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Asymmetric price transmission in the Japanese seafood value chain

- Analyses focusing on six fish species -

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OUTLINE of this Presentation

1. Introduction
2. Methodology / Model
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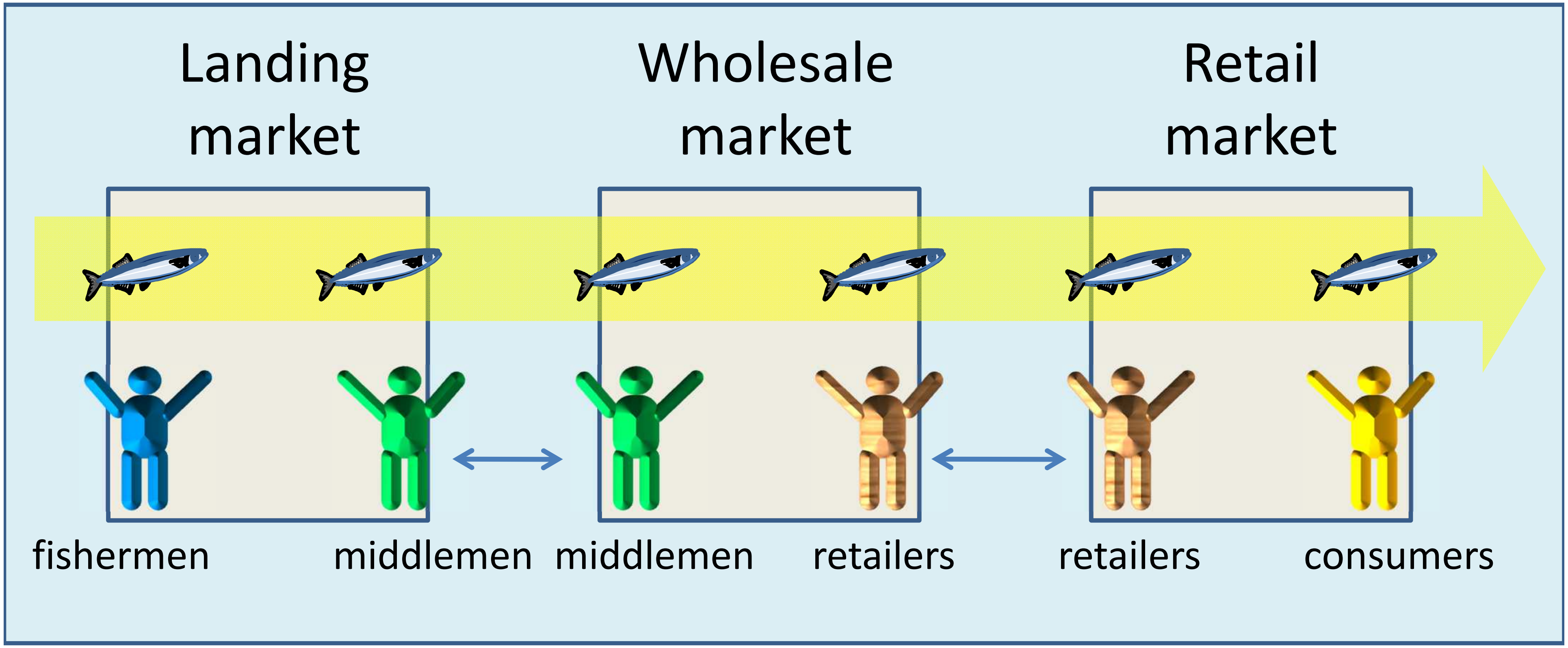
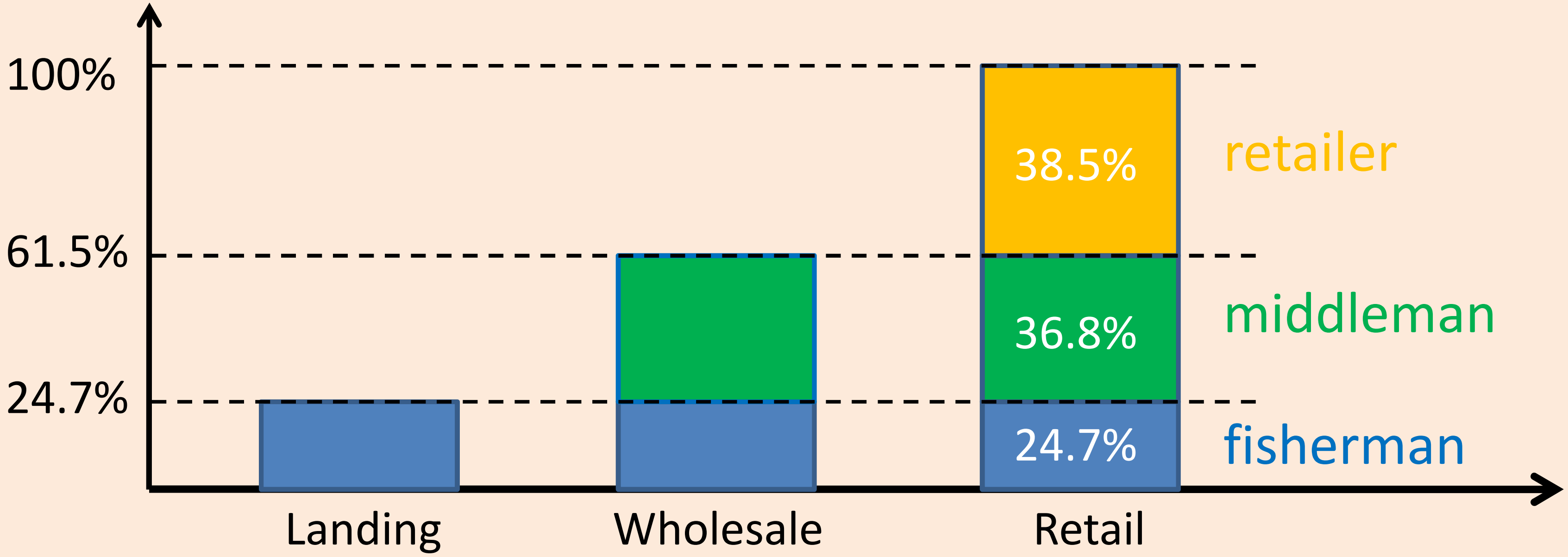
Japanese seafood value chain has typically three markets from producers to consumers



This value chain has developed to deal with various fish species and their flexibility of use

Fisheries Agency conducted a research for the seafood value chain in Japan in 2009

Fig.1 Revenue share in the retail price

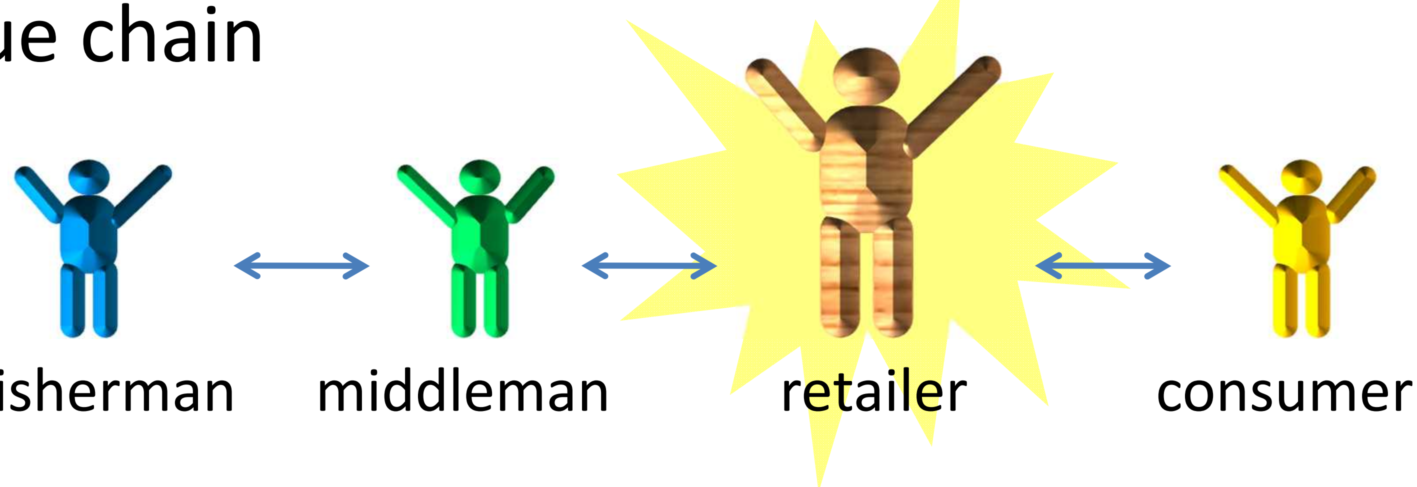


Fishermen's revenue is 24.7% of the retail price while retailers' revenue is 38.5%

(Fisheries Agency (2009))

Whether this value chain is really efficient or not is one of the major issues in Japanese fisheries

Retailers such as supermarkets are said to have a strong market power in the Japanese seafood value chain



Most of the previous studies are descriptive, and no study has shown it quantitatively

- Objective -

to examine the market structure of the Japanese seafood value chain using statistical methods

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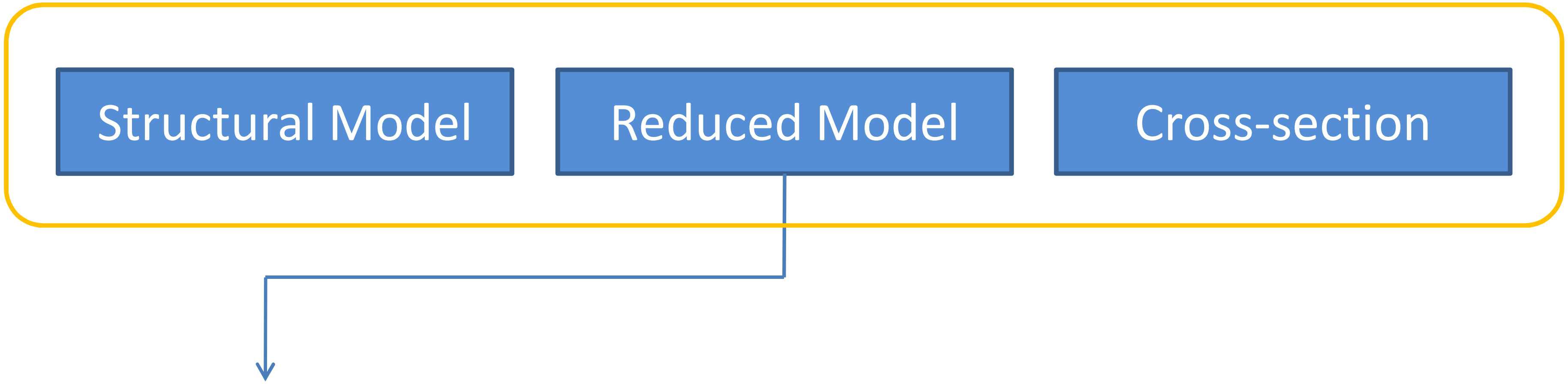
Methodology

"Notes of Prices and Margins in Fish Marketing"

(by Dr. Bjorndal and Dr. Gordon)



With special emphasis on:

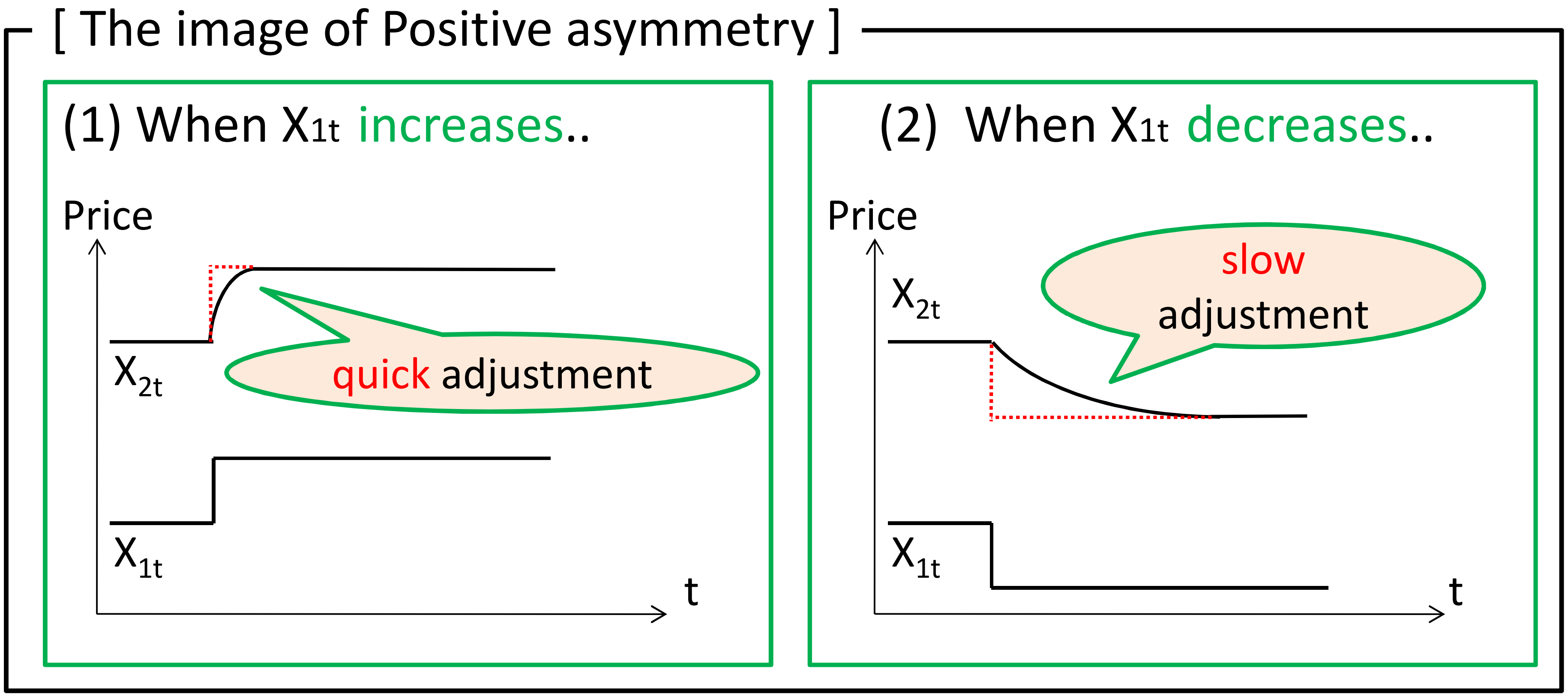
Asymmetry price transmission

"Cointegration and Threshold Adjustment"

Walter Enders and Pierre L. Siklos

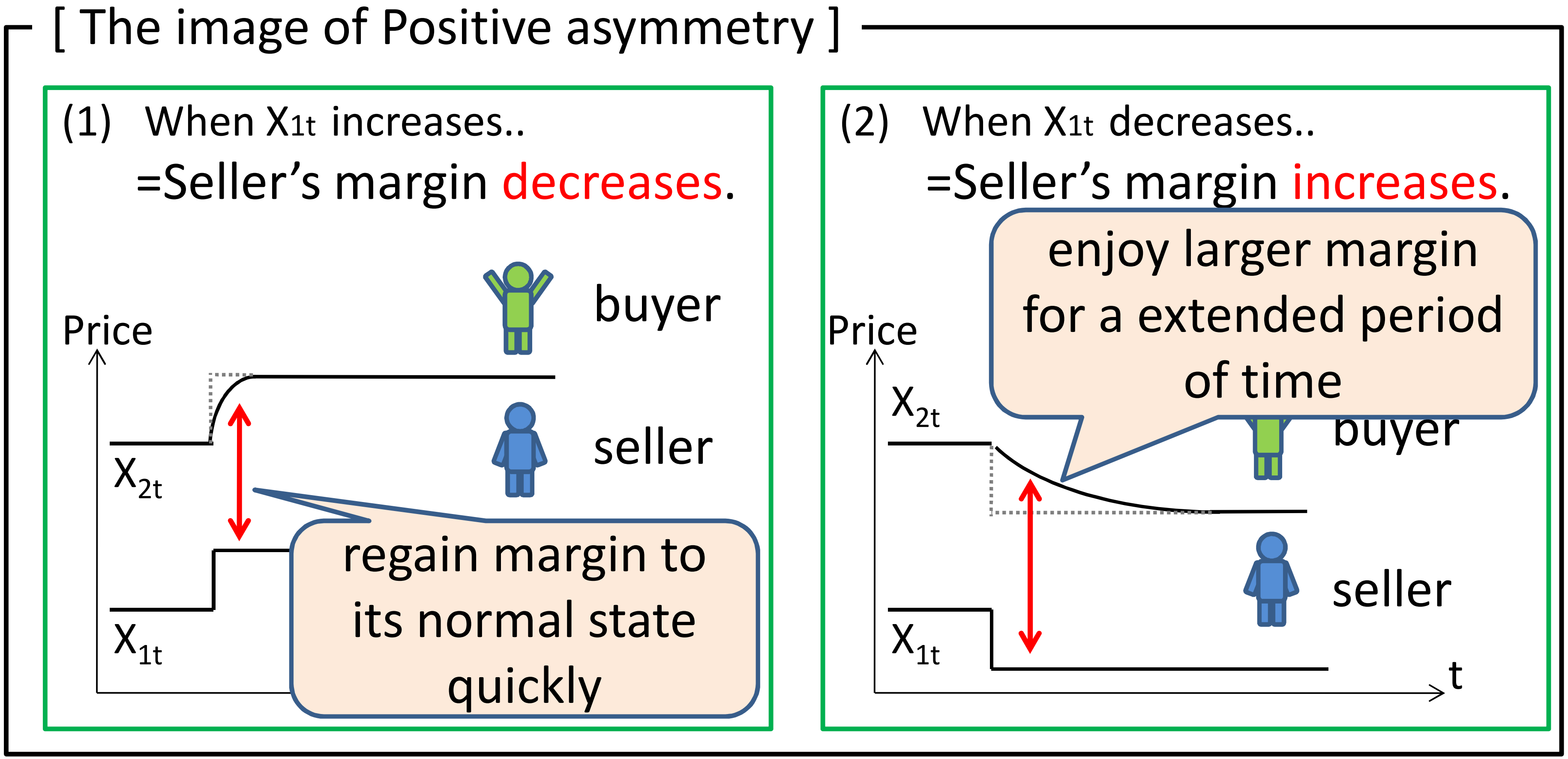
Journal of Business & Economic Statistics (2001)

The concept of asymmetric price transmission



Asymmetry type	When X1t increases	When X1t decreases
Positive	quick	slow
Negative	slow	quick

One possible interpretation of this asymmetry is the market power



Asymmetry type	When X1t increases	When X1t decreases	Market power
Positive	quick	slow	seller > buyer
Negative	slow	quick	seller < buyer

Model

Two models are used in this analysis

(1) TAR (Threshold Autoregressive) model

$$\Delta\mu_t = \rho_1 I_t \mu_{t-1} + \rho_2 (1 - I_t)\mu_{t-1} + \sum_{i=1}^{T} \gamma_i \Delta\mu_{t-i} + \varepsilon_t \qquad I_t = \begin{cases} 1 & if \quad \mu_{t-1} \geq \tau \\ 0 & if \quad \mu_{t-1} < \tau \end{cases}$$

(2) M-TAR (Momentum Threshold Autoregressive) model

$$\Delta\mu_t = \rho_1 M_t \mu_{t-1} + \rho_2 (1 - M_t)\mu_{t-1} + \sum_{i=1}^{T} \gamma_i \Delta\mu_{t-i} + \varepsilon_t \qquad M_t = \begin{cases} 1 & if \quad \Delta\mu_{t-1} \geq \tau \\ 0 & if \quad \Delta\mu_{t-1} < \tau \end{cases}$$

T: Number of lags, τ: Threshold,

I_t, M_t: Heaviside indicator function

μ_t: Disturbance term ($x_{2t} = \alpha + \beta x_{1t} + \underline{\mu_t}$)

τ is determined by Chan (1993)'s method

$$I_t = \begin{cases} 1 & if \quad \mu_{t-1} \geq \tau \\ 0 & if \quad \mu_{t-1} < \tau \end{cases} \qquad M_t = \begin{cases} 1 & if \quad \Delta\mu_{t-1} \geq \tau \\ 0 & if \quad \Delta\mu_{t-1} < \tau \end{cases}$$

1st Step

Estimate the following equation and save the residuals as {$\hat{\mu}$}.

$$x_{2t} = \alpha + \beta x_{1t} + \mu_t$$

2nd Step

Sort the {$\hat{\mu}$} and call it as {μ^{τ}}.
Discard the largest and smallest 15%. The remaining 70% are the candidate of τ.

3rd Step

Estimate TAR/MTAR model for each μ^{τ} and select the one which yields the lowest residual sum of squares.

Co-integration and asymmetry test

(1) TAR model

$$\Delta\mu_t = \rho_1 I_t \mu_{t-1} + \rho_2 (1 - I_t)\mu_{t-1} + \sum_{i=1}^{T} \gamma_i \Delta\mu_{t-i} + \varepsilon_t \qquad I_t = \begin{cases} 1 & if \quad \mu_{t-1} \geq \tau \\ 0 & if \quad \mu_{t-1} < \tau \end{cases}$$

(2) M-TAR model

$$\Delta\mu_t = \rho_1 M_t \mu_{t-1} + \rho_2 (1 - M_t)\mu_{t-1} + \sum_{i=1}^{T} \gamma_i \Delta\mu_{t-i} + \varepsilon_t \qquad M_t = \begin{cases} 1 & if \quad \Delta\mu_{t-1} \geq \tau \\ 0 & if \quad \Delta\mu_{t-1} < \tau \end{cases}$$

Co-integration test

H_0: $\rho_1=\rho_2=0$
is tested by Φ test.

*Critical values are given by Ward et. al (2004)

Asymmetry test

H_0: $\rho_1=\rho_2$
is tested by F test.

If H_0 rejected

$|\rho_1| < |\rho_2|$
Positive asym.

$|\rho_1| > |\rho_2|$
Negative asym.

Analytical procedure

◆Objective

: to analyze the statistical relationships between two price data

Step 1: Unit root test — : Augmented Dickey-Fuller test

↓

Step 2: Co-integration test

↓

Step 3: Asymmetry test

(Steps 2–3) :TAR / M-TAR model

Asymmetry type	When X1t increases	When X1t decreases	Market power	Estimate
Positive	quick	slow	seller > buyer	$\lvert\rho_1\rvert < \lvert\rho_2\rvert$
Negative	slow	quick	seller < buyer	$\lvert\rho_1\rvert > \lvert\rho_2\rvert$

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Data and unit root test

- Data
  - Japanese sardine, horse mackerel, Japanese common squid, skipjack tuna, Japanese saury, red sea-bream
  - Ex-vessel price, wholesale price at consuming market, retail price
    - Source: Government statistics
    - Jan 1971 – Dec 2009, monthly data
- Unit root test
  - ADF test was conducted and it was found that price data are non-stationary and I(1)

Estimation results

Market	Period	Sardine	Horse mackerel	Common squid	Skipjack tuna	Saury	Sea-bream
Wholesale	-1994	Pos**	-	-	-	Pos***	Neg**
	1995-	Neg**	-	-	Neg***	Pos**	Neg*
retail	-1994	Neg**	Neg*	Neg***	Pos**	Pos***	Neg***
	1995-	Neg***	Neg*	Neg***	Neg***	Pos***	Neg**

- Pos : Positive asymmetric price transmission: sellers have stronger power
- Neg : Negative asymmetric price transmission: buyers have stronger power
- -: Asymmetry not detected
- *p<0.1, **p<0.05, ***p<0.01

Findings

- In and before 1994, sellers had stronger power in some species and buyer had stronger power in other species.

- After 1994, market power of buyers has apparently increased.

- Saury is in a unique situation where sellers have stable market power over the observation period.

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Discussion

- The results are in conformity with an market observation that retailors obtained stronger power in Japan after traditional fishmongers were replaced by large supermarkets around 1994.

- Saury's uniqueness could be explained by the traded form of this fish species: consumers are happy to buy whole saury and venders are free from additional labors such as heading and gutting of the fish at the site of the sales.

Thank you