World Applied Sciences Journal 13 (8): 1901-1908, 2011
ISSN 1818-4952

Price Transmission and Marketing Margin in the Iranian Fish Markets

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Abstract: As in many other transition economics processing and marketing margins are also larger in the Iranian fish market than respective margins in market economies. In addition, margin of the Iranian North fish chain is greater than in the South and Farming chain. Its decline in the North fish market indicates an adjustment to more competitive markets. Co-integration models are applied to estimate vertical price transmission and to examine margins and degree of competition in the fish marketing chains. Results indicate the existence of a long run equilibrium regarding vertical price transmission in the fish sectors. The farm-gate of North, South and Farming fish prices are identified as weakly exogenous in long run. The structural tests imposing homogeneity restriction suggest a competitive price strategy for fish in the fish processing and marketing chain.

Key words: Price Transmission · Marketing Margin · Co-integration · Competition · Iran

INTRODUCTION

Over the last three decades several studies have examined competitive models in factor and product markets and how various shifts in demand and supply affect the farm-to-retail price transmission. Most of these studies, however, have been conducted for OECD economies and very rarely for new emerging market economies [1, 2]. These studies lately rely on structural models to estimate price transmission [3]. Initially, the econometric modeling work on price analysis in food marketing chain largely followed Wolffram's [4] studying irreversibility in supply, Houck's [5] model specifications investigating asymmetric price transmission and Garner's [6] theoretical work on the farm-to-retail price spread. Among the best known empirical studies of price transmission in the food risk on the marketing margin, Heien's [7] investigation of the dynamic price adjustment by mark-up pricing rules and Wohlgenant's [8] examination of lead-lag relations between prices at different levels of the marketing chain. Moreover, following Ward's [9] dynamic asymmetric mark-up model to study asymmetric price transmission, several studies have analyzed the speed and the magnitude of a price transmission shock when the initial price is rising or falling, to establish whether price development in the food marketing chain is either symmetric or asymmetric [10-12]. The common feature of these models is that they capture behavior within static long-run equilibrium relationship by explaining structural relations and causes of price and margin determination. More recently, Bessler and Akleman [13] have investigated vertical price transmission of the US pork and beef sector and examined the direction of information flows in linear models by using directed graphs relying on lagged relationships.

Our work was motivated by rather large farm-to retail price spread in Iranian fish markets. This indicates that the Iranian fish market is likely non-competitive markets. In spite of important policy relevance, to date no study examines vertical price transmission, farm-to-retail price spread (margin) and degree of competition in the Iranian fish market. It is important for policy design and formulation to investigate if price liberalization and market deregulation during transmission to a market economy is reflected in a more competitive and efficient price transmission. Therefore, the important objective of our article is to provide in-depth evidence on vertical price transmission and on a magnitude and pattern in development of the processing and marketing margin for Iranian fish market during the 1997-2006. We analyze a long-run vertical price interrelationship at farm and retail stages in the vertical fish chain. We use a Co-integration approach to study long-run relations and vertical-market integration effects of two commodity markets, namely North fish and South fish, using the multivariate Johansen maximum likelihood (ML) Co-integration approach [14, 15].

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The paper is structured as follows: First, we describe the theoretical background underlying our analysis. In the next step we explain the methodology used and describe our data. The section dealing with empirical analysis consists of unit root tests,, a multivariate Johansen ML Co-integration approach and testing procedure to analyze whether are competitive or not. Finally, we summarie the main empirical results and draw our main conclusions.

MATERIALS AND METHODS

Similar to Cameron-Taubadel [15] and Jumah [16] vertical price transmission between farm and retail levels has been investigated within a linear model.The vertical price relationships at two different marketing levels in a certain fish chain is observed using three variable whereby the difference between a retail price (P_r) and farm gate price (P_f) is the processing and marketing margin (M). The vertical price relationship can be described as:

$$P_r = M + P_f \tag{1}$$

The margin (M) can generally be seen as a linear combination of a constant absolute amount (a) and a percentage (mark-up) amount (b) of retail price [17, 18]:

$$M = a + bP_r, \tag{2}$$

With a ≥ 0 and 0 ≤ b < 1.

Under a situation of perfectly competitive market b equals zero (b=0) and the margin is constant (M=a) which denotes a marginal cost. Under a situation of market power, the fish processors and fish traders influence margin in such a way that it will be above marginal cost by charging mark-up in an amount 0 < b < 1 of the retail price. By substituting equation (1) into (2) it leads to:

$$P_r = a + bP_r + P_f \tag{3}$$

Or

$$P_r = \frac{1}{1-b}a + \frac{1}{1-b}P_f \tag{4}$$

If a market is a perfectly competitive there is no percentage mark-up in the market, i.e. b=0 and hence only a constant absolute margin remains in equation (4):

$$M = a = P_r - P_f \tag{5}$$

Equation (4) can be rewritten in the reduced form as:

$$P_r = \hat{a} + \hat{b}P_f \tag{6}$$

With $\hat{a} = \frac{1}{1-b}a$ and $\hat{b} = \frac{1}{1-b}$

If P_r and P_f are non-stationary, the tested relationship can be described as:

$$P_{r,t} = \hat{a} + \hat{b}P_{f,t} + \varepsilon_t \tag{7}$$

Where ε_t must be stationary if the above tested model is true in long run. If the two prices are only linked by a constant absolute margin, then $\hat{b}$ has to be equal to unity ($\hat{b}$=1). If $\hat{b} \neq 1$, one can assume that the margin consist of two components: a constant absolute amount $\hat{a}$ and a percentage amount $\hat{b}$ of the retail price. In this case it can be assumed that intermediate trades and/or retailers charge a mark-up.

Data and Model Specification: Unit root test, to test the number of unit root in each time data series we applied the Augmented-Dickey-Fuller (ADF) test [19, 20] and the Phillips-Perron (PP (test [21, 22]. Since monthly data are used seasonal unit root test can occur. According to Schwert [23], the ADF test is valid only for non-seasonal data and the shorter the time series, the more difficult it is to reject the hypothesis of non-stationary time series. However, Gyhsels *et al.* [24] show that the usual ADF test is still valid as long as a sufficient number of lagged terms are included to take into account seasonal unit root in the data. But they also show that the test leads to serious size distortion. So, one faces a difficult choice either to use unadjusted data resulting in the test with the wrong size or to use adjusted data with adjustment procedures having adverse effects of power [25]. The zero frequency unit root tests including 12 lags were used to capture seasonal structure.Co-integration analysis, Long-run vertical price relationships and reaction to deviation to long run equilibrium in the Iranian fish market is investigated using the multivariate Johansen [26]. ML Co-integration approach, which allows testing for the presence of multiple co-integrating vectors and the speed of adjustment parameters. In the long run, we expect the equilibrium price relationship in the form of a Co-integration equilibrium relationship and a co-integrating vector to describe the speed of adjustment toward equilibrium. Co-integration refers to a linear combination of two or more integrated (i.e.difference-stationary) variables, which implies that stochastic trends of variables are linked over time, where there is also a link with the current deviation form the equilibrium relationship.

We use the vector autoregressive error correction model (VECM) which takes the following reduced form:

$$\Delta z_t = \Gamma_1 \Delta z_t + ... + \Gamma_{k-1} \Delta z_{t-k-1} + \Pi \tilde{z}_{t-k} + \Theta D_t + \varepsilon_t \quad (8)$$

Where z_t is two-dimensional vector consisting of retail and farm-gate price,

$z_t = (P_{i,t} P_{j,t})', \tilde{z}_{t-z}$ is defined as, $\tilde{z}_{t-k} = (z'_{t-t}\, 1)', D_t$ are center seasonal dummies and ε_t is the stochastic term (ε_t are niid)o, □)). This VECM contains information on both the short- and long-run adjustments to changes in z_t. The estimates of Γ_i provide the short-run and estimates of Π the long-run parameters. The latter matrix can be written as, $\Pi = a\tilde{\beta}' = a(\beta'\mu)$, where α represents the speed of adjustment to long-run equilibrium and $\tilde{\beta}' z_{t-k}$ is the matrix containing long-run coefficients and represents the co-integrating vectors. According to equation (7) the constant μ is restricted to the Co-integration space and represents the constant absolute component of the marketing and processing margin.

The estimation and testing procedure is the following: Estimating the number of Co-integration vectors using trace and maximal eigenvalue tests. Tests on residuals are used to determine the lag length of models (according to the procedure described by Boswijk and Franses, [27]). Weakly exogenity is tested to find out whether farm gate or retail prices adjust to long run equilibrium after price shock. The condition for a variable to be weakly exogenous for the long run parameters is that the alpha (α) vector of the weakly exogenous variable equals zero. If a price variable ($P_{j,t}$)is found to be weakly exogenous, then a partial model is re-estimated:

$$\Delta P_{i,t} = \Gamma_0 \Delta P_{j,t} + \Gamma_1 z_{t-1} + ... + \Gamma_{k-1} z_{t-k-+1} + \Pi \tilde{z}_{t-1} + \Theta D_t + \varepsilon_t \quad (9)$$

It is worth mentioning that the Π does not contain any information on the factor loading α of the weakly exogenous variable $P_{j,t}$. The re-estimation of equation (8) as partial model shown in equation (9), i.e.conditioning on weakly exogenous variables, is very likely to lead to improved statistical properties of the model [28].

To test whether fish market is competitive, we carried out structural test, i.e. imposing restrictions on the $\tilde{\beta}$ vector. A market is considered to be competitive, if the long run coefficients of retail and farm gate prices are equal in absolute terms but with opposite signs. This means that we impose the following homogeneity constraint:

$$H_0 : \beta_{Pi} = -\beta_{Pj} \quad (10)$$

The restricted Co-integration vector $\tilde{\beta}^* = H\varphi$ is defined as:

$$\tilde{\beta}^* = H\varphi = \begin{bmatrix} 1 & 0 \\ -1 & 0 \\ 0 & 1 \end{bmatrix} \varphi \qquad ,\varphi(2\times 1) \quad (11)$$

Where H is the matrix containing homogeneity restrictions and unrestricted parameters and φ is a matrix with unknown parameters. Linear restrictions are using a likelihood ratio test.

The Co-integration analysis and testing procedure are carried out by use of EVIEWS. Data, Due to problems constructing data series of higher frequency (e.g., weakly) for Iran, farm-gate and retail fish prices used in this analysis are monthly observations (1997 to 2006). Farm-gate prices are represented by average purchase prices in Iran per kg of weight for fish (FF), while a comparable set of retail prices fish (FR) is constructed from prices for fish cuts. Data on nominal prices are deflated using the Iranian consumer price index (CPI) with the base period in 1997 to obtain a series of retail prices. From this point onward, whenever the word price is used in the paper, it means real prices. The deflation procedure dose not cause changes in the farm-to-retail price ratio and neither does it result in a different price transmission model. Therefore, we assume the absence of money illusion [29, 30], i.e. inflation does not affect relative price structures.The source of price and CPI data is the Center Bank of the Republic of Iran (CBI).

Price data analysis showed some kind of volatility in the period 1997-2006 (Figure 1). The retail North fish prices per kg are higher than retail South or Farming fish, while the farm-gate Farming fish prices are higher than the farm-gate North and South fish prices. Consequently, the processing and marketing margin in the North market is greater than in the South and Farming market. Lower farm-gate prices for South compared to North and Farming can be explained by supply side factors, especially better cost efficiency in conversion of feed into South fish than into North and Farming fish. Higher North fish retail prices compared to South and Farming retail prices can be explained by demand side factors, especially consumer preference for North fish in contrast South or Farming fish. In general the farm-gate North, South and Farming prices are more stable than the retail prices. In Iran, factors affected retail prices are more than farm-gate prices, because agents, influence retail price in gap between farm and retail market, therefore, they activities cause retail prices fluctuate more than farm-gate prices.

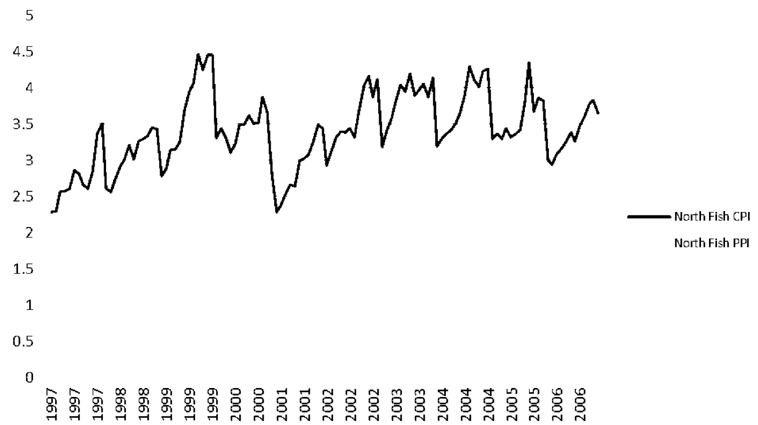

Fig. 1: Monthly North fish prices in Iran, 1997-2006.
Source: Own calculations on the basis of data from the Center Bank of the Republic of Iran

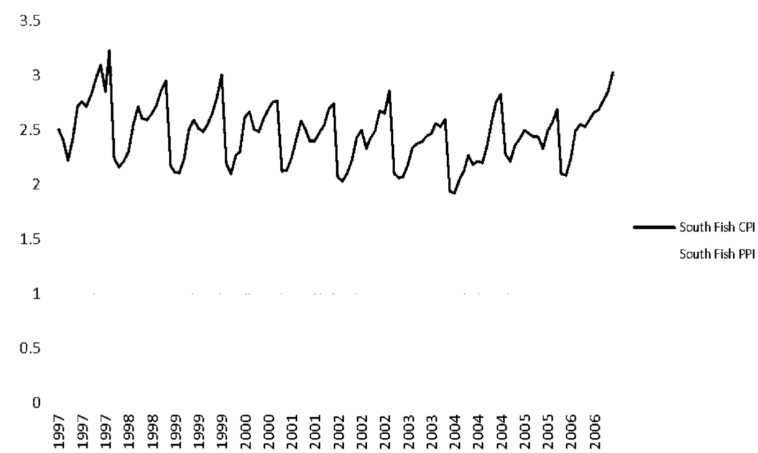

Fig. 2: Monthly South fish prices in Iran, 1997-2006
Source: Own calculations on the basis of data from the Center Bank of the Republic of Iran

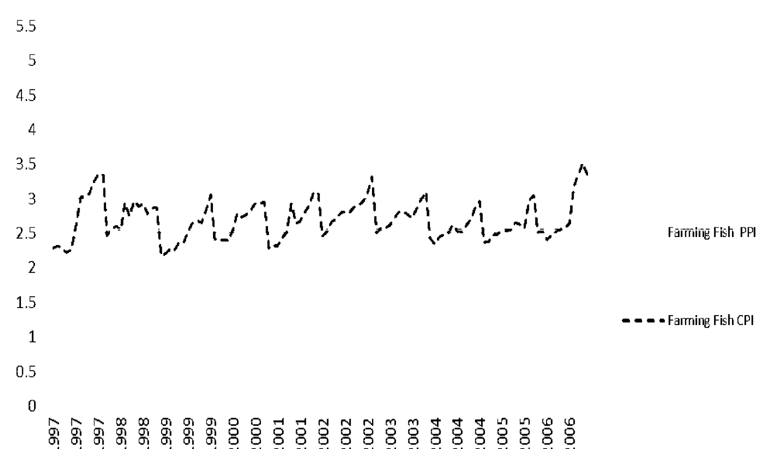

Fig. 3: Monthly Farming Fish Prices in Iran, 1997-2006
Source: Own calculations on the basis of data from the Center Bank of the Republic of Iran

RESULTS AND DISSCUSSION

In this chapter the results of the unit root test, Co-integration analysis, weak exogeneity and structural test are represented.

First, we estimated the long-run price transmission for the total period 1997-2006 and in a second step, investigating the order in which price series are individually integrated. With applying zero frequency ADF unit root tests including 1 lag and the PP test with one truncation lag to 1997-2006 series we found -on a 0.95 significant level- that (using unit root tests with trend) 10 of 12 tests indicate the time series to be trend stationary (Table 1). On a 0.95 significant level the farm-gate prices are seen as I(0), i.e. trend- stationary variables.

Since there is a near equivalence between trend-stationary and difference–stationary processes it is difficult to distinguish between them in finite samples. A crucial problem in applying unit root tests is their tendency to over-reject the null hypothesis when it is true (poor size property) and to under-reject when it is false (poor power property). Thus, it is not possible to state that a variable is stationary or non-stationary, but to state that a certain finite sample exhibits stationary or non-stationary attributes (Harris 1995). This was the reason we also applied Co-integration analysis to the 1997-2006 period, although the unit root tests for that period suggested most of variables to be trend-stationary.

The relative number of agents between fish markets does not necessarily imply a stronger probability of finding price transmission in the market with higher number of agents (the fish market in our case). Namely, price transmission can be influenced by some other factors such as government policies, bargaining and different contractual arrangements. To test vertical price transmission in fish chain, the Co-integration analysis is carried out within the same vertical fish market chain (i.e., separately for North, South and Farming fish) evaluating the size and relationship between farm-gate price on one side and retail- price on the other.

Results of Co-integration analysis are presented in Table 2, 3 and 4. Based on the trace statistics, the results of the rank (r) test indicate one co-integrating vector in the fish market in period 1997-2006. The test for the unit root within the multivariate Johnson ML approach suggest that all data series used in our models with one Co-integration vector are non-stationary.

The Co-integration vector is presented in a normalized form, in such way that the first element (retail price NRF) of the vector $\tilde{\beta}'$ is set equal to unity. The coefficients of NRF and constant are presented in column 5 and 6 in Table 2.

Table 1: Results of unit root tests 1997-2006

Tests	NFR	NFF	SFR	SFF	DFR	DFF
ADF test with trend	-3.84**	-4.84**	-3.01	-5.36**	-2.96	-3.71**
ADF test with constant	-3.06**	-4.91**	-3.50	-5.75**	-15.15	-3.62*
PP test with trend	-3.87**	-4.42**	-4.68**	-5.28**	-4.45**	-3.71**
PP test with constant	-4.15**	-4.89**	-4.53**	-5.75**	-4.47**	-3.62*

*,** denote a 0.95 and 0.99 significance level, respectively.

Source: Author Finding

Table 2: Results of Co-integration analysis

Model	Lags	dummies	Trace statistics	β_{gj}	Constance
NFR-NFF	14	No	13.21373	-0.603028	-4.12638
NFR-NFF[a]	12	No	-	-2.826286	-0188714
SFR-SFF	11	No	16.19330	-0.696750	-1.770628
SFR-SFF[a]		No	-	-0.279669	-2.743848
DFR-FFF	12	No	21.02375	-0.286221	-2.292017
DFR-FFF[a]	12	No	-	-0.286221	-2.292017

Source: Author Finding

Table 3: Factor loading matrix

Model	Variable	∝	t value
North Fish	DNFR	-0.153635	-2.54755
	DNFF	0.072018	2.47651
South Fish	DSFR	0.231167	2.37717
	DSFF	-0.070831	-1.88543
Farming Fish	DFFR	-0.416466	-4.85136
	DFFF	0.073365	1.27533

Source: Author Finding

Table 4: Test results for weak exogeneity

Model	Variable	Test	LR statistics	p-value
North Fish	NFR	$\alpha_{NFR} = 0$	$\chi^2(1) = 7.503$	0.0061
	NFF	$\alpha_{NFD} = 0$	$\chi^2(1) = 5.114$	0.02374
South Fish	SFR	$\alpha_{SFR} = 0$	$\chi^2(1) = 29.931$	0.0000
	SFF	$\alpha_{SFF} = 0$	$\chi^2(1) = 0.2023$	0.6526
Farming Fish	FFR	$\alpha_{FFR} = 0$	$\chi^2(1) = 22.771$	0.0000
	FFF	$\alpha_{FFF} = 0$	$\chi^2(1) = 0.581$	0.4449

Source: Author Finding

Table 5: Results of the structural test

		Coefficients			Statistics	
Model	Test	β_{pi}	β_{pj}	Constant	LR	F
North Fish	$\tilde{\beta}^* = \tilde{\beta}$	1	-1	3.45	(1) = 32.246	32.246
South Fish	$\tilde{\beta}^* = \tilde{\beta}$	1	-1	3.20	(1) = 42.186	42.186
Farming Fish	$\tilde{\beta}^* = \tilde{\beta}$	1	-1	2.30	(1) = 45.456	45.456

Source: Author Finding

Table 3 presents the ∝ parameters for speed of adjustment of retail and farm-gate prices to long run equilibrium. In the case of DNFF, DSFR and DFFF, the ∝ parameter is of the negative sign. As can be seen from the ∝ parameter, retail prices reacted more intensively to unanticipated shocks than farm-gate prices. The responses in the Farming fish market were faster than in the South and North fish market. The greatest magnitude in the ∝ parameter is found in the case of DFF. It ranged between 0.073365 and -0.416466 suggesting the intensive and significant adjustment in retail fish price to unanticipated shocks away from the long-run equilibrium. The ∝ parameter associated with farm-gate prices are less than retail prices.

Based on the estimated coefficients in column 5 and 6 in the Table 2 the long run price relationship (ECT) for fish (1997-2006) can be formulated as:

$$ECT=NFR-4.126389-0.603028*NFF \quad (12)$$
$$ECT=SFR-1.770628-0.696750*SFF \quad (13)$$
$$ECT=DFR-2.292017-0.286221*FFF \quad (14)$$

As illustrated in equations (12, 13 and 14) we cannot determine whether fish price changes were mainly induced by demand or supply side factors (Table 4).

The results of the weak exogenity test (Table 4) indicate that in the 1997-2006 models the farm-gate prices (NFF, SFF and DFF) are weakly exogenous and the retail prices (NFR, SFR and FFR) react to changes in the farm-gate prices.This means that the price changes were mainly induced by producer side factors as only NFR, SFR and FFR respond to deviations from the long run equilibrium. Due to this, these models were re-estimated as partial models where the farm gate price entered the model as weakly exogenous variable.

The long run price relation between retail and farm gate pieces for period 1997-2006 can be described as:

$$NFR=0.188714+2.826286*NFF \quad (14)$$
$$SFR=2.743848+0.279669*SFF \quad (15)$$
$$DFR=2.292017+0.286221*FFF \quad (16)$$

To test whether markets are competitive or non-competitive structural tests have been carried out. Results are presented in Table 5. If the restricted model is not significantly different from the unrestricted model, this means that the margin in model is a constant absolute margin. As can be seen, structural market of North, South and Farming fish are competitive for period 1997-2006, so the margin in the North, South and Farming fish model is a constant absolute margin.

Price transmission in the fish sector in the period 1997-2006 and long run margin equation can be described as:

$$Margin_{Nfish} = 3.45 \quad (17)$$

NFR=3.45+NFF

$$Margin_{Nfish} = 3.45 \quad (18)$$

SFR=3.20+SFF

$$Margin_{Nfish} = 3.45 \quad (19)$$

FFR=2.30+FFF

This indicates a competitive processing and marketing margin in the fish sector.

CONCLUSIONS

One of the most striking finding of our analysis is that protected and regulated/controlled markets may perform as competitive markets, but it is less likely to be an efficient market in terms of the size of the margin. This is revealed by greater processing and marketing margin for a provided similar quality of marketing service than in more perfectly competitive markets in market economics. The processing and marketing margin in the Iranian. North fish market is greater than in South and Farming fish market owing to the higher retail North fish price compared to the lower retail South and Farming fish prices on the one side and due to the lower farm-gate. North fish price compared to the higher farm-gate South and Farming fish prices. We conclude the structure of North fish market more competitive than South fish market.

The results of the vertical price transmission using the multivariable Johansen ML Co-integration approach suggest a long-run price relationship in three fish markets. Co-integration results indicate that there is along-run vertical price transmission between the farm-gate and retail prices in the analyzed period 1997-2006 as a whole. The results of weak exogeneity tests in the period 1997-2006 identify the farm-gate North, South and Farming prices as weakly exogenous, while the retail North, South and Farming prices react to changes in the farm-gate North, South and Farming prices. Therefore, one could assume that efficiency improvements and lower cost arising from producer side factors were crucial for the retail price changes in the Iranian fish market.

The structural test imposing the restriction implied by competition indicates that processors and traders in the fish market charged a constant absolute margin suggesting absence of market power and competitive processing and marketing margin formation. This smoother input price and margin transmission in the fish processing and marketing chain seem to be due to the rather vertically integrated fish market in Iran.

Our Co-integration results clearly suggest that even in a situation of an externally isolated and internally regulated fish markets, the fish market may behave like competitive market. However, it is less likely that existent market structures and equilibrium situation which occurred within protectionist trade policies and policy induced transfers prevail in the future.

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