

Vertical integration in the fishing sector of the Basque Country: applications to the market of mackerel

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Abstract. This paper analyses the internal market of fresh fish at the Basque Country, in particular the prices of mackerel coming from the inshore sector. The existence of vertical equilibrium relationships between the prices of mackerel sold at auction (at ports) and sold at central market is examined. For that purpose, different econometric techniques for the analysis of market integration are applied, paying especial attention to the long-term equilibrium relationships by means of both integer and fractional cointegration. The results show that it is a non-integrated market, and each price series, at port and at central market, has an independent evolution.

Keywords: Integrated markets, structural change, cointegration, mackerel.

This paper examines the possibility of vertical equilibrium relationships in an internal market of fresh fish at the Basque Country. In particular we analyse the monthly prices of mackerel, coming from the inshore sector, sold at auction (at ports) and at the central market, from January 1997 to December 2006. Different econometric techniques for the analysis of market integration are applied, examining the long-term equilibrium relationships by means of both integer and fractional cointegration.

A necessary condition for cointegration is that the potentially cointegrated series be balanced, i.e. they should have the same integration order. Also, as a previous step to that verification, it is convenient to make sure that the series does not have any structural change, which can mislead the conclusions in favour of the I(1) hypothesis. The series of prices in Fig 1 show an apparent change in the structure of prices at the central market, which goes from being quite steady before 2002 to have an increasing tendency from 2002 onwards.

To confirm this visual impression we use the test of structural change proposed by Zivot and Andrews [1], which finds evidence of a structural change in the trend in November/December, coinciding with the first effects of the euro entrance as the European single currency (January 2002) and the sinking of the oil ship *Prestige* by the Spanish coast (November 2002).

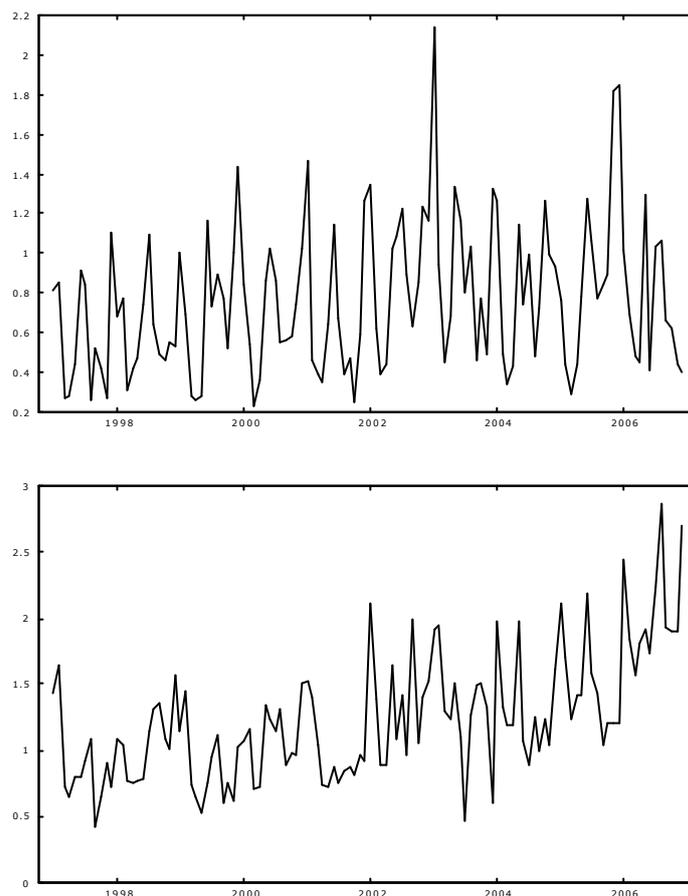


Fig 1. Prices of mackerel at ports (above) and at central market (below)

Once the structural change has been identified, it is removed by a simple regression in Gretl of the central market price series on a dummy trend, which takes zero until December 2002 and t , being $t=1,2,\dots$, from January 2003 until 2006.

Once the structural change has been removed, we implement the tests that will help us to determine the order of integration of the series. For that purpose, we use the Augmented Dickey and Fuller test [2] and [3] (hereafter ADF) and the

Kwiatkowski, Phillips, Schmidt and Shin stationarity test [4] (hereafter KPSS), both implemented in Gretl. Whereas the ADF test is not affected by the strong seasonality of the data, the results obtained with the KPSS test can be seriously distorted. For that reason, we first remove the seasonality in order to focus on the cointegration at frequency zero, which is the frequency related with a long run equilibrium.

Due to the limited number of observations, the estimation of the memory parameter at different cycles and the tests to detect the presence of seasonal unit roots are not very reliable. For that reason, we naively consider unit roots at all seasonal frequencies, and apply the summation filter over the corresponding series: $1 + L + L^2 + L^3 + L^4 + L^5 + L^6 + L^7 + L^8 + L^9 + L^{10} + L^{11}$, where L is the lag operator. Notice that this filter is easily applicable in Gretl, cause it is only a sum of lagged series.

After the series have been seasonally adjusted, the ADF and KPSS tests are carried out. Both tests agree in not rejecting the I(1) hypothesis in the price series at ports at 5% significance level. However, the results for the price series at central market are more ambiguous. Whereas the ADF does not reject the unit root null hypothesis at 5% level, the KPSS test identifies the series as I(0) at 5% and I(1) at 10%. It is not possible, thus, to assure the existence of unit root on the basis of these tests. Therefore, in order to shed more light on the situation, we estimate the memory parameter of the differenced price series (to avoid nonstationarities) at central market by means of the semiparametric estimator of Geweke and Porter-Hudak [5] (hereafter GPH). A bandwidth $m = \lfloor T^{0.6} \rfloor$ is chosen, for T the sample size, because this is the value predetermined by Gretl. We obtain that $d = 0$ falls in the 95% confidence interval, giving further evidence of unit root also in the price series at central market. In consequence, a cointegration analysis between these two series can be proposed.

In order to analyse the cointegration relationships, the two most usual tests in econometrics are used, that is, the Engle-Granger [6] and the Johansen [7] tests, both implemented in Gretl.

Taking into account that the direction of causality in the Engle-Granger test is unknown, we prefer to consider the two possible situations: the one in which the central market prices have an influence in the ports ones and vice versa. After applying the ADF test on the residuals of both cointegration relationships, evidence in favour of the I(1) hypothesis is confirmed.

Again, the results with the KPSS are more ambiguous. Whereas the stationarity of the cointegrating residuals is rejected at 5% significance level in the first causality specification, the results are less conclusive in the case of causality ports-central market, with a null hypothesis which is rejected at 10%

but not at 5%. Again we estimate the memory parameter of the first differences of the cointegrating residuals by means of the GPH method, and the value $d = 0$ falls inside the corresponding confidence interval, supporting the unit root hypothesis.

Thus, according to the Engle-Granger method, it does not exist neither fractional nor integer cointegration, since the residuals in both cointegration relationships can be considered integrated of the same order as the series, that is, $I(1)$.

Finally, the Johansen's trace and maximum eigen value tests are applied. The hypothesis of zero cointegrating relationships is not rejected in any case, giving further evidence that the mackerel prices series at ports and at the central market are not cointegrated.

The methods to detect cointegration show that, even in the absence of structural change in the central market, the two studied links of the mackerel value chain in the Basque Country are not integrated, taking each one an independent evolution. The regulation systems of this fishery have an influence in the configuration of both markets (ports and central market), contributing to very different process in the fixing of prices. The fish prices at ports depend on aspects such as the Total Allowed Captures (hereafter TAC), the bilateral agreements with other countries, the fishing zones or areas, the fishing techniques used, etc. In the particular case of the mackerel, the auctioned amounts at ports do not depend as much on the demand as on the fixed TAC, and on the consecutive agreements, becoming a rigid supply. However, the prices at central market seem to answer a traditional demand and supply model. Thus, the result here described is not surprising. Whereas the central market has managed to transmit to the prices the shocks that have affected negatively to this fishery (environmental disaster derivate from the Prestige sinking), fishermen have not transferred these effects to prices at port, highlighting its limited market power.

This situation has unleashed an important rentability problem of the inshore subsector. Both the Administration and the sector itself have become aware of this problem. Thus, regarding the demand incentives, the local authorities have been financing advertising campaigns trying to increase the mackerel consumption. As far as the supply is concerned, a pilot experience has been introduced during 2008, consisting on a daily coupon system, per ship and sailor, that limits the fished units in order to induce a rise of the mackerel prices.

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