t$  can be expressed as  $p_t = p_{t-1} - 0.22(q_t - q_{t-1}) - 0.48D1 + 0.37D2 + 0.31D3$ . Figure 2 shows the one step a head estimation of the price for 1930-2005.

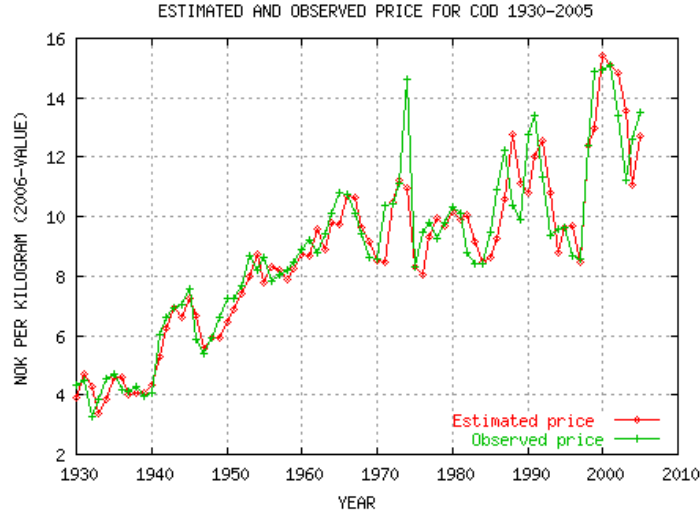


Figure 2: Estimated price of cod

It is also possible to apply the equation for forecasting. One step a head forecast can be expressed in the following way:  $p_{t+1} = p_t - 0.22(q_{t+1} - q_t)$ . All dummies are zero, so they are not relevant in the further analysis. The quantity landed in  $t = 2005$  was  $q_{2005} = 5.41252$  and the price was  $p_{2005} = 2.6033$ . The Norwegian share of the TAC of Northeast Arctic cod for 2006 is 212.7 thousand tons (Directorate of Fisheries in Norway), or  $q_{2006} = 5.3599$ . The change in quantity between 2005 and 2006 is  $(q_{t+1} - q_t) = -0.052637$ . If we substitute the information into the equation, we have the following estimate for the expected average price for 2006, i.e.  $\hat{p}_{2006} = 2.615$ . By taking the antilog, the estimated price for cod in 2006 is 13.7 NOK per kilogram.

ICES has recommended a radical reduction in the TAC for cod for 2007 (ICES 2006), and the reduction implies that the Norwegian quota will be about 133 thousand tons. If the recommendation for 2007 is followed the quantity of landed cod will be reduced by about 80 thousand tons as compared to the 2006-level. The change can be expressed as:  $(q_{t+1} - q_t) = 0.4695$ . What will be the expected price if the reduction becomes a reality? By substituting the estimated price for 2006 and applying the calculated reduction in quantity, the average price for 2007 is expected to be  $\hat{p}_{2007} = 15.16$  Norwegian kroner.

We have extended the analysis by using the results from the estimation that there is a probability of 0.95 that  $\beta$  is in the following range or interval

$\beta \in [-0.34, -0.10]$ . The Norwegian fishing fleet can catch 212.7 thousand tons of cod in 2006. Above we estimated that the average price in 2006 is 13.7 NOK per kilogram. The average gross revenue ( $R$ ) of the landed fish (first hand value) for 2006 is  $R = 212.7 \times 13.7 = 2.9$  billion Norwegian kroner. Let us apply the estimated revenue for 2006 as the benchmark and compare it with different scenarios for 2007.

The gross revenue ( $R_t$ ) can be expressed as the product of quantity and price, i.e.  $R_t = P_t Q_t$ . The change in revenue is dependent on the magnitude of change in quantity and price. The total change can be expressed as  $\Delta R = R_{2007} - R_{2006} = \Delta PQ - \Delta QP$ . The statistical analysis shows that the quantity landed has some influence on the price of cod. However, it is uncertain how strong this effect is, except that there is a 95% probability that the coefficient  $\beta$  is inside this closed interval  $\beta \in [-0.34, -0.10]$ . Further the size of the TAC of the Northeast Atlantic cod has not been finally determined. The fisheries biologists in ICES have recommended a total TAC of 309 thousand tons. This implies that the Norwegian share of the TAC will be 133 thousand tons. The rest of the analysis takes into consideration the uncertainty connected to (1) the price-sensitivity and (2) the size of the TAC for 2007. In the following we compare different scenarios for 2007 with the 2006 situation. The price sensitivity embraces the following values  $\beta = -0.34$ ,  $\beta = -0.22$  and  $\beta = -0.10$ . The Norwegian part of the TAC embraces quantities from 130 to 200 thousand tons. Figure 3 shows the reduction in gross revenue compared to the expected 2006 level, given the mentioned combinations of different price-sensitivities and different sizes of quotas of cod.

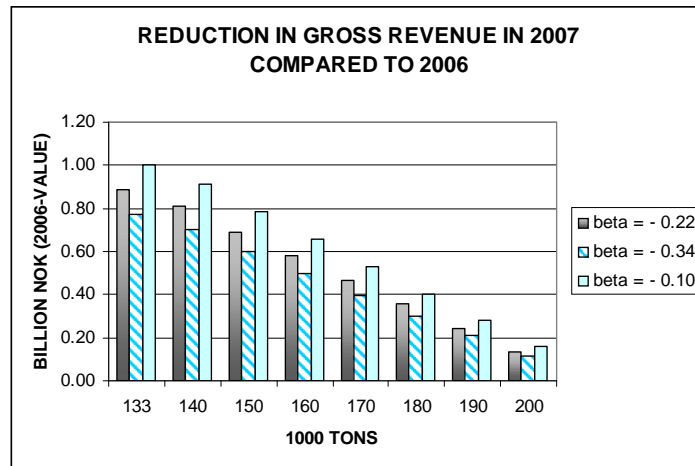


Figure 3: Reduction in revenue compared to 2006-level



Figure 3 shows that the reduction in revenue is dependent on the final size of the quota which the Norwegian fishermen can catch. The revenue is also dependent on how sensitive the price is to changes in quantity. The figure shows that the reduction in gross revenue is highest if the Norwegian quota is reduced to 133 thousand tons. In this case the reduction in revenue will be between 0.7 and 1 billion Norwegian kroner. The smallest change in revenue is the combination of high value on  $\beta$  (most price sensitive) and marginal reduction in quota. Figure 4 shows the percentage change in gross revenue compared to the expected 2006-level.

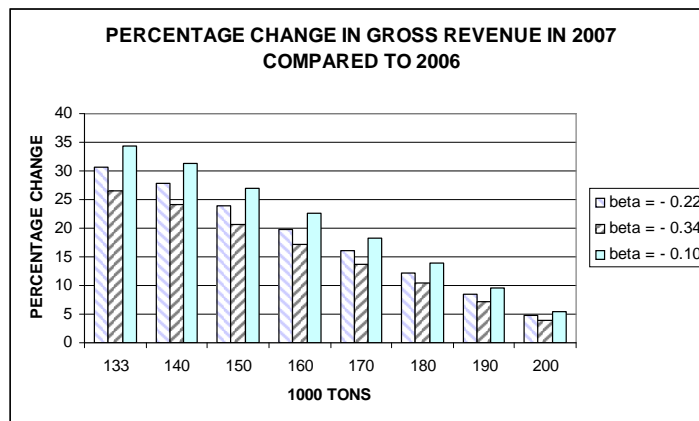


Figure 4: Percentage reduction in revenue between 2006 and 2007

Figure 5 shows the expected price for 2007 given different quotas and price sensitivity.

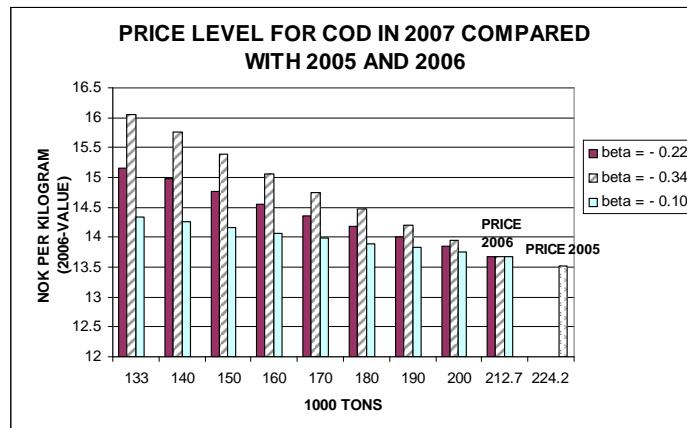


Figure 5: Price scenarios for cod in 2007

Figure 5 shows that the price for cod will increase in 2007 because of a reduction in quantity landed. The price increase is not strong enough to

offset or compensate for the reduction in quantity, so the change in revenue is expected to be negative, i.e.  $\Delta R = \Delta PQ - \Delta QP < 0$ . Figure 6 shows how big share the positive price effect amounts relative to the total change in gross revenue  $\frac{\Delta PQ}{\Delta R}$ .

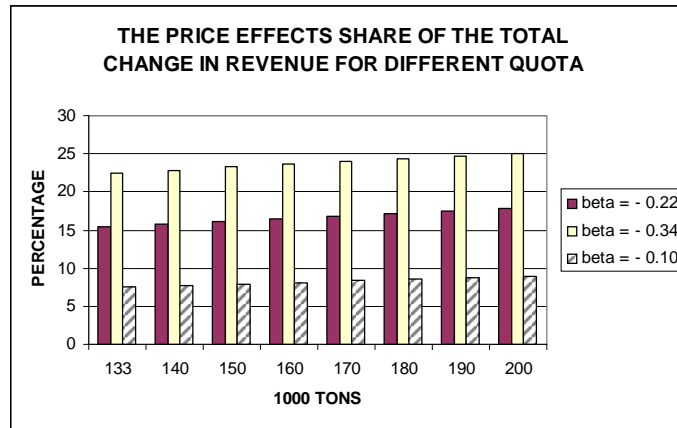


Figure 6: The price effect's share of total change in revenue

Figure 6 shows that the positive price effect is strongest for the combination of high price sensitivity (high numerical value on  $\beta$ ) and low quota. Figure 7 shows the gross revenue realized by the Norwegian fleet given different quota-scenarios. The figure also includes the expected landed value for 2006 and 2007.

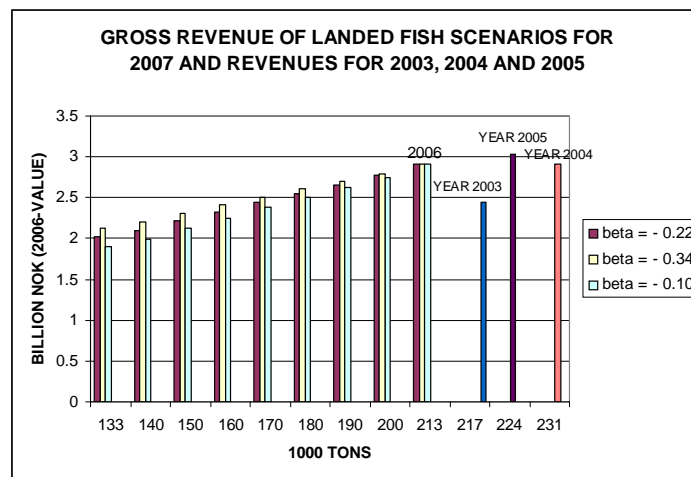


Figure 7: Scenarios for the gross revenue in 2007

Figure 8 shows how the actual gross revenue of landed cod from the Norwegian fleet has developed during the last 20 years.

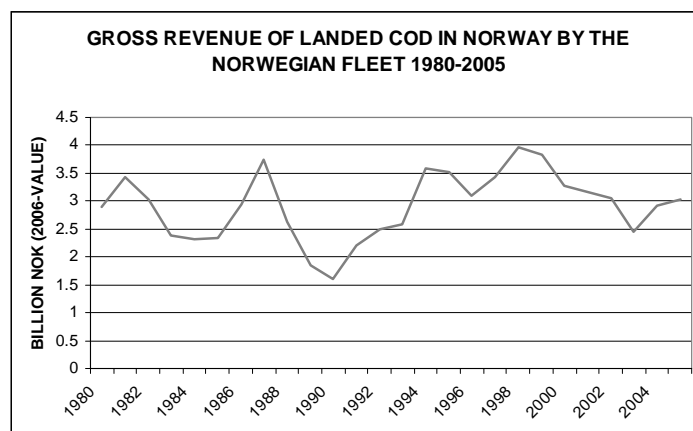


Figure 8: Gross revenue for landed cod 1980-2005

The average value of the revenue during the period 1980-2005 amounts to 2.9 billion NOK per year. The figure also shows two instances where the revenue has been at a low level. In the period 1983-85 the revenue was about 2.3-2.4 billion NOK. In the period 1990-1991 the revenue was below 2 billion NOK. In 2004 the gross revenue was 2.4 billion NOK. The situation facing the Norwegian cod fishery in 2007 may be similar to the one in 1983-85. Although the effect may not be as dramatic as the situation in the early 1990s - but it will probably be close if the recommended quota is followed in practice.

The analysis shows that the average yearly annual amount of landed cod in Norway by the Norwegian fleet totals to about 3.2 billion NOK during the last 10 years. It should be emphasized that the landed value of the fish has not been constant over time, so it is no argument that the future quota necessarily has to be equal to the 2006-level. The standard deviation of the first hand sales value (gross revenue) is about 430 billion NOK, so a 95% confidence interval for the landed value is in the closed interval [2.4, 4.0] billion NOK per year. Figure 9 shows the observed value (gross revenue) of landed cod and three simulated paths for the gross revenue for 1995-2005.

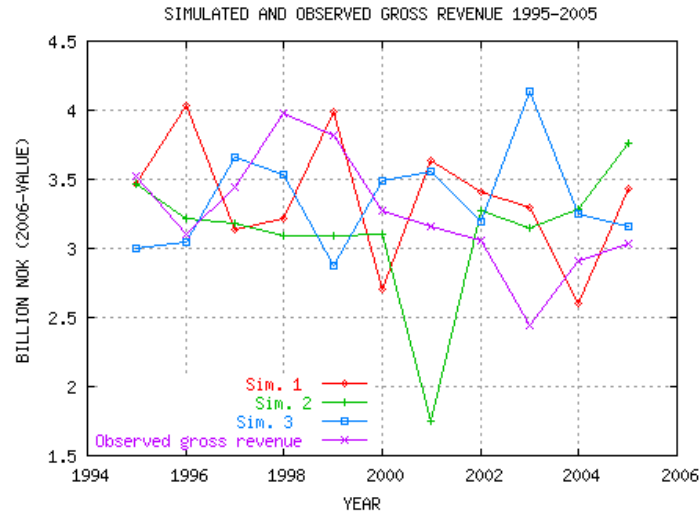


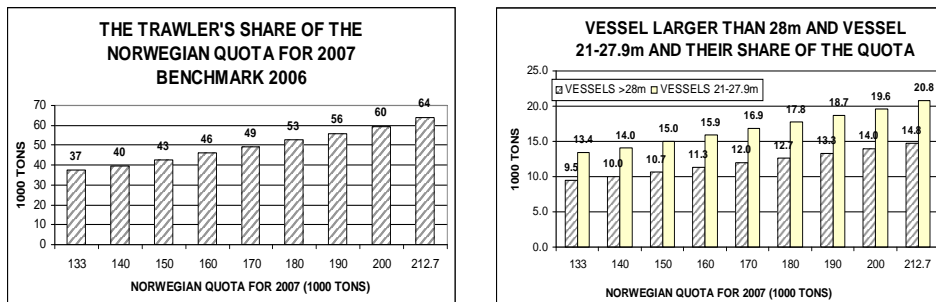
Figure 9: Simulated and observed gross revenue 1995-2005

Figure 9 shows that there is a natural variation in the gross revenue. The expected landed value for 2007 is dependent on the size of the quota and the price sensitivity. The analysis shows that if the Norwegian quota for 2007 is lower than 180 thousand tons, the gross revenue is outside the 95% confidence interval based on figures from the last 10 years (see figure 7), and in that respect the recommended TAC by ICES will result in an extreme situation for the Norwegian cod fishery in 2007.

## 6 Quota for 2007 and gross revenue for different vessel groups

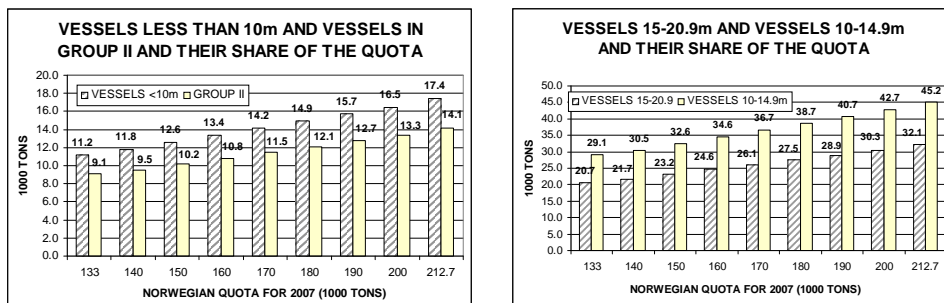
So far the analysis has focused on the aggregated effects of different quota scenarios for 2007. In the following we ask: What is the effect of a change in quota for different vessel groups in Norway? The total Norwegian quota of cod is shared between two main vessel groups, trawlers and vessel groups which apply so-called “traditional” fishing gear. The latter are also called the “conventional group”. If the total quota is below 130 thousand tons, 72% of the quota is allocated to the “conventional” group and 28% to the trawlers. If the total quota is larger than 330 thousand tons, then 33% is allocated to the trawlers and 67% to the “conventional” group. If the total quota is in the interval 130-330 thousand tons, the following distribution formulae is used in calculating the share  $\alpha$  for the trawlers;  $\alpha = 0.28 + 0.00025(TAC - 130)$ , where  $TAC$  is the total Norwegian quota given the restriction  $130 < TAC < 330$ . The conventional group consists of different vessels sub-groups of categorized

by length meters. There are five groups plus an open group which consists of vessels with different lengths. Each group has a particular share of the total quota. The described distribution formula is called “trålstigen” or the “trawling ladder”. The following section shows the distribution of the recommended quota for 2007 between trawlers and different vessel groups in the “conventional” sector. The analysis takes into account the effect from the so-called “trawling ladder”. Figures 10 and 11 show the quota allocated to trawlers and vessels larger than 28 length meters and vessels between 21 and 27.9 length meters.



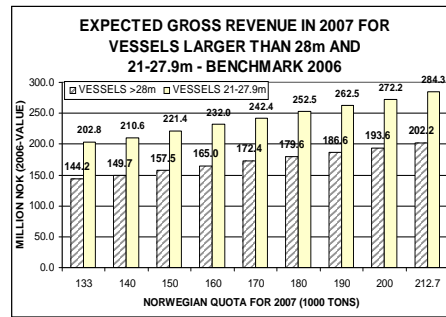
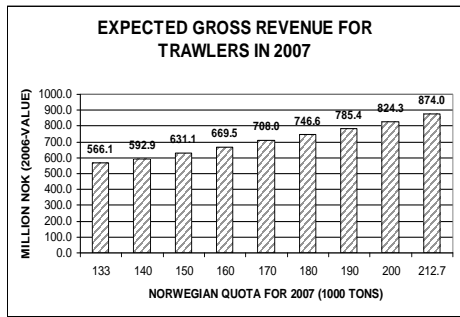
Figures 10 and 11: Allocation of quota to trawlers, vessels larger than 28 length meters and vessels between 21 and 27.9 length meters

Note that the column to the far right in each figure shows the distribution of the quota for 2006. The figure shows that the trawlers will get a dramatic reduction from today’s 64 thousand tons to 37 thousand tons in 2007 if the recommendation from ICES is followed. The reduction is about 42%. The same conclusion can be drawn if we look at the other vessels groups, even though the reduction is a couple of percentage points smaller. Figure 11 shows the impacts of different quota regimes for vessels larger than 28 length meters and vessels between 21 and 21.9 length meters. Figures 12 and 13 show the distribution of the 2007-quota for group 2, vessels less than 10m, vessels between 15 and 20.9 length meters and vessels between 10 and 14.9 length meters respectively.



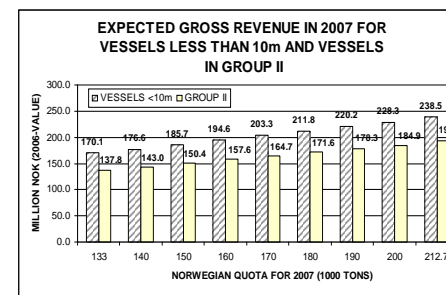
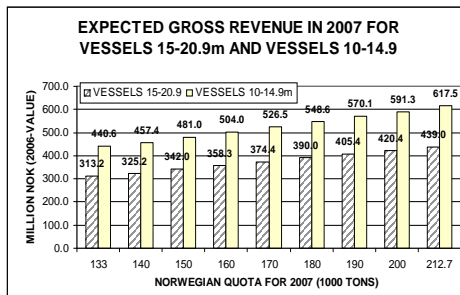
Figures 12 and 13: Allocation of quota to group 2, vessels less than 10 length meter, vessels between 10 and 14.9 length meter and vessels between 15 and 20.9 length meters

The figures show a dramatic reduction in quota for all vessels groups if the recommendation from ICES is followed. In the following we present the expected gross revenue for the different vessel groups, i.e. figures 14 to 17. In connection with the analysis of the economic effects the value of  $\beta$  is fixed to  $\beta = -0.221$ .



Figures 14 and 15: Expected gross revenue for trawlers and vessels larger than 21 length meter

The figure shows that loss in revenue compares to the 2006 situation is also dramatic if the change is measured in economic terms. The positive price effect is far from strong enough to offset the negative effect from reduced quantity. The economic effect on the remaining groups is shown in figures 16 and 17.



Figures 16 and 17: Expected gross revenue for vessels between 15-20.9 length meters, vessels between 10-14.9 length meters, vessels in group II and vessels less than 10 length meters

The analysis quantifies the impact a change in quota is expected to have on each vessel group. Sensitivity analysis shows that ICES' recommended quota for 2007 will reduce the quota for trawlers from 64 thousand tons

in 2006 to 37.3 thousand tons in 2007. The reduction is about 42%. The reduction is expected to have a significant negative economic effect. The expected economic impact of the reduction in quota for the trawlers implies a reduction from 874 million NOK in 2006 to 566 million NOK in 2007, which is a reduction of 35%. The economic impact analysis takes into account the positive price effect due to a general reduction in the total quota. If we apply a value of  $\beta$  which indicates a situation where the price is most sensitive for changes in quantity, i.e. where  $\beta = -0.340$ , the revenue for the trawler group is reduced by 31.5%.

If we look at a sub-group of fishing vessels in the conventional sector, for example vessels with 15-20 length meters, they as a group will see a reduction in quota of 11.4 thousand tons – from 32.1 thousand in 2006 to 20.7 thousand in 2007 which represents a reduction of 35.5%. In economic terms the reduction in quota will reduce the gross income by 28.7% - from 439 million NOK in 2006 to 313.2 million NOK in 2007.

The “Trawling ladder” is a distribution formula for how to share the total Norwegian quota between trawlers and vessels in the conventional group. When the total quota is low, which will definitely be the situation if ICES’ advice is followed, a relatively larger percentage of the total quota will be allocated to the conventional fleet compared to a situation with higher total quota. All in all the trawler group will lose relatively more compared to the percentage reduction for vessels in the conventional sector. The “Trawling ladder” function as a redistributor when the quota varies in the interval 130 to 330 thousand tons. The figures presented in figures 10-17 can also be applied in assessing the effect when the stock is rebuilt and quota increases from year-to-year.

## 7 Concluding remarks

The background for the analysis is the expected reduction in TAC for North-east Arctic cod for 2007. Norway is one of the main principals in the managing of the cod stock. Due to overfishing ICES has recommended a dramatic reduction of 35% in the quota for 2007 compared to the 2006 level. The objective of the paper is to analyze the potential economic effect the recommended reduction in quota may have on the Norwegian cod fishing fleet.

The statistical part of the analysis shows that both price and quantity landed cod are nonstationary time series and that they are integrated of order one. The analysis shows that quantity of landed cod affects the price level of cod. The statistical properties of the model fulfil criteria which indicate validity of the estimated parameters.

The sensitivity analysis shows that the revenue of the Norwegian fleet will be reduced due to a reduction in the quota. The price will increase because of less supply of cod, but the positive price effect is not strong enough to offset the negative effect of reduced landed quantity. The net effect is dependent on the level of reduction in quota and how sensitive the price is for changes in quantity. The negative correlation between price and quantity offsets some of the risk caused by fluctuation in quantity. The analysis shows that the loss may be as big as 1 billion NOK compared to the 2006-level if the recommendation of ICES/ACFM is followed. An average solution (between 133 thousand tons and 212 thousand tons in 2006) will imply a “moderate” reduction in the revenue by about 0.5-0.6 billion NOK compared to the 2006-level. If the final solution is the average of the scenarios presented in the paper, then the Norwegian TAC will be about 170-180 thousand tons in 2007. The expected revenue amounts to about 2.5 billion NOK and this level is equal to the low level the industry was exposed to in the period 1983-1985. Statistical analysis shows that a quota lower than 180 thousand tons will result in a gross revenue level that is outside the 95% confidence interval for the distribution of the revenue based on figures for the last 10 years.

The analysis estimates the effect a reduction in quota will have on different vessel groups. If ICES’ recommendation is followed, the gross income for the trawler group will be reduced by about 35% compared to the 2006-level. The quota for the trawlers will be reduced by 42%, whereas vessels in the conventional sector will get a reduction in quota of 35.5%. The gross income for the trawler group will be reduced by 35%, whereas the gross income in the conventional sector will be reduced by 28.7%. The differences are explained by the distribution formula, the “Trawling ladder”, which redistributes quota between trawler and conventional sector. The analysis focuses on changes in quota and income between 2006 and 2007. If we compare historical data, we find that quota has changed from year to year. It is therefore not irregular that income in natural based fisheries changes over time. But the expected change for 2007 can be characterized as one of the most severe during the last 10-15 years. The fish processing industry will also be hit by the reduction in quota. A reduction of 35% may reduce the employment in the fish processing industry by between 1.1 and 7% (95% confidence interval). If the employment is 10.000, the reduction in landings may reduce the employment level by between 110 and 700 persons. The wide interval indicates that the estimate is uncertain. If the middle is the realistic estimate, then 400 employed in the industry will be directly affected by the reduction in quota.

How big the reduction in gross revenue will be in 2007 is dependent on the final decision of the size on the TAC and the outcome of the political discussion about which country should bear the costs. Who is to blame for the



over exploiting the resource, and who should take the costs of rebuilding the stock? No doubt: The most important question and challenge for the managing countries are to find a long run solution of the problem of uncontrolled fishing of cod in the Barents Sea.

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