EAFE ANNUAL MEETING
LISBOA, INIP
MARCH 5-7 1990

THE MARKET FOR FRESH SOLE AND ITS IMPORTANCE IN NORTHERN FRENCH FISHERIES

By
Chris IOANNIDIS* and Frederic LANTZ**

Introduction :

Sole is a species whose market has been expanding steadily since the end of the 70's ; landings have doubled, from 4097t in 1979 to 8048t in 1987. In real terms (1980=100) the value of landings has increased from FF124 m to FF265 m over the same period.

One must appreciate that the importance of fresh sole lies in its high valuation. Despite the fact that the species occupies no more than 1.66% of total landings in terms of weight, in value terms exceeds 8.5% of the total, making sole the third most valuable species in France.

Sole is consumed essentialy fresh and its price to the consumer does not therefore depend on any transformation process. It depends solely on demand and supply (domestic landings plus imports) conditions. The role of supply is probably the dominant one. The evidence for such assertion may be found in the latest steep price increases which followed the imposition of strict fishing quotas in the Bay of Biscay in December 1988.

Sole landings are concentrated between two geographical areas in France : the North-East coast and the Northern part of the Bay of Biscay. Between them they account for 25% and 41% of total sole landings in 1987. Imports of fresh and frozen sole represent a non-trivial part of total supply. Fresh sole

* Lecturer, Cardiff Business School, University of Wales College of Cardiff.
** Economist, Ifremer Paris.

imports have risen to 2516t in 1987 and they originate from the other North Sea fishing countries such at the Netherlands, Belgium and Britain. Sole exports consist primarily of small size fish and they are directed towards Spain and Italy.
The importance of sole in the context of the Northern French fishing ports cannot be underestimated, the species represents a mere 2% of total tonnage but its value is in excess of 20% of the value of landings in the ports of Boulogne s/mer, Dunkerque and Dieppe. The aim of the following section to establish the extent that fresh sole prices quoted at these ports are related.

Section 1 : Is there a "dominant market" for sole in Northern France ?

In this study we have focused on three main ports in Northern France, those of Boulogne-sur-mer, Dunkerque and Dieppe. In addition we will examine the influence of Boulogne landing prices on the price of imports of fresh sole for the whole of France.
We are aware that import prices refer to the whole of France rather than imports entering France via Boulogne only, but for all intents and purposes given that the majority of sole imports into France come from the Netherlands and that their most frequented port is that of Boulogne, the difference between import prices in Boulogne and the rest of France should be neglible.

The concept of "dominant market" is used here to determine whether price signals from one market can be used in forming prices in another. It is assumed that price signals from the the "dominant market" will determine prices quoted in other markets.

This hypothesis can be tested by establishing that prices from the most important port "Granger cause" landing prices in the other two. For reasons outlined in the previous section of this study, the obvious candidate to assume the role of the dominant market is port of Boulogne-sur-mer. We have therefore based our statistical tests on the hypothesis the Boulogne landing prices "Granger cause" prices in Dunkerque and imports.

Here we give a brief account of the econometric methodology used in this section. The literature on causality is vast and eminates from Granger's seminal paper (1969). Geweke (1982) provides the framework for the testing causality and exogeneity hypotheses for stationary AR(p) processes and more recently Gourieroux et al (1987) have proposed causality measures based on the Kullback Information Criterion.
This approach is based on the assumption that the true joint probability distribution of the multivariate vector $Z=(X,Y), l_{ot}(Z)$ belongs to the maintained hypothesis H. The use of the criterion allows us to define the discrepancy between the true joint pdf, and any other joint pdf computed under alternative hypotheses concerning the causality relations between the two sets of variables.
By using this approach Gourieroux et al. derive the appropriate test statistics and explore the similarities between traditional measures of causality, and the ones based on the Kullback Information Criterion. They have shown that it is possible to formulate and test a variety of hypotheses concerning the causality of the two sets of series.
These can be nested within the framework of the traditional time series represantation (normally AR(p)) of the variales in question. To obtain the test statistics we require the following linear regression representation of the series of interest :

1) Finite Marginal Autoregressions

$$X_t = \sum_{i=1}^{p} A_{1i} X_{t-i} + u_{1t} \qquad Eu_{1t} = 0 \qquad D(u_{1t}) = V_1$$

$$Y_t = \sum_{i=1}^{p} B_{1i} Y_{t-i} + u_{2t} \qquad Eu_{2t} = 0 \qquad D(u_{2t}) = \Omega_1$$

2) Finite Joint Autoregressions

$$X_t = \sum_{i=1}^{p} A_{2i} X_{t-i} + \sum_{j=1}^{p} B_{2j} Y_{t-j} + u_{2t}^* \qquad Eu_{1t}^* = 0 \qquad D(u_{it}^*) = V_2$$

$$Y_t = \sum_{j=1}^{p} A_{3j} X_{t-j} + \sum_{i=1}^{p} B_{3i} Y_{t-i} + u_{2t}^* \qquad Eu_{2t}^* = 0 \qquad D(u_{2t}^*) = \Omega_2$$

3) Finite Joint Autoregressions including present values

$$X_t = \sum_{i=1}^{p} A_{4i} X_{t-i} + \sum_{j=0}^{p} B_{4i} Y_{t-j} + u_{1t}' \qquad Eu_{it}' = 0 \qquad D(u_{it}') = V_3$$

$$Y_t = \sum_{i=0}^{p} A_{5i} X_{t-i} + \sum_{j=1}^{p} B_{5j} Y_{t-j} + u_{2t}' \qquad Eu_{it}' = 0 \qquad D(u_{2t}') = \Omega_3$$

Replacing the true covariance matrices by their ML estimates from the above defined models the resulting likelihood ratio statistics assigned to each hypothesis can be computed as follows :

Hypothesis to be tested	Test Statistic	Deg. of freedom
H1 : X does not cause Y	$T\log(\det\Omega 1/\det\Omega 2)$	N1.N2.p
H2 : Y does not cause X	$T\log(\det V1/\det V2)$	N1.N2.p
H3 : No instantaneous causality	$T\log(\det V2/\det V3)$ or $T\log(\det\Omega 2/\det\Omega 3)$	N1.N2

Where N1 and N2 are the number of variables included in the vectors X and Y respectively.

Cross hypothesae can also be formulated and tested, such as :

H13 : Global non causality from X to Y : $H1 \cap H3$

H23 : Global non causality from Y to X : $H2 \cap H3$

H123 : Independence : $H1 \cap H2 \cap H3$

The resulting test statistics of using this method over the one traditionally employed by Sims (1972) is that this approach does not require the theoretical use of regressions with infinite number of terms which make the test statistic dependent of the choice of truncation. In this case the Markovian assumption, AR(p), and has been taken explicitly into account ; the procedure provides justification for the method proposed by Geweke (1982) where all the regressions are truncated at the same order p. But such truncation will not be appropriate in the case of causality measures are à la Sims, where the autoregressive polynomials for future and past are assymetric.

Our data set consists of monthly observations of prices and quantities landed in all ports as well as imports. The data set covers the period from January 1985 to December 1988. The series were seasonally adjusted using either seasonal dummies or seasonal differences. The tests were performed using both methods of seasonal adjustment to establish whether the results were sensitive to seasonality.
Denoting landing prices quoted in Boulogne by X, landing prices at Dunkerque by Y1, Y2 Dieppe landings'prices and import prices by Y3 we have computed the test statistics outlined above.

We have started the testing procedure by attempting to establish the non-causality of Boulogne prices and the remaining set of landing prices. This corresponds to Hypothesis 2, i.e Y does not cause X. All the series of interest were first differenced and then seasonal differences were taken. To establish that the newly transformed series were stationary and did not contain unit roots we tested for non-stationarity using the Dickey-Fuller (1981) test statistic; however recently there is some ambiguity on the interpretation of this procedure (Perron, 1989). As the subsequent table confirms the resulting series were stationary; having established stationarity we embarked on the causality tests.

TABLE 1

Dickey-Fuller tests for Unit Roots

Model : $(1-B)\ (1-B^{12})\ X_{it} = \Phi\ (1-B^{12})\ X_{it-1} + n_t$

X_i = LBP, LDP, LDDP, LMIP

(B = backward shift operator)

	LBP	LDP	LDDP	LMIP
DF(τ)	-5.68	-4.13	-5.41	-4.85
DF(μ)	-5.52	-4.17	-5.49	-4.77

(critical values DF(τ)* = -3.41   DF(μ)* = -2.86)

After some experimentation with the dynamic structure of the series we have adopted the lag length of 4 for all but the series of import prices were the appropriate lag length turned out to be 6. We tested the chosen lag structure against both shorter and longer lag specifiation and we were unable to reject the prefered specification.

The following table summarises the results from testing the hypothese Y DOES NOT CAUSE X :

TABLE 2

Hypothesis : Y does not cause X

Model : $(1-B)(1-B^{12})LBP_t = A(L)(1-B)(1-B^{12})LBP_{t-i} + D(L)(1-B)(1-B^{12})Pi_{t-i}$

P_i = LDP, LMIP, LDDP

$H_o = D(L) = 0$

LAG LENGHT SERIES	4	6
LDP	7.11*	-
LMIP	-	7.72*
LDDP	7.03	-

(* indicates that we were unable to reject H_o at the 5% level of significance).

In all the tests we were failed to reject this hypothesis as none of the price series were found to exercise significant influence on the Boulogne prices. However the hypothesis of global non-causality could not be supported.

These tests partially confirm our conjecture that the Boulogne market is playing an important role in determining other markets' prices. But the above test provide only one half of the story for although we have established that other prices do not cause Boulogne prices we have not as yet aquired the necessary evidence for the proposition of interest. Subsequently we performed a series of causality tests on the Hypotheses X DOES NOT CAUSE Y=(Y1,Y2,Y3), the test were performed in a pairwise fashion and the resulting test statistics firmly rejects the null hypothesis in all cases. In the case on global non-causality the hypothesis could not be rejected, as we have discovered in the previous tests, and for what it is worth the test statistics were of greater magnitude than the ones previously obtained. The following table presents our results and provide considerable support for considering Boulogne as the "dominant market" for sole for the Northern French ports.

TABLE 3

Hypothesis : X does not cause Y

Model: $(1-B)(1-B^{12})P_i = D_i(L)(1-B)(1-B^{12})P_i + C_i(L)(1-B)(1-B^{12})LBP$

P_i = prices at : Dunkerque, Dieppe, Imports

$H_0 = C_i(L) = 0$

Lag Lenght Series	4	6
LDP	14.3*	
LDPP	19.6*	
LMIP		15.6*

* indicates rejection of H_0

We will now turn our attention to the detailed examination of the nature of price interaction between the different markets. In particular we will be testing to what extent these markets can be viewed as "price integrated" either in the short term or the long term.

Section 2 : Are the markets for sole in Northern France Price Integrated ?

The port of Boulogne-sur-mer has assumed a very important role in the French fishing industry not only because of the quantities of fish landed by the French fishing fleet but also because of the installation in the area of substantial industrial capacity relating to fish processing. Thus despite the recent relative decline of volumes landed at Boulogne the port's influence as the main trading center of the area has been increasing. In the previous section we have established that Boulogne quoted prices for sole 'Granger cause' prices in the other neighbouring landing ports. It is surprising that in the case of Dieppe which in terms of volume is of the same importance as Boulogne the influence of Boulogne prices is very strong indeed.

The concept of markets that are integrated by prices implies that price movements in the markets in question are not independant but they coordinated. Of course the degree of integration and its time profile may differ in terms of its long run and short run characteristics, but the existence of price integration between markets shouls result in certain unambigious statistical regularities.

Following Ravallion (1986) and more recently Squires et al. (1989), we propose in the first instance the following simplified econometric model of price formation for the markets under consideration.

First, prices in the 'dominant' market are assumed to be determined by the following process :

$P_{1t} = h_1(X_{1t}, P_{it})$ i = Dieppe, Dunkerque, Imports (1)

1 = Boulogne

and X_{1t} refers to the local supply conditions, which are assumed to be exogenous, at least in the immediate and short-run. Increases in landings should result in quay price falls thus $h'_{1xt} < 0$.

Further influences on prices can be incorporated into X_{1t}, such as prices/landings of competing species and other local factors.

The influence of the prices quoted in other markets, if present, should be procyclical.

Price formation in other markets can be written as :

$P_{it} = h_i (P_{1t}, X_{it})$ (2)

Linkages between the markets of Dieppe and Dunkerque are minimal and they can safely ignored ; such assumption allows us to identify the parameters of equation (2) and test restrictions arising out of the hypothesis of market integration.

A dynamic version of the model can be written (in log form) as :

$$p_{1t} = \sum_{s} a_{\tau}\, p_{1t-s} + \sum_{i}\sum_{s} a'_{is}\, p_{it-s} + \sum_{s} a^*_s\, X_{t-s} + u_{1t} \quad (3)$$

$$p_{it} = \sum_{s=0} \beta'_s\, p_{1t-s} + \sum_{s=1} \beta'_{is}\, p_{it-s} + \sum_{s=0} \beta^*_s\, X_{it-s} + u_{2t} \quad (4)$$

(t,s=0,...T ; and i=Dunkerque, Dieppe, Imports)

The causality tests conducted in the previous section suggest that $\Sigma_i \Sigma_s a'_{is}=0$, but identification problems remain concerning the parameters associated with the current values of prices quoted in the other markets.

But equation (4) presents no such problems and market integration restrictions can be formulated and tested.

The following hypotheses are testable :

a) Market segmentation :

$\beta_s = 0 \qquad s = 0,...T$

i.e. there is no relationship between the 'dominant' market and the individual markets.

b) Immediate/short run market integration

$$\beta_0 = 1 \;/\; \sum_{s=1} \beta_s + \sum_{s=1} \beta'_{is} = 0$$

Here we assume that lagged affects will eventually disappear. In this case the market (i) is but a reflection at the dominant market price with deviations due the difference in local conditions.

c) Absence of influence of local market, characteristics results in the imposition of

$$\beta_s{}^* = 0 \qquad\qquad s = 0,...T$$

or $\Sigma\beta_s^* = 0$

d) Long-run market integration requires that

$$\sum_{s=0} \beta_s + \sum_{s=1} \beta_s' = 1$$

The model can be estimated in dynamic framework by the use of ECM model which can incorporate the long-run restrictions of market integration provided that they are accepted ; in effect the proportionality relationship amount to a test of signifiance of the ECM term in the general dynamic model (Hendry et al. 1984).

So we can rewrite equation (4), incorporating long-run market integration as

$$\Delta p_{it} = a_o + a_1(p_i - p_1)_{t-1} + a_2(B)\Delta p_{it-s} + a_3(B)\Delta p_{it-s+1} + a_4\ (B)\Delta X_{it-s+1} + a_5(B)X_{it-s} + U_{3t}$$

where $a_1 \neq 0$ implies long-run market integration.
An equivalent procedure to impose the long-run market integration restriction on the cointegrating regression and then use the residuals from this regression, lagged once, in the dynamic specification.
The proposed specifications in (3) and (4) suggest that market prices in both sets at markets are simultaneously determined. To test whether such simultaneity requires the use of an I.V. estimator we have conducted a series of exogeneity test, based on the following rationale. The price in the dominant market P_{1t}, can be decomposed into two components a deterministic one $P_{1t}{*}$ and a stochastic one $\tilde{P}_{1t}$. Problems of simultaneity arise if there is significant association between $\tilde{P}_{it}$ and the error term in equation (4). The procedure is similar to a Lagrange Multiplier test for exogeneity as proposed by Smith (1984). The tests indicated that I.V. estimation was appropriate, in order to avoid inconsistent estimates.
The existence of lagged prices in the price determination equation can be attributed to arise due to price inertia. Such phenomenon can be attributed to inefficient expectations formation by the wholesales under uncertainty (since they face both uncertain demands and costs of adjustment) as it is suggested by Ravallion (1985).

Data :

Data for landings and imports both quantities and prices are monthly observations covering the period 1984 to 1988. They correspond to those of fresh and chilled sole but not frozen, since the two types of fish are marketed differently and their respectives markets are separate.
For Boulogne and Dunkerque, the series are taken from the sources of CRTS (Reseau National de Statistiques de Pêche) who registers all quay transactions statistics from CCPM (Comité Central des Pêches Maritimes) was used for the relevant data for the port of Dieppe.

The prices for Rungis and retail prices for fresh sole and the average banding prices are given in CCPM, as are the data for the total quantities traded and the quantities and landings in the port of Lorient.

Estimation :

We have estimated the specification in equation (4) in a simple dynamic form, using an IV estimator for the Boulogne price, for the ports of Dunkerque, Dieppe and import prices.
The use of an IV estimator was considered imperative as the conducted exogeneity test established firmly the associated between prices quoted in individual ports and the stochastic component of Boulogne prices.

The seasonal adjustment adopted in this study is 12th differences * .
Preliminary tests on market integration employing a simple static specification reveal that the markets of Dunkerque and Boulogne are very closely related. The same relationship prevails between import prices and those quoted in Boulogne. We have conducted the tests in either OLS or IV form and the following table summarises our results.

* Results using monthly dummies are available on request.

TABLE 4

Models $p_{it} = a + b\ p_{1t} + u_t$; $p_{it} = a' + b'\ p_{1t} + u'_t$

(i= Dunkerque, Dieppe, Imports ; period : 1986:3, 1988:12)

H_0 : b, b' =1

Significance level		
Port	OLS	IV
Dunkerque	0.0004	0.343
Dieppe	0.04	0.0035
Imports	0.03	0.224

All the OLS results reject the null hypothesis, most emphatically in the case of Dieppe. However, the reliability of these tests is suspect since the equations suffer from severe misspecification. The tests based on the IV estimator for the Boulogne price are quite different revealing immediate market integration for Dunkerque and imports but the evidence did not support the hypothesis for Dieppe.

Subsequently, we have estimated the dynamic specifications as in equation 4 and we have tested the different hypotheses outlined above.

The only determinants of local market condition which were included in the equations were the ratios of local landings to Boulogne landings, we have also included the squares of the changes of such ratios as proxy for local supply variability.

The lag length was chosen employing the AIC to limit unnecessary waste of degrees of freedom. The significance levels of the tests for the different hypotheses, using an IV estimator for the Boulogne prices are given in the following table.

TABLE 5

Null hypothesis	Local markets (period:1985:3,1988:12)		
	Dieppe	Dunkerque	Imports
Short run integration	0.29	0.1614	0.19
Long run integration	0.08	0.160	0.33
Market segmentation	0.00005*	0.002*	0.007
No local characteristics	0.0035*	0.70	0.06

* indicates rejection of the null hypothesis

All the estimated equations are well specified and there appears no evidence of misspecification as the following table suggests.

DUNKERQUE

```
DEPENDENT VARIABLE    99      LDPS
FROM    1986: 3 UNTIL    1988:12
TOTAL OBSERVATIONS       34      SKIPPED/MISSING          1
USABLE OBSERVATIONS      33      DEGREES OF FREEDOM      27
R**2               .69541834     RBAR**2          .63901433
SSR          .41213170           SEE         .12354812
DURBIN-WATSON  2.26252497
Q(  15)=     18.4380          SIGNIFICANCE LEVEL  .240337
NO.      LABEL     VAR  LAG    COEFFICIENT    STAND. ERROR     T-STATISTIC
***     *******    ***  ***   ***********    ***********      ***********
  1      CONSTANT    0    0   .1482565E-01   .2357377E-01     .6289045
  2      ILBPS     119    0   .7940224       .2051638         3.070188
  3      ILBPS     119    1  -.6322705       .2244846        -2.816543
  4      LDPS       99    1   .6477501       .1557092         4.159998
  5      DOBDS     108    0  -.1638689E-01   .4413124E-01    -.3713217
  6      DOBDS     108    1  -.1753491E-02   .4138280E-01    -.4237246E-01


?test 1
s?# 2
s?# 1
F(   1 ,    27) =    1.007949         SIGNIFICANCE LEVEL    .3243081


?restrict(create) 1
s?# 2 3 4
s?# 1 1 1 1
F(   1 ,    27) =    1.377087         SIGNIFICANCE LEVEL    .2508463


DEPENDENT VARIABLE    99      LDPS
FROM    1986: 3 UNTIL    1988:12
TOTAL OBSERVATIONS       34      SKIPPED/MISSING          1
USABLE OBSERVATIONS      33      DEGREES OF FREEDOM      28
R**2               .67988369     RBAR**2          .63415279
SSR          .43315174           SEE         .12437727
DURBIN-WATSON  2.21098504
Q(  15)=     20.5770          SIGNIFICANCE LEVEL  .100871
NO.      LABEL     VAR  LAG    COEFFICIENT    STAND. ERROR     T-STATISTIC
***     *******    ***  ***   ***********    ***********      ***********
  1      CONSTANT    0    0   .1063176E-01   .2345767E-01     .4532318
  2      ILBPS     119    0   .8872981       .1904102         4.659930
  3      ILBPS     119    1  -.5354704       .2101808        -2.547666
  4      LDPS       99    1   .6481723       .1567538         4.134970
  5      DOBDS     108    0  -.2475391E-01   .4384374E-01    -.5645939
  6      DOBDS     108    1  -.1775790E-01   .3933310E-01    -.4514747
```

DIEPPE

```
DEPENDENT VARIABLE  101      LDPPS
FROM     1986: 6 UNTIL     1988:12
TOTAL OBSERVATIONS       31      SKIPPED/MISSING           0
USABLE OBSERVATIONS      31      DEGREES OF FREEDOM       20
R**2               .84305458     RBAR**2            .76458187
SSR          .13550316           SEE           .82311348E-01
DURBIN-WATSON  1.79123422
Q(  15)=    9.53274         SIGNIFICANCE LEVEL  .840058
NO.      LABEL     VAR  LAG    COEFFICIENT     STAND. ERROR    T-STATISTIC
***     *******    ***  ***   ************     ************    ************
  1     CONSTANT     0    0  -.4335955E-01    .2196677E-01   -1.973870
  2     ILBPS      119    0   1.181955        .1702355        6.943055
  3     ILBPS      119    1  -.3317798        .2964523       -1.119168
  4     ILBPS      119    2  -.2271885        .2007522       -1.131686
  5     LDPPS      101    1   .5269227        .2037150        2.586557
  6     LDPPS      101    2   .7312935E-01    .1891617        .3865971
  7     LDPPS      101    3   .2130250        .1315154        1.619773
  8     DQBPS      110    0  -.8568469E-01    .2401657E-01   -3.567434
  9     DQBPS      110    1  -.4536551E-02    .3161027E-01   -.1435151
 10     DQBPS      110    2  -.7373343E-01    .2632403E-01   -2.800994
 11     DQBPS      110    3   .3546951E-01    .2510569E-01    1.412808


?test 1
s?# 2
s?# 1
F(   1 ,    20) =    1.142422        SIGNIFICANCE LEVEL    .2978724


?restrict(create) 1
s?# 2 3 4 5 6 7
s?# 1 1 1 1 1 1 1
F(   1 ,    20) -    3.357944        SIGNIFICANCE LEVEL   .8181410E-01


DEPENDENT VARIABLE  101      LDPPS
FROM     1986: 6 UNTIL     1988:12
TOTAL OBSERVATIONS       31      SKIPPED/MISSING           0
USABLE OBSERVATIONS      31      DEGREES OF FREEDOM       21
R**2               .81752162     RBAR**2            .73931660
SSR          .15754775           SEE           .86615667E-01
DURBIN-WATSON  1.80438544
Q(  15)=    6.97522         SIGNIFICANCE LEVEL  .958334
NO.      LABEL     VAR  LAG    COEFFICIENT     STAND. ERROR    T-STATISTIC
***     *******    ***  ***   ************     ************    ************
  1     CONSTANT     0    0  -.1802669E-01    .1796385E-01   -1.003490
  2     ILBPS      119    0   1.047068        .1615256        6.482368
  3     ILBPS      119    1  -.5149448        .2936876       -1.753376
  4     ILBPS      119    2  -.3283829        .2031004       -1.616830
  5     LDPPS      101    1   .6214739        .2073787        2.996807
  6     LDPPS      101    2   .5323149E-01    .1987253        .2678647
  7     LDPPS      101    3   .1215538        .1280369        .9493658
  8     DQBPS      110    0  -.7058048E-01    .2373970E-01   -2.973098
  9     DQBPS      110    1   .1320013E-01    .3166533E-01    .4168612
 10     DQBPS      110    2  -.5221809E-01    .2479260E-01   -2.106197
 11     DQBPS      110    3   .5578964E-01    .2370186E-01    2.353800

NULL HYPOTHESIS
THE FOLLOWING COEFFICIENTS ARE ZERO
Series      DOBMIS  (  107 )   LAGS     0 TO     2
F(   3 ,    28) =    2.796346        SIGNIFICANCE LEVEL   .5849006E-01
```

To summarise the results of this section:

a) Market segmentation cannot be supported by the data for any port. The hypothesis is firmly rejected in all cases.

b) Short run/immediate market integration is upheld very strongly, a rather surprising result.

c) A corrolary of the short-run is that long-run market integration must also be supported and the data is consistent with it.

d) Local market conditions exert significant influence on the port of Dieppe although their long-run effect is modest compared its impact. This result is consistent with the growing importance of this port. Sole landing is Dieppe have been increasing faster than those of Boulogne. After a significant fall during in 1986 they have now stabilised at 67% of Boulogne landings in 1988.

Conclusion :

We have proposed and tested a model of market integration for fresh sole on the Northern french ports of Boulogne, Dieppe and Dunkerque. In addition, the market for imports of fresh sole was included to the set of markets. We have established that Boulogne is by far the most important in terms of price formation and that price fluctuations there have proportional effects which are felt in the quoted prices in the others ports. The effect is immediate fully realised in the short and long-run. The quantities landed in each of the ports in question have exhibited great variations especially the port of Dieppe. In Dieppe landed quantities of fresh sole were exceeding those of Boulogne until 1987, but they have dropped considerably in the remaining two years of our sample. The port of Boulogne has assumed a leading role as a trading port, where prices are formed and to that extent there is a strong need to provide models of price determination at the Boulogne level. The existence of such central market for sole makes unnecessary the detailed study of all the ports in the region on a dissagregated basis.

References :

Dickey D.A., Fuller W.A. (1981) : "Likelihood ratio statistics for autoregressive time series with a unit root", Econometrica

Geweke J. (1982) : "The measurement of linear dependence and feedback between multiple time series", JASA, 77

Gourieroux C., Monfort A., Renault E. (1987) : "Kullback causality measures", Annales d'Economie et de Statistiques

Granger C.W.J. (1969) : "Investigating causal relations by econometric models and cross-spatial methods", Econometrica 37, 424-438

Hendry D.F. et al. (1984) : "Dynamic specification", Chap. 18 in Handbook of Econometrics, Vol. 2, ed. Z. Griliches and Intrilligator, North Holland

Perron (1989) : "The great crash, the oil price shock and the unit root hypothesis", Econometrica

Ravaillon M. (1985) : "the informational efficiency of trader price expectations in the Bangladesh Price market", Oxford Bulletin of Economics and Statistics

Ravaillon M. (1986) : "testing market integration", American journal of agricultural Economics

Sims C.A. (1972) : "Money, income and causality", American Economic Review, 62, 540-552

Smith (1984) : "Efficient testing for weak exogeneity using limited information", Discussion papers in Econometrics and Social statistics, University of Manchester

Squires D., Herrick S.F., Hastie J. (1989) : "Integration for Japanese and United States Sablefish markets", Fisheries bulletin