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Asymmetric Price Transmission: A Case Study of the French Hake Value Chain

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Abstract *Asymmetry in price transmission has recently attracted much attention in the food literature, but hitherto this important issue has been overlooked in fish and fish product market studies. This paper seeks to fill this gap, and thus takes the fisheries market literature closer to the general food literature. To this end, an asymmetric error correction price transmission model has been estimated for the whole fresh French hake value chain. This paper tests for cointegration between auction and retail prices using the Engle and Granger two-step method, and the Enders and Granger Threshold Autoregression (TAR) and Momentum Autoregression (M-TAR) methodologies. The results present clear evidence of asymmetric price transmission in the whole hake value chain and that the assumption of symmetric adjustment in this sector produces misleading and biased results. The price response behaviour of retailers is found to be consistent with asymmetric price transmission: retailers immediately respond to positive changes in auction prices by adjusting their prices upward, but they do not react as quickly to falling auction prices. These findings have profound implications for studying margins along the value chain of fish and fish products. By ignoring the asymmetry in price transmission at different levels of the value chain, calculations of margins will be biased.*

Key words Asymmetry, value chain, price transmission, Threshold Autoregression (TAR), and Momentum Autoregression (M-TAR).

JEL Classification Code Q22.

Introduction

In the literature on food markets, it has been widely recognised that a study of demand and supply at one level of the value chain provides useful information for policymakers. However, it is also argued that a good understanding of the margins along the whole value chain would provide a fuller picture of supply and demand forces and their interactions. It has also been recognised that responses of different economic agents to markets forces may not necessarily be symmetric, implying that changes in the raw material or product prices at the 'upstream' level (auction) may exhibit different responses at the 'downstream' level (*e.g.*, retail level) and vice

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versa. For instance, many consumers complain that retail petrol prices rise more quickly when crude oil prices are rising than they fall when crude oil prices are falling (Borenstein, Cameron, and Gilbert 1997).

Intuitively, this means that cost increases are completely and rapidly passed on to the consumer, while there is a slower and less complete transmission of cost savings. A number of competing theories have been put forward to explain the existence of asymmetric farm-retail price transmission in the food sector. Common explanations of this phenomenon include: market power, search costs, consumer response to changing prices, producer adjustment cost, and the behaviour of markups over the business cycle. Using the case study of hake in France, this paper tests for the presence of asymmetry in price transmission between producer and retail prices. Subsequently, the error correction models that take into account this asymmetry have also been estimated, and provide the direction as well as the magnitudes of this asymmetric price transmission.

Here, we describe some requirements to work with time series data, followed by a discussion of an alternative procedure suggested by Enders and Granger (1998). These issues highlight the usefulness of the approach adopted in the paper. With time series data, it is essential that the time series properties of the data are tested using the unit root test before estimating the price transmission at different levels of the value chain. The modelling process then starts by estimating the long-run relationship between these series. If the residuals from the long-run relationship are stationary, then according to Engle and Granger (EG) (1987), the two series are cointegrated. Furthermore, according to EG, this enables us to specify the error correction model, which incorporates the long-run as well as short-run relationship between the two series. However, this two-step EG methodology assumes *a priori* a linear-symmetric adjustment in the transmission of changes in the upstream (auction) prices to changes in the downstream (retail) prices. A shock to producer prices of a given magnitude would elicit the same response in retail prices, regardless of whether the shock reflected a price increase or price decrease.

Enders and Granger (1998) considered an alternative error correction specification called threshold autoregressive (TAR) model. This model recognises the fact that a shock may have to reach a critical level before a significant response is evoked. In this specification, a *linear-asymmetric* adjustment in the price transmission is modelled. An increase or decrease in producer prices of a given magnitude would elicit a different quantitative response in retail prices. When the adjustment is asymmetric, such that the series exhibit more '*momentum*' in one direction than the other, the methodology is termed as Momentum-Threshold Autoregression Models (M-TAR). The TAR model can capture asymmetrically '*deep*' movements in a series, while the M-TAR model is particularly useful in capturing the possibility of asymmetrically sharp or '*steep*' movements in a series.

One other important issue in the study of price transmission along the value chain is the amount of value added to the product. If the value added is very high due to packaging, or substantial processing is involved, then these factors have to be taken into account in the methodology. The whole fresh hake chain involves very little processing. Because of this, our results are robust.

In this paper, simple error correction mechanism (ECM), TAR, and M-TAR specifications have been tested. The final error correction model of price transmission from upstream (auction) to downstream (retail level) has been estimated using the M-TAR methodology. For retail prices, adjustments to positive and negative shocks to the marketing margins are statistically significant. It is found that hake retail prices at the supermarkets level respond strongly to negative shocks in auction prices, but positive shocks in hake auction prices are allowed to persist at retail level prices. Auction prices, however, only seem to respond to the positive shocks at the retail level. These findings have profound implications for the study of margins along the value chain and supply chain of fish and fish products. If one does not take into account the asymmetry in price transmission at different levels of the value chain, then calculations of margins along this chain will be biased.

The rest of the paper is organised as follows. The next section provides the description of price transmission, and recent advances in the methods for testing asymmetry are highlighted. This is followed by a description of the implications of this methodology for testing asymmetries in price transmission. The next section introduces the fresh whole hake value chain in France, which is the case study used in this paper. Empirical findings are presented in the next section of simple EG, TAR, and M-TAR methodologies. The following section provides the results of asymmetric and symmetric price transmission error correction models for fresh whole hake in France. The final section summarises the conclusions of the study.

Asymmetric Price Transmission

Price transmission has widely been studied in the food marketing sector. However, a major shortcoming of some earlier studies (Houck 1977; Boyd and Brorsen 1988; Hahn 1990) is that they fail to take into account the possibility of the presence of an equilibrium relationship between any price series being examined (von Cramon-Taubadel and Loy 1997). Retail and producer prices may drift apart in the short run, but in the long run, economic forces bring them together (Palaskas 1995; Enders 1995).

Balke and Fombe (1997) point out that the presence of fixed costs of adjustment may prevent economic agents from adjusting continuously. Only when deviation from equilibrium exceeds a critical threshold do the benefits of adjustment exceed the costs and cause economic agents act to move the system back towards the equilibrium.

Due to the above reasons, the threshold models of dynamic economic equilibrium have gained increased attraction in the analysis of price transmission asymmetries (*e.g.*, Azzam 1999). Most recent studies of price transmission (*e.g.*, Abdulai 2002) have followed the methodology of Enders and Granger (1998). They consider the time series properties of the variables, but do not presuppose a linear-symmetric adjustment to study the transmission of producer price changes to changes in retail prices in the Swiss pork market. This paper uses the same methodology for the fresh whole hake value chain in France over the period May 1989 to December 1999. To date, asymmetric price transmission has received little attention in the fisheries sector.

Econometrics Methodology

Potentially, the log of auction price (p^a) and the log of retail price (p^r) are nonstationary variables and, at most, there is a single long-run relationship between p^a and p^r:

$$p_t^r = \beta_0 + \beta_1 p_t^a + u_t. \tag{1}$$

Assuming that the prices (p^a) and (p^r) are both I(1), then EG (1987) show that cointegration exists if $u_t \sim I(0)$. Residuals from equation (1) are used to estimate the following relationship:

$$\Delta u_t = \rho u_{t-1} + \varepsilon_t. \tag{2}$$

Rejection of the null hypothesis of no cointegration implies that the residuals in equation (1) are stationary ($\rho \neq 0$).

According to Enders and Siklos (1998), equation (1) can be viewed as an attractor with its pull strictly proportional to the absolute value of u_t. According to the EG (1987) theorem, if $\rho \neq 0$, equations (1) and (2) jointly imply the existence of an error correction model that can be represented as:

$$\Delta p_t^r = lagged(\Delta p_t^r \Delta p_t^a) - \lambda u_{t-1} + v_t. \tag{3}$$

Equation (3) implies that if u_t is above its equilibrium value (0), the adjustment is equal to λ, and if u_t is below its long-run equilibrium, the adjustment is still equal to λ. This implies that the adjustment is symmetric.

Enders and Granger (1998) consider an alternative error correction specification called the TAR model, in which equation (2) is replaced as:

$$\Delta u_t = \begin{cases} \rho_1 u_{t-1} + \varepsilon_t & \text{if} \quad u_{t-1} \geq 0 \\ \rho_2 u_{t-1} + \varepsilon_t & \text{if} \quad u_{t-1} < 0 \end{cases}. \tag{4}$$

A necessary condition for $\{u_t\}$ to be stationary is: $-2 < (\rho_1, \rho_1) < 0$. The adjustment process is then formally expressed as:

$$\Delta u_t = I_t \rho_1 u_{t-1} + (1 - I_t)\rho_2 u_{t-1} + \varepsilon_t, \tag{5}$$

where I_t is the Heaviside indicator function such that:

$$I_t = \begin{cases} 1 & \text{if} \quad u_{t-1} \geq 0 \\ 0 & \text{if} \quad u_{t-1} < 0 \end{cases}, \tag{6}$$

where 0 represents a critical threshold. Models using equations (5) and (6) are termed as TAR models. If u_{t-1} is above its equilibrium value (0), the adjustment is $\rho_1 u_{t-1}$, and if u_{t-1} is below its long-run equilibrium, the adjustment is $\rho_2 u_{t-1}$.

The error correction model incorporating the threshold adjustments can then be represented as:

$$\Delta p_t^r = lagged(\Delta p_t^r \Delta p_t^a) + \rho_{1.1} I_t u_{t-1} + \rho_{2.1}(1 - I_t) u_{t-1} + v_t. \tag{7}$$

Enders and Granger (1998) show that when adjustment is asymmetric and the series exhibits more ‘momentum’ in one direction than the other, replacing equation (6) by the following is more valuable:

$$I_t = \begin{cases} 1 & \text{if} \quad \Delta u_{t-1} \geq 0 \\ 0 & \text{if} \quad \Delta u_{t-1} < 0 \end{cases}. \tag{8}$$

This is termed the Momentum-Threshold Autoregression Model (M-TAR).

The Case Study

Hake is an important whitefish in Europe. The majority of locally caught hake in Europe is mainly consumed in fresh form in France and other parts of Europe. This makes fresh hake a good case study. Recent declines in hake stocks have resulted in lower production. The demand for imported hake, which normally comes in frozen form, is very low. French consumers have not yet developed the taste for frozen hake. However, this may change over time.

Figure 1 shows fluctuations in hake prices at the auction (Lauwhfr—log of whole auction hake prices) and retail (Lsmwhfr—log of whole supermarket hake prices) market levels. Increases at the auction level are always followed by even bigger increases at the retail level. However, price reductions at the auction level are not necessarily followed by reductions of the same magnitude at the retail level.

The above discussion can easily be understood when two series are plotted in first differences form in figure 2 below.

This apparent asymmetry shown in the figures has very important implications for the hake market in France. Low catches due to low stocks are resulting in a steady increase in whole hake prices at auction level, which are then transmitted to consumers. If asymmetric price transmission is present, then consumers may not benefit from price reductions which will tend not be fully passed on to them. Hake fisheries management has to take this asymmetry into account, and good cost benefit analysis of management actions will be required comparing the cost of enforcement of the policy of stock improvement and marginal benefits of reduced prices to the consumer. This means that a bioeconomic solution to the problem of stock depletion in hake fisheries is required in contrast to exclusively supply side measures of effort control.

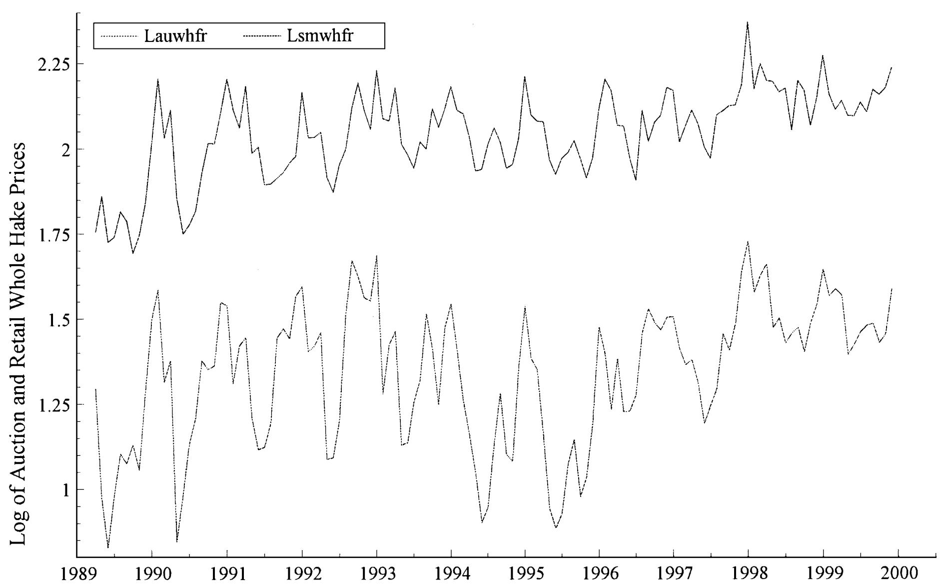

Figure 1. Log of Auction and Retail Whole Hake Prices in France
Lsmwhfr = Log of supermarket retail prices of whole hake in France.
Lauwhfr = Log of auction retail prices of whole hake in France.

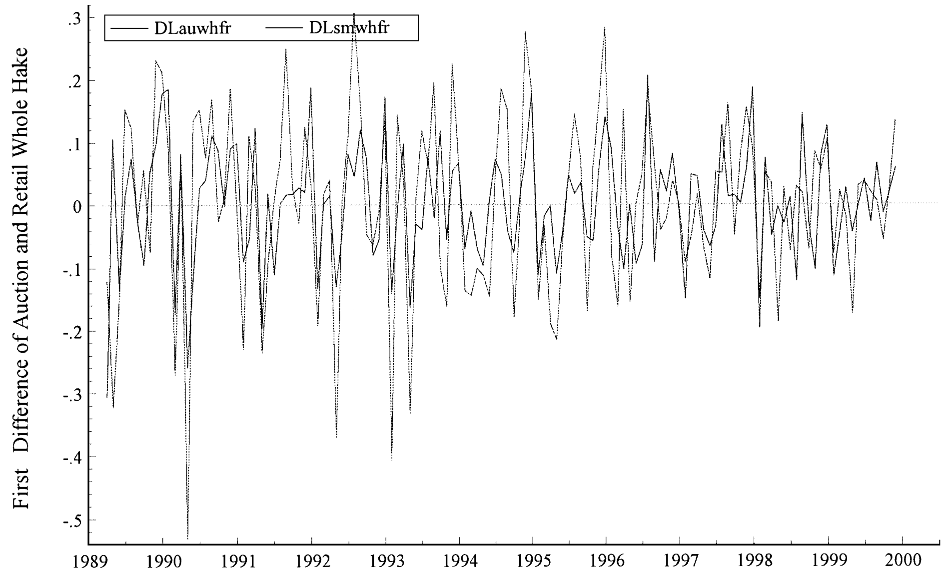

Figure 2. First Difference of Auction and Retail Whole Hake Prices
DLsmwhfr = First difference of log of supermarket retail prices of whole hake in France.
DLauwhfr = First difference of log of auction retail prices of whole hake in France.

Asymmetry Tests

Table 1 shows Augmented Dickey Fuller unit root test results and they indicate that whole hake auction and retail prices have a unit root (*i.e.*, non-stationary). Table 2 shows the results of cointegration tests using the EG (1987) methodology and Enders and Granger (1998) TAR and MTAR methodologies. Using equation (2), the EG (1987) test indicates that the two price series *are* cointegrated. The null of no cointegration is rejected at the 1% level of significance.

Using Enders and Granger's (1998) TAR methodology, the cointegration test also shows that the two price series are cointegrated, and the null of no cointegration ($\rho_1 = \rho_2 = 0$) is rejected using the F test at the 1% level of significance. The M-TAR model also confirms that the two price series are cointegrated, and the null of no cointegration ($\rho_1 = \rho_2 = 0$) is rejected at the 1% level of significance.

The asymmetry hypothesis is tested using TAR and M-TAR methodologies. Both methods show that the null of symmetry ($\rho_1 = \rho_2$) is rejected using the F test at the 5% level of significance. These results confirm that there are asymmetrically 'deep' as well as 'sharp' or 'steep' movements in the prices series, and the adjustment process between these prices at the auction and retail levels, due to positive and negative shocks at the upstream level, is also asymmetric.

In equation (6), the value zero represents the critical threshold. If u_{t-1} is above its equilibrium value (0), the adjustment is equal to $\rho_1 u_{t-1}$, but if u_{t-1} is below its long-run equilibrium, the adjustment is equal to $\rho_2 u_{t-1}$. Enders and Granger (1998) termed this "the asymmetric adjustment process."

Table 1
Stationarity Tests

	ADF~ INTERCEPT Critical Values: 1%: –3.4804 5%: –2.8834 10%: –2.5785	ADF~TREND & INT. Critical Values: 1%: –3.4808 5%: –3.8836 10%: –3.5786
Auction Hake Prices		
LAGS	10	10
ADF	–1.400272	–1.664941
1st DIFF. ADF	–8.106891**	–8.069244**
Retail Hake Prices		
LAGS	10	10
ADF	–1.660214	–2.360457
1st DIFF. ADF	–8.419763**	–8.429876**

** = Reject the null of unit root at the 1% level (*i.e.*, series are I(1)).

Table 2
Estimates of Speed of Adjustment Parameters in the French Whole Hake Price

	Transmission Models		
	Engle-Granger (equation 3)	Threshold (equation 7)	Momentum-Threshold (based upon equation 8)
ρ_1	–0.3431 (–4.329)	–0.4107 (2.705)[1]	–0.3582 (–3.144)[1]
ρ_2	NA	–0.2879 (–2.181)[1]	–0.2549 (–2.125)[1]
$\rho_1 = \rho_2 = 0$	NA	9.4501 (0.0002)[2]	6.73 (0.0017)[2]
$\rho_1 = \rho_2$	NA	4.7554 (0.031)[2]	4.5177 (0.0356)[2]

Notes: [1] Values in the parentheses are *t* values. [2] Values in parentheses are estimated probability values; outside parentheses are the F statistic values.

Figure 3 clearly shows this asymmetry. When the auction and retail prices of whole hake are modelled, adjustment to negative shocks on the auction prices (uplus—errors above zero showing slow adjustment) and positive shocks to the auction prices (unminus—errors below zero showing fast adjustment) are asymmetric.

The cointegration results allow us to model these series in error correction form. The null of cointegration was not rejected using either of the methodologies. Because of this, we have estimated retail and auction price error correction models. These models provide us with the magnitudes of the asymmetric responses (see table 2). The results clearly show that both shocks do not result in similar responses ($\ddot{\rho}_1 \textit{uplus}$ and $\ddot{\rho}_2 \text{uminus}$) and do not reach the equilibrium level (steady-state, long-run equilibrium state between auction and retail whole hake prices) at the same speed ($|\ddot{\rho}_2 \text{uminus}| < |\ddot{\rho}_1 \text{uplus}|$).

Estimates of Price Transmission

Asymmetric Error Correction Models

Retail Price Model

Table 3 shows the estimated asymmetric error correction model results of whole hake retail monthly prices from June 1989 to December 1999.[1] The results show that for retail prices, adjustments to positive and negative shocks to the marketing margin are statistically significant and retail prices respond strongly to negative shocks. However, positive shocks are allowed to persist.

These results imply that whole hake retail prices adjust to correct long-run disequilibria in retail and auction whole hake prices. Other things being equal, the speed of adjustment indicates that adjustment is immediate in the whole hake retail sector, where only 23.9% of the disequilibria are removed each month when the shock is negative, and 35% disequilibria is removed each month when there is a positive shock in auction prices. These results show that retailers immediately respond to changes in auction prices by adjusting their prices. This means that there is asymmetric price transmission in the whole hake market.

A number of possible economic interpretations are provided in the literature of the asymmetric price transmission in the product value chains. The auction (input) market is highly competitive with many suppliers, none of whom have any market power. Consequently they are compelled to take the price determined by changing market conditions—in both directions. Conversely the retail (output) market is characterised by a smaller number of firms, each of which possesses market power against its customers. Consequently, they do not need to immediately reduce their price when cost conditions improve. They must do so in the long run of course, or their competitors will undercut them, but the market does not require immediate downward adjustment. Instead, they can temporarily increase their profit margins. However, with cost increases, they will quickly adjust retail prices in order to preserve profit margins.

The other possible economic explanation of this asymmetry is the menu costs in a market with generally increasing prices. Being more charitable to the supermarket there are costs (menu costs) in making changes to marked prices. If a firm is considering a price change in light of cost changes, they would want to weigh the costs of these adjustments and compare them with any losses resulting from being temporarily out of equilibrium. If the evidence is that prices are generally moving upwards, this means that firms will be less inclined to lower prices, as these lower prices are likely to be only temporary at an equilibrium level. Quite soon if costs are rising, then the price will have to go up again. On the other hand, a price increase is likely to be in the same direction as the long-run trend, even if it temporarily exceeds that trend.

To understand this asymmetric price adjustment in the hake market, it is vital to be aware of the dynamics of the hake market in France. The demand for hake grew from 30,000t Live Weight Equivalent (lwe) (apparent consumption) in 1975 to 90,000 t lwe (apparent consumption) in the early 1990s and fell to 60,000 t lwe in 1998 (LeGrel, Corre, and Tuncel 1998). According to LeGrel, Corre, and Tuncel, the market for hake in France is relatively small, with a mean market share of only 3.2% in value between 1982 and 1995. Current estimates show that roughly 40% of total hake consumption in France is made up of whole fresh hake, with the remainder composed mainly of frozen products (Hartmann, Jaffry, and Asche 2000). Domestic producers supply the bulk of fresh hake in France, which is mainly sold through

[1] Lag length 2 was selected on the basis of Akaike's information criteria (AIC).

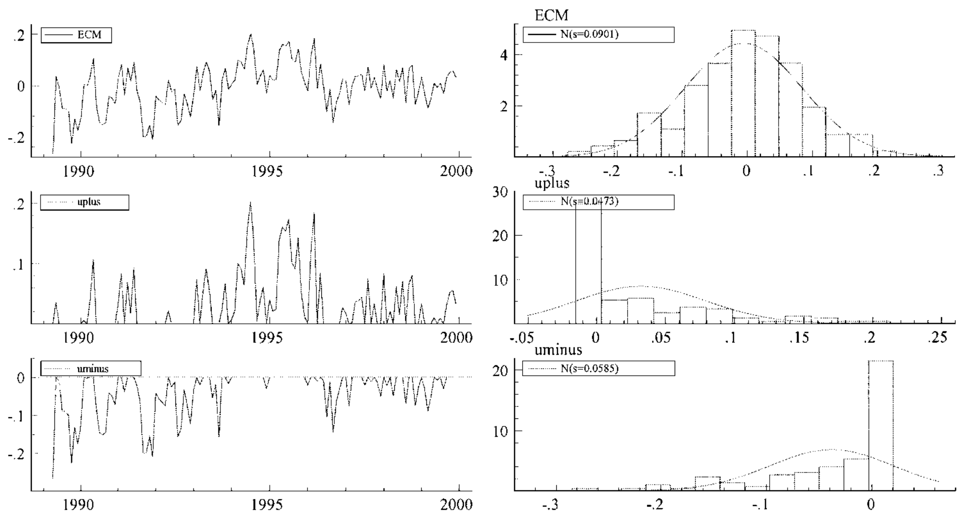

Figure 3. TAR Graphs

ECM = errors from the long-run equation.
uplus = positive errors MTAR term from equation (8).
uminus = negative errors MTAR term from equation (8).

auction markets. Earlier findings show that all auction markets belong to a single area of price setting (Perez Agundez 2001).

These dynamics in the hake market explain asymmetric price responses at the retail level to the price changes at the auction level. Hake has only a very small share of this market and is also a perishable product; consequently, if the prices rise beyond some threshold due to presence of the fixed costs of adjustment, this may prevent French retailers from adjusting quickly to price changes. They may then turn to other species if price increases persist. As Ball and Mankiw (1994) and Balke and Fombe (1997) explain, only when deviation from the equilibrium exceeds a critical threshold do the benefits of adjustment exceed the costs, and hence, economic agents act to move the system back toward equilibrium. The above results of threshold models of dynamic economic equilibrium between auction and retail hake prices have provided useful insights into the price transmission asymmetries.

Table 5 presents the diagnostics tests. The model has high $R^2 = 0.6$ and the model passed all the regression evaluation tests including the F-tests for the hypothesis that the i-period lag ($Fk = i$) is zero. We find that there was no serial correlation present (F_{ar}, against 2nd order autoregression), and there was no autoregressive conditional heteroskedasticity (ARCH, against 1st order). There was no heteroskedasticity (*Fhet*), and lastly, a χ^2-test for normality shows no non-normality in the errors. There was no evidence of model misspecification on the basis of these evaluation tests. These tests are given below. Plots associated with the adequacy of this model (based on recursive estimation statistics, namely one-step residuals and one-step ahead Chow tests)[2] were also examined, with no evidence of parameter instability.

[2] These tests also show that there were no structural breaks in the equations relating the variables.

Table 3
Asymmetric Error Correction Model Estimates for Whole Hake in France

	Retail Price Equation		Auction Price Equation	
Dependent Variable	Δlsm_t		Δlau_t	
VARIABLE	Estimated Coefficient	t-statistics	Estimated Coefficient	t-statistics
Δlsm_{t-1}	–0.261	–2.806**	0.078	0.436
Δlsm_{t-2}	–0.033	–0.429	0.064	0.444
Δlsm_t			1.140	8.444**
Δlau_t	0.328	8.410**		
Δlau_{t-1}	0.198	3.600**	–0.141	–1.306
Δlau_{t-2}	0.010	0.179	–0.116	–1.126
$uplus_{t-1}$	–0.239	–1.824*	–0.516	–2.123**
$uminus_{t-1}$	–0.352	–2.983**	–0.105	–0.461
Constant	0.003	0.333	–0.011	–0.688

Notes:
** significant at the 1% level; * significant at the 5% level.
Δlsm = First difference of log of supermarket retail prices of whole hake in France.
Δlau = First difference of log of auction retail prices of whole hake in France.
*uplus*_1 = positive errors MTAR term from equation (8).
*uminus*_1 = negative errors MTAR term from equation (8).

Auction Price Model

Table 3 shows the estimated asymmetric error correction model results of whole hake monthly auction prices from June 1989 to December 1999. The results show auction prices only seem to respond to the positive shocks in the retail prices (demand increases).

Other things being equal, the speed of adjustment indicates that the adjustment in the auction price is quite fast, with 51.6% of the disequilibrium being removed each month. They show that fishermen respond positively to the higher retail prices.

Table 5 presents the diagnostics tests. The model has an $R^2 = 0.44$. The model does not pass all the regression evaluation tests. The F-tests for the hypothesis that the i-period lag ($Fk = i$) is zero is not rejected. We find that there was some serial correlation present (F_{ar}, against 2nd order autoregression), but there was no autoregressive conditional heteroskedasticity (ARCH, against 1st order). There was no heteroskedasticity (Fhet), and lastly, a χ^2-test for normality shows no non-normality in the errors. There was some evidence of model misspecification on the basis of these evaluation tests. These tests are given below. Plots associated with the adequacy of this model (based on recursive estimation statistics, namely one-step residuals and one-step ahead Chow tests)[3] were also examined, with some evidence of parameter instability being evident.

[3] These tests also show that there were no structural breaks in the equations relating the variables.

Table 4
Symmetric Error Correction Model Estimates for Whole Hake in France

	Retail Price Equation		Auction Price Equation	
Dependent Variable	Δlsm_t		Δlau_t	
VARIABLE	Estimated Coefficient	Standard Error	Estimated Coefficient	Standard Error
Δlsm_{t-1}	–0.262	–2.817**	0.077	0.430
Δlsm_{t-2}	–0.035	–0.455	0.068	0.472
Δlsm_t			1.162	8.672**
Δlau_t	0.332	8.737**		
Δlau_{t-1}	0.198	3.600**	–0.144	–1.333
Δlau_{t-2}	0.013	0.236	–0.107	–1.039
ECM_{t-1}	–0.300	–4.000**	–0.300	–2.055**
Constant	0.0007	0.140	–0.003	–0.300

Notes:
**significant at the 1% level; *significant at the 5% level.
Δlsm = First difference of log of supermarket retail prices of whole hake in France.
Δlau = First difference of log of auction retail prices of whole hake in France.

Symmetric Error Correction Models

For comparison purposes, we also present symmetric error correction model results for auction and retail whole hake monthly prices from June 1989 to December 1999 in table 4.

These results show that whole hake retail and auction prices adjust to correct long-run disequilibria in retail and auction whole hake prices. Other things being equal, the speed of adjustment indicates that adjustment is similar in the whole hake retail and auction prices, where only 30% of the disequilibria is removed each month. This is much higher than the retail equation and very low compared to above 50% in the auction equation. This shows that assuming symmetric response produces misleading and biased results.

Due to asymmetric adjustments, it is incorrect to examine the short-run dynamics with a symmetric error correction model. According to Enders and Granger (1998), a symmetric error correction model would not reveal differential adjustments of the positive and negative changes. The diagnostics tests of symmetric models show similar results to the asymmetric models (table 5).

Conclusions

The responses of different economic agents to market forces may not necessarily be symmetric, implying that changes in the raw material or product prices at the upstream level (production) may exhibit different responses at the 'downstream' level (*e.g.*, retail level) and vice versa. This paper tests the presence of asymmetry in price transmission between producer and retail prices of whole hake in France. Subsequently, the error correction models that take into account this asymmetry have also been estimated and provide the direction as well as the magnitude of this asymmetric price transmission.

Table 5
Model Evaluation Diagnostics

Statistic	Asymmetric Error Correction Retail	Asymmetric Error Correction Auction	Symmetric Error Correction Retail	Symmetric Error Correction Auction
Lag length = 2				
R^2	0.60	0.44	0.60	0.44
σ	0.058	0.109	0.058	0.110
$F_{ar}(7,112)$	0.6383	2.4704*	0.6839	2.6029*
F_{arch} (7, 105)	0.4071	0.65582	0.40874	0.7398
χ^2_{nd} (2)	1.5917	0.29439	1.2475	0.6511
F_{het} (34, 84)	0.6600	0.97597	0.7233	1.019
RESET F(1, 118)	1.4095	1.007**	0.8944	7.7138**

** significant at the 1% level; * significant at the 5% level.

For retail hake prices, adjustments to positive and negative shocks to the marketing margin are found to be statistically significant, and retail prices respond strongly to negative shocks. However, positive shocks are allowed to persist. Auction prices only seem to respond to positive shocks. This implies that whole hake retail prices adjust to correct the disequilibria in retail and auction whole hake prices. However, auction prices only respond to positive disequilibria.

Other things being equal, the speed of adjustment indicates that the response is slow in the whole hake retail sector, where some 23.9% of the disequilibria is removed each month. However, the adjustment in the auction price is quite fast, where some 52% of the disequilibria is removed each month. This adjustment is possibly due to the perishable nature of the product. These results show that retailers immediately respond to changes in auction prices by adjusting their prices due to hake's small share in the French market. They also show that fishermen respond positively to higher retail prices.

Overall, this paper shows that there is asymmetric price transmission in the whole hake market, and to assume that adjustment is symmetric is likely to produce misleading and biased results. Due to asymmetric adjustments in the hake fisheries, it is incorrect to examine the short-run dynamics using a symmetric error correction model. According to Enders and Granger (1998), a symmetric error correction model would not reveal differential adjustments of the positive and negative changes.

These findings have clear implications for studying margins along the value chain of fish and fish products. By ignoring the asymmetry in price transmission at different levels of the value chain, the calculation of margins will be biased.

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