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Market Structure and Price Adjustment in the Iranian Tea Market

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Abstract

This study investigates the Iranian tea market structure based on the price transmission mechanism between farm, wholesale and retail prices using annual data for the period 1977–2010. For the study of the asymmetry, the Johansen cointegration analysis was used while at the same time an Error Correction Model (ECM Model) was estimated. With the assistance of the cointegration technique, we surveyed the existence of a long-run relationship between farm and wholesale prices, farm and retail prices. The causality test showed that the farm price determines wholesale and retail prices and the wholesale price causes the retail price, whereas the reverse was determined not to be valid. In addition, application for an error correction model confirmed the existence of asymmetry in the price transmission mechanism within the farm-retail and wholesale-retail. This study used concentration ratios and a Herfindahl-Hirschman indicator to show that the market structure of the Iranian tea industry is almost exclusive. The presence of market power and the exclusive market structure of the Iranian tea industry are the main reasons for price asymmetry.

Keywords: Cointegration Techniques, Price Transmission, Error Correction Model, Iranian Tea Market, Concentration Ratio and Herfindahl- Hirschman Indicator.

1- Introduction

Market structure is an indicator of a market organization's characteristic economic behavior so the relation among the market components can be specified. Market structure specifies those organizational market characteristics that help determine the nature of listing prices and competition in the marketplace. Price transmission in a goods market is

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influenced by market structure such that non-competitive structures can take advantage of market power influence on the transfer of prices and the welfare of consumers and producers. Another prevalent belief is that price transmission at different stages in the market-chain is not symmetrical. This means it is possible for positive and negative price impulses between two levels of a market, e.g. on-garden and retail, to not be transmitted similarly. According to the Standard Theory of Markets, in a perfectly competitive market when prices change any change in price is quickly and symmetrically transmitted to market levels. However, experimental researches has shown that in practice markets for agricultural products do not act in the same way as perfectly competitive markets (Brown and Yucel, 2000; Weerahewa, 2003; Bakcus and Ferto, 2005; Reziti and Panagopoulos, 2006; Bukeviciute and et al., 2009; Seyoum, 2010).

Tea is a good for which the change in price is important to Iranian policymakers, producers, and consumers. Iran produces 1.5% of global tea production, while Iran's tea consumption is 3.7% of global production. The annual Iranian tea requirement is about 90,000–120,000 tons from which 30,000-40,000 tons (about 35%) is produced in Iran while at least, 60,000-80,000 tons (about 67%) is imported from countries like India and Sri Lanka to meet the deficiency (National Tea Research Institution, 2009). An important issue in the tea economy, especially considering its market structure, is how the price of tea behaves at different market levels, i.e., on-garden, wholesale and retail. Understanding how price changes takes place from producer (on-garden) to consumer and vice versa can help policymakers make appropriate decisions in this regard. Studying the Iranian tea price over a decade (2000-2010) shows the average price per one kilogram of dried green tea leaves on-garden, wholesale and retail has been 1700, 5800, and 16,300 Rials, respectively (Department of Northern Tea, Statistics from Previous Years). Consequently, in the market under preview the existence of asymmetry in the price transmission mechanism is an expected result. The main objective of this paper is to confirm or to reject the existence of ATP in the Tea market. Studying the asymmetry in the price transmission mechanism, the operation of the market can become predictable based on the rational behavior of the economic agents (Koutroumanidis, et al., 2009; Giulietti, et al 2010). Aiming at the empirical study of the asymmetric price transmission, different empirical models have been used.

In our study, the ECM–EG approach was applied (Oladunjoye, 2008; Moghaddasi, 2009; Minot, 2010). Furthermore, the present paper surveys the role of market power of some plants and processors in the marketing process imports with the application of the concentration ratios and a Herfindahl-Hirschman indicator. Studying the cause of high price differences at different levels, which are probably due to the existence of market power of some plants and processors in the marketing process, is essential for policymakers, planners, producers and consumers. Considering the importance of the aforesaid and taking into account that no research concerning the Iranian tea market has taken place, this research will study the tea market structure on the basis of price transmission between the different market levels, i.e., on-garden, wholesale and retail. The paper is organized as follows; Section 2 gives an insight to the literature review, Section 3 refers to the methodology applied for the empirical study, Section 4 describes the results and discussion of this study and finally Section 5 concludes.

2- Literature Review

The asymmetry of the price transmission mechanism has been surveyed using different empirical models (Geweke, 2004; Meyer and Cramon-Taubadel, 2004; Frey and Manera, 2007). Cointegration techniques have been used extensively in the study of asymmetry (Bakcus and Ferto, 2005; Rao, 2005; Reziti and Panagopoulos, 2006; Paulsen, 2007; Oladunjoye, 2008; Feinberg, 2008; Koutroumanidis, et al., 2009; Seyoum, 2010; Minot, 2010).

A cointegration technique is used to survey the speed and the magnitude of price transmission. A cointegration technique helps build an error-correction model (ECM), the adjustment process towards long run equilibrium and how prices transfer. With the help of cointegration techniques, Reziti and Panagopoulos (2006) developed transmission mechanism between producer and consumer prices in the Greek food sector during the 1994–2004 periods. Results showed the existence of asymmetry in food markets expressed through a greater adjustment speed for negative rather than positive shocks. This conveyed the ability of the intermediaries to exploit their market power on the producer’s shoulder. Oladunjoye (2008) investigated market structure and price adjustment in the U.S. wholesale gasoline market using an error correction model. He found the existence of asymmetry in the transmission speed of the price change of crude to wholesale gasoline prices. Market concentration was found to affect wholesale gasoline markets. Amador et al. (2009) assessed the vertical price transmission mechanism between producer and consumer prices of milk products in Austria using monthly data for the period 1996-2008. They results indicated that asymmetries play an important role in the pass-through of prices for milk products in Austria.

Koutroumanidis et al. (2009) studied the existence of asymmetry in the price transmission mechanism between producer and consumer prices in the forest products sector using quarterly data from the period 1985–2004. Application of the error correction model confirmed the existence of asymmetry in the price transmission mechanism within the round wood market in Greece. Bukeviciute et al. (2009) studied price transmission affecting the food supply chain for new members of the European Union using two models for error correction and a simple regression, OLS. Estimated results from January 2005 to August 2008 showed the transmission amount was similar in cases of price increase and decrease for the European Union region, and that price decreases were transmitted quickly. Results showed asymmetry in the transmission of price from producer to consumer among the new member countries of the European Union. A difference in bargaining power was recognized as the main resource difference in price transmission between the provider and seller of a chosen food product.Minot (2010) studied the transmission of world food price changes to African markets using monthly price series for staple food crops over 2007-2008.He found the international prices of food grains do have an effect on African markets for rice and (to a lesser degree) maize. This implies that rice markets in Africa are generally better connected to world markets than maize markets. Seyoum (2010) investigated price transmission system in Ethiopian coffee market. This study covers the periods from December 1991 to April 2009 using the vector error correlation method. The result on the VECM indicated that the producer market and the foreign market are poorly dependent and have had very weak relationships to one another as comparing to auction to the foreign market. Ahn and Lee (2012) extended the estimation of price relationships in wood processing and empirical assessment of asymmetric price transmission in Korea. Estimation results indicated asymmetric price transmission between factory and wholesale prices of fiberboard. Liu et al. (2012) studied price transmission from retail markets to the farmgate using price data for 170 markets, in 29 out 33 provinces of China, at the detail of 12 main products and for the five-year period 1996 to 2000. They found that Chinese farmers are generally well connected to retail markets.

Nikookar (2007) examined weekly and monthly data from September 2003 to February 2007 to determine the transmission model for different levels of chicken prices in Iran using Houck, error correction and threshold tests. Results showed price transmission at different levels of the long-term Iranian chicken market were symmetric, while the short-term market for both chicken farm to retail and farm to slaughterhouse was asymmetric. Moghaddasi (2009) analyzed monthly on-farm and retail price data for the period 1996–2006 for price transmission in pistachios and date in Iran using the Houck approach and error correction models. Results showed a lack of symmetry in the pistachio market. The Error Correction Model for the date market showed an increase in farm price was transmitted more quickly and completely than a decrease. Nikookar, Hosseini and Doorandish (2010) studied price transmission between the different levels of the Iranian beef market using weekly statistics for farm, slaughterhouse and retail beef prices during the period 1998–2005. Results showed price transmission at all levels of Iran's long-term beef market was symmetric, while over the short term it was asymmetric from farm to retail and from farm to slaughterhouse.

Most national and international research on agriculture and animal farm products has not studied price transmission of garden products, such as tea, despite the high importance of the product. Further, no research has examined the main reason for price transmission asymmetry considering market structure using existing methodologies; rather, they have only alluded to reasons for price asymmetry. This research is the first to comprehensively study the price transmission mechanism in Iran's tea market using available indexes.

Research data consisted of garden, wholesale and retail tea prices extracted from the Organization for Northern Tea and Syndicate for Northern Tea Plants. According to the experts at Iran's Tea Organization and Syndicate for Northern Tea Plants, about 20% and 80% of first- and second-class green leaves of northern tea gardens are harvested and sold per year. Thus, the second-class green leaf price has been considered a price indicator of garden price. Also, according to these experts, about 85% of packaged tea in the country is of the broken type. Reasons for price asymmetry were studied using questionnaires completed by tea plant managers who provided statistics of annual sales of individual tea plants. Annual observations for the period 1977–2010 were studied using SHAZAM10 and Eviews software.

3- Methodology

3-1- Asymmetric Price Transmission

The study of asymmetry in price transmission requires a particular methodology. The cointegration techniques have been used extensively in the study of asymmetry. This technique is used to survey only the speed but not the magnitude of the price transmission. The objective of this test is to allow for asymmetric adjustment. In order to apply the Johansen cointegration technique, we examined the stationarity of the time series studied. The unit root test is the Augmented Dickey Fuller (ADF) test (1979). The ADF (1979) test has been widely used for testing the existence of a unit root in the time series studied.

At the second stage, the Johansen and Juselius co-integration technique (1990) was used to determine the existence of a long-run relation between price series. The Johansen method is a generalization of the Dickey Fuller test into multivariable form. If we generalize the Johansson method to *n* variable form, the following relations can be stated in the form of an *AR* model. The trace and the maximum eingenvalue statistics are used to reach a conclusion on the number of cointegrating equations.

In the third stage, the dynamic error correction Engle–Granger model was applied, as represented by the following equations (1) and (2):

$$\Delta FP_t = \mu_1 + \sum_{t=1}^{n_1} \beta_{fp} \Delta FP_{t-1} + \sum_{t=0}^{n_2} \beta_{rp} \Delta RP_{t-1} - \pi_1 Z_{t1-1} + e_{t1} \quad (1)$$

$$\Delta RP_t = \mu_2 + \sum_{t=1}^{n_1} \beta_{fp} \Delta FP_{t-1} + \sum_{t=0}^{n_2} \beta_{rp} \Delta RP_{t-1} - \pi_2 Z_{t2-1} + e_{t2} \quad (2)$$

Finally, the ECM–EG model, which was solved with the least squares method, was estimated for each of the three relations (farm-retail, farm-wholesale and wholesale-retail). For the sake of brevity, only the transmission model between farm and retail prices is reported.

$$\Delta RP_t = \mu_0 + \sum_{i=0}^{L_1} \mu_{fp}^{+} \Delta FP_{t-i}^{+} + \sum_{i=1}^{L_2} \mu_{rp}^{+} \Delta RP_{t-i}^{+} + \pi^{+} \hat{Z}_{rf,t-1} + \sum_{i=0}^{L_1} \mu_{fp}^{-} \Delta FP_{t-i}^{-} + \sum_{i=1}^{L_2} \mu_{rp}^{-} \Delta RP_{t-i}^{-} + \pi^{-} \hat{Z}_{rf,t-1} + \omega_{ti} \quad (3)$$

The + superscript on the coefficients and the variables is relevant when changes in the variables are positive whistle the – superscript is relevant when changes in the variables are negative. More analytically, for any positive change ($\Delta FP>0$) in the dependent variable of equation 3, we are expecting a corresponding reaction of all positive coefficients (β^{+}) plus the coefficient of the speed of adjustment (π^{+}).On the other hand the corresponding negative coefficients ($\Delta FP<0$) will be "engaged" in any negative change of the dependent variable of equation 3.

The Wald test was applied after estimation of the model. In particular, the validity of the equality $\pi^{+} = \pi^{-}$ regarding the existence of the symmetry was examined.

3-2- Market concentration

Market concentration is one of the most important structural variables and organizational features of a market. Researchers have also largely been able to measure competition and monopoly levels. In order to judge the amount of competition and monopoly in the Iranian tea market it was necessary to first regard the number of active tea processing plants in market and then consider the way the "market distributes among them." In applied economics, the Herfindahl-Hirschman index is used to measure the concentration ratio of *n* companies in a market structure.

a) Concentration ratio of *n* companies

This index is determined as follows:

$$CR_n = \sum_{i=1}^{N} S_i \quad i = 1,..., K \quad K \rangle N \quad (4)$$

Where K and N are the number of active plants in the tea market and the number of large tea processing plants in Iran, respectively, and the largest amount of tea market available to them. S_i is the market share of the *ith* plant and CR_n is the "concentration ratio of *n* plants." Market share is also determined using the sale ratio of each tea processing plant to the total sales of the tea industry, i.e., $S_i = \frac{X_i}{\sum X_i}$

b) Herfindahl-Hirschman index (HHI)

The Herfindahl index determines better than other indexes the distribution of market size of available companies as well as the type of market structure. This index is calculated by summing the square of the market share of the *n* largest tea processing plants in Iran's tea market with the square of the market share of all plants, if their numbers are less than 50. Davies (1979) divided the sensitivity of this index into two combinational parts: the number of companies in the market and the inequality in market share of different companies. He found that when the number of companies in an industry is very large this index bears less sensitivity against changes in the number of market companies. Therefore, the Herfindahl-Hirschman index can be written as an increasing function of market share variance of companies:

$$\sigma=\delta+\sum_{i=1}^{n}(S_i-\delta)^2\ ,\ \delta=\frac{1}{n}\ ,\ HHI=\frac{1}{n}+n\sigma^2 \qquad (5)$$

After computing the concentration rate indexes and the Herfindahl-Hirschman index, table (1) can be used to specify the market nature classifying the markets on the basis of amounts for these indexes.

If there are more than 50 industry companies the concentration ratio for 6, 8 and 20 large companies will be computed and the decision regarding the nature of the market will be made using the *1/HI* index (Kirsten and Abdulrahman, 2007).

Table 1: Type of Market Structure and Characteristics of the Number and Size of Firms

Market	CR_i	HHI	The main feature of market
Perfect competition	$CR_1 \to 0$	$HI \to 0$	Large firms, without a significant share of the market
Monopolistic competition	$CR_1 < 10$	$(1/HI) \to 10$	Large number of firms, effective competition do not monopolize more than %10 of market
Loose Oligopoly	$CR_4 < 40$	$6 < (1/HI) \leq 10$	Four firms monopolized up %40 of market
Tight Oligopoly	$CR_4 < 60$	$6 < (1/HI) \leq 6$	Four firms monopolized at least %60 of market
Dominant firm market	$CR_1 \geq 50$	$1 < (1/HI) \leq 4$	one firm is monopolizes more than %50 of market
Perfect monopoly	$CR_1 \to 100$	$HI \to 1$	A firm monopolizes all of market

Source: Adopted and Excerpted from Maddala, Dabson and Miller (1995).pp, 189-195.

4- Results and Discussion

A Augmented Dickey-Fuller Test was used for on-garden prices (*PP*), wholesale prices (*WP*) and retail prices (*RP*) of broken tea, which are represented as *I(1)* (as shown in Table (2)).

Table 2: *ADF* Test Results

	τ	Critical values		
		(%1)	(%5)	(%10)
PP	1.71	-4.34	-3.59	-3.23
WP	-0.84	-4.27	-3.56	-3.21
RP	0.24	-4.27	-3.56	-3.21
ΔPP	-4.55	-4.34	-3.59	-3.23
ΔWP	-5.53	-4.27	-3.56	-3.21
ΔRP	-7.34	-3.65	-2.96	-2.62

Source: Research Findings

Considering the time-series of the price is *I(1)*, (Johansen and Juselius, 1990) techniques can be used to test whether there is a static combination (linear relation) of variables or not. Johansen's cointegration technique discusses and tests a "zero assumption," i.e., there is no cointegration relation against the existence of a cointegration relation. This includes using Trace and Max-Eigen value indexes. Results from Johansen's cointegration test for variables of on-garden and wholesale prices, on-garden and retail prices, and wholesale and retail prices are shown in table (3). According to these results, in each of the three cases the respective critical values for the trace statistics and the maximum Eigen value for the first null hypothesis at a 5% level are greater than the critical amount while the critical values for the second null hypothesis for the same criteria and for the same level are less than the critical amount. This means that there is at least a long-term relation between the variables of on-garden and wholesale prices, on-garden and retail prices, and wholesale and retail prices.

Table 3: Cointegration Test Results

	Rank Under Null hypothesis	**Trace statistic**	**Max. Eigen value**	**Results of Granger Causality**
Between wholesale and on garden price	r=0	26.93*	23.28*	PP causes WP
	r ≤1	3.65	3.65	
Between retail and on garden price	r=0	48.21*	*36.17	PP causes RP
	r ≤1	12.04	12.04	
Between retail and wholesale price	r=0	32.01*	*24.13	WP causes RP
	r ≤1	7.88	7.88	

*Significant at 5%

The causality direction between different market levels needs to be determined before estimating a price transmission model. Results from the Granger causality test are shown in table (3).

In this regard, price transmission between the different levels of the Iranian tea market was studied. In order to study how transmission occurs, an Engle-Granger approach (ECM-EG) error correction model was estimated using *SHAZAM* and annual price data. Initially, two regression model $WP_t = \beta_0 + \beta_1 PP_t + \varepsilon_t$ and $RP_t = \alpha_0 + \alpha_1 PP_t + \varepsilon_t$ were estimated and the components of regressions error term were estimated in the form of two variables. Negative and positive residuals were defined and added to the models as descriptive variables and estimated using a least squares method. Table (4) is given the equations of asymmetric price adjustment from on-garden to the wholesale and from on-garden to the retail. It is evident from the table, Dorbin-Watson statistics show there is no correlation problem for the components of residual in the two estimated models. Jarqu- bera statistics indicate that the residual has normal distribution. A structural break test (*CUSUMQ*) was conducted for the two estimated models and results show a structural break had taken place since 1989 for on-garden to wholesale equation and For on-garden to retail equation occurred during the years 1996–2005, which exerted an incremental shock on the tea market affecting the Iranian Ministry of Agriculture’s support for tea cultivation and the tea industry. This occurred coincident with the presentation of the structural plan for improving the Iranian tea market. Therefore, a virtual variable was added to the model whose amount for before-break observations were zero and other observations were 1.

Table4: Equations of Asymmetric Adjustment in the Prices for Tea; Annual Data, Iran 1977–2010

	Asymmetric Adjustment Equations from on-Garden to Wholesale		Asymmetric Adjustment Equations from on-Garden to Retail	
	Coefficient	T-Statistic	Coefficient	T-Statistic
Constant	-59.54	-5.24*	-255.53	-6.06*
ΔPP^{+} (on-garden price increases)	0.06	0.4	0.92	5.61*
ΔPP^{-} (on-garden price decreases)	0.27	0.36	16.22	1.17
ΔWP^{+}_{t-1} (1st lag of wholesale price increases)	0.52	6.38*	-	-
ΔRP^{+}_{t-1} (1st lag of retail price increases)	-	-	0.59	9.21*
ΔPP^{+}_{t-1} (1st lag of on-garden price increases)	0.36	2.24**	11.28	8.29**
ΔWP^{-}_{t-1} (1st lag of wholesale price decreases)	-1.74	-2.15**	-	-
ΔPP^{-}_{t-1} (1st lag of on-garden price decreases)	-2.35	-3.36*	-76.76	-10.83*
ΔPP^{+}_{t-2} (2st lag of on-garden price increases)	-	-	13.43	9.89*
ΔRP^{+}_{t-2} (2st lag of retail price increases)	-	-	-0.81	-8.66*
ΔPP^{+}_{t-3} (3st lag of on-garden price increases)	-	-	-22.04	-11.82*
ΔPP^{+}_{t-4} (4st lag of on-garden price increases)	-	-	-0.04	0.03
D (dummy variable)	200.52	4.83*	1636.4	8.08*
ECT^{+}_{t-1} (positive values of lag error term)	-0.30	-8.25*	0.66	9.02*
ECT^{-}_{t-1} (negative values of lag error term)	-0.25	-4.90*	-0.44	-6.02*
	R^2=0.6 R^2 adjusted=0.50 dw=1.7 JB=2.04		R^2=0.8 R^2 adjusted=0.83 dw=1.9 JB=0.38	
The estimated equation with the OLS method in the first stage of the ECM	$WP_t = 396.37 + 3.01PP_t$		$RP_t = 401.13 + 9.19PP_t$	
Test of symmetry using the Wald method	$x^2(1) = 0.69(0.40)$		$x^2(1) = 67.5(0.000)$	
Test of symmetry in price transmission speed	$x^2(1) = 0.07(0.79)$		$x^2(1) = 31.65(0.000)$	

*Significant at %1 **Significant at %5

A Wald test with a zero assumption on the basis of equality of ECT_{t-1}^{+} and ECT_{t-1}^{-} coefficients were used. Results show in equations from on-garden to wholesale, these coefficients are statistically equal($x^2(1)$ =0.69, p=0.40); that is, zero assumption has been not rejected and price transmission in the on-garden and wholesale tea market is symmetric. Any increase or decrease in the on-garden price is exactly transmitted to the wholesale price. Further, ECT_{t-1}^{+} and ECT_{t-1}^{-} coefficients in the price transmission model show the way on-garden prices are adjusted in order to reach a balanced state in the tea market. Estimated coefficients in table (4) show that both coefficients are significant at a 1% level. Coefficient ECT_{t-1}^{+} shows that tea wholesale prices adjust the market so in each period (year) they remove nearly 0.30% (of a unit) of positive change in deviation from the equilibrium relation. Coefficient ECT_{t-1}^{-} shows in each period (year) nearly 0.25% (of unit) of negative change in deviation from the equilibrium relation due to the change effect of the on-garden price. A Wald test showed a zero assumption of symmetry in transmission speed is accepted (x^2 *(1)* = 0/07, p = 0.79).

While test of symmetry in on-garden to retail equations showed ECT_{t-1}^{+} and ECT_{t-1}^{-} coefficients statistically bear significant differences from each other (x^2 (1) = 67.5, p = 0.000). So, zero assumption is rejected and price transmission in the tea market from on-garden to retail is asymmetric. Any increase or decrease in the on-garden price is not exactly transmitted to the retail price and this asymmetric price transmission is perpendicular and positive. Asymmetry in perpendicular and positive price transmission is the result of quicker and more complete price transmission of tea producers compared to the decrease in price transfer of tea producers to the retail level, which is unwanted for consumers. Considering the greatness of the variable coefficient of the positive deviations (0.66) from the absolute value of the variable coefficient of the negative deviations (0.44), it can be concluded that incremental price adjustments from on-garden to consumers are transmitted more quickly than descending adjustments. The Wald test shows a zero assumption of symmetry is not accepted in the transmission speed (x^2 (1) = 31.65, p = 0.000). In other words, increases and decreases in tea producer prices are not transmitted by the same amount to retail prices in all periods.

On the whole, the price transmission model for the on-garden to wholesale level indicates symmetry in the Iranian tea market. Therefore, the possibility exists for market dealers to gain profit from the on-garden to wholesale markets. Price transmission from on-garden to the retail level is indicative of asymmetry. So the tea producing industry in Iran (market dealers) gain profit by transmitting increases in on-garden prices immediately and delaying transmitting decreases in on-garden prices to the retail price of tea.

Results of a price transmission model for wholesale to retail level are shown in table (5). First, $RP_t = \gamma_0 + \gamma_1 WP_t + \varepsilon_t$ was estimated. In this level, a structural break occurred during the years 1996–2004.

Table 5: Asymmetric Adjustment Equations from Wholesale to Retail for Tea; Annual Data, Iran 1977–2010

Name of Variable	Coefficient	T-Statistic
Constant	342.44	9.26*
ΔWP^{+} **(wholesale price increases)**	0.73	3.68*
ΔWP^{-} **(wholesale price decreases)**	4.94	9.03*
ΔRP_{t-1}^{+} **(1st lag of retail price increases)**	-0.54	-3.60*
ΔWP_{t-1}^{+} **(1st lag of wholesale price increases)**	2.90	7.34*
ΔRP_{t-1}^{-} **(1st lag of retail price decreases)**	1.18	4.06*
ΔWP_{t-1}^{-} **(1st lag of wholesale price decreases)**	15.39	3.76*
ΔRP_{t-2}^{+} **(2st lag of retail price increases)**	0.41	1.97**
ΔWP_{t-2}^{+} **(2st lag of wholesale price increases)**	-1.94	-5.33*
ΔRP_{t-3}^{+} **(3st lag of retail price increases)**	2.49	8.78*
ΔRP_{t-4}^{+} **(4st lag of retail price increases)**	0.97	4.07*
ΔWP_{t-5}^{+} **(5st lag of wholesale price increases)**	4.87	5.42*
D **(dummy variable)**	-111.5	-2.55*
ECT_{t-1}^{+} **(positive values of lag error term)**	-0.87	-7.07*
ECT_{t-1}^{-} **(negative values of lag error term)**	-0.24	-1.91**
R^2=0.76	**R^2 adjusted=0.57**	**D-W=1.7 JB=4**
The estimated equation with the OLS method in the first stage of the ECM $RP_t = 393.07 + 2.89 WP_t$		
Test of symmetry using the Wald method $x^2(1) = 14.79(0.000)$		
Test of symmetry in price transmission speed $x^2(1) = 80.53(0.000)$		

*Significant at %1 **Significant at %5

A Wald test with a zero assumption based on the equality of ECT_{t-1}^{+} and ECT_{t-1}^{-} coefficients showed significance and that they are statistically different (x^2 (1) = 14.79, p = 0.000). Consequently, a zero assumption is rejected and price transmission in the tea market from the wholesale to the retail level is asymmetric. Further, any increase or decrease in the wholesale price is not exactly transmitted to the retail price as the asymmetric price transmission is perpendicular and positive. Compared to the transmission of the decrease in the tea price from the wholesale to the retail level, asymmetry in price transmission is perpendicular and positive, and results in a quicker and more complete increase in the wholesale tea price, which is unwanted for consumers. Considering the greatness of the absolute value of the variable's positive deviation stop coefficient (0.87) compared to the absolute value of the variable's negative deviations stop coefficient (0.24), it can be concluded that incremental increasing price adjustments from wholesaler to consumer are transmitted more quickly than descending adjustments. The Wald test showed that a zero assumption of symmetry in transmission speed is not accepted (x^2 (1) = 80.53, p = 0.000). In other words, increases and decreases in the wholesale price of the tea are not equally transmitted to the retail price of this good in all periods. The effect of changing the wholesale price apart from the change (increase or decrease), takes specified time to be observed in the retail price. Therefore, the price transmission speed from the wholesale to retail level is asymmetric.

Elasticity of an increase or decrease in variables of the on-garden and the wholesale prices in terms of average prices at the present period (t) and the next period ($t + 1$) have been computed and are shown in table (6)

Table 6: Elasticity of Increase and Decrease Variables of on-Garden and Wholesale Prices

	On-Garden Price Increases		On-Garden Price Decreases		Wholesale Price Increases		Wholesale Price Decreases	
period	t	t + 1	t	t + 1	t	t + 1	t	t + 1
Elasticity	0.10	1.24	0.08	0.42	0.23	0.90	0.09	0.28

Source: Research Findings

Elasticity of a decrease or increase in the variable of the on-garden price shows that for each 1% increase in on-garden price the retail price of tea increased in the present period 0.10% and at the next period 1.24%. However, 1% decrease in on-garden price resulted in a decreased retail price of tea of 0.08% at present and 0.42% at next periods, respectively. For each 1% increase in the wholesale price, the retail price of tea at the present period and the next period was increased 0.23% and 0.90%. However, 1% decrease in the wholesale price showed the retail price of tea at the present period and the next period decreased 0.09% and 0.28%.

Therefore, the effect of an increase in the on-garden and wholesale prices on the retail price of tea is greater than the effect of a decrease in the on-garden and wholesale prices in the current and the next period. On the whole, the price transmission model on-garden to retail level and from the wholesale to the retail level indicate asymmetry in Iran's tea market.

As mentioned earlier, there are different reasons for asymmetric price transmission. One of the most important is the existence of market power in the industry. The existence of market power in Iran's tea industry was another consideration which studied in this research.

A concentration ratio (CR_n) for 1, 4, 8 and 20 tea processing plants that sell large amounts of tea in the market was computed. The tea industry in Iran has more than 50 tea processing plants. A Herfindahl-Hirschman indicator (*HHI*) was computed as the sum of the squares of market share variance of the 50 largest companies (plants) in the industry. In general, an increase in *HHI* shows a decrease in competition and an increase in market power. The total amount of dried tea sales of these plants during the period 2005–2009was used to compute the indicators of CR_n and HHI. Results of these computations are shown in table (7). Findings indicate that the concentration ratio averages of the 4, 8 and 20 tea processing plants that enjoyed the highest sales rates were respectively 45, 62 and 82 percent within the 2006–2010 periods. Among 140 tea processing plants present in the country's tea industry, 8 plants enjoy the greatest portion of total industry sales with a sales rate of 62%. The average of the Herfindahl-Hirschman indicator during this period was about 23% and the inverse was 4.29. Considering table (1) in which market structure was specified on the basis of concentration ratio amounts and the Herfindahl-Hirschman indicator, comparison with the findings in table (7) which $4 < (1/HHI) \leq 6$, it can be concluded that the structure of the Iranian tea industry is a multilateral monopoly (inclined to be closed). In a closed multilateral monopoly plants are able to fix prices as they choose through collusion and cooperation, and usually encounter tensionless demands. Lower and upper limits of the Herfindahl indicator during the 2006–2009 periods were 22.8% and 23.9%. Iran's local tea market was distributed among 20 tea processing plants and the greatest share was available for 8 of the 20 plants. Therefore, within the production sector of Iran's tea industry there is monopoly power with intense concentration and dependence on a few plants.

Table 7: Measure of Market Power Results of Tea Processing Plants During 2006-2010

Year	Number of tea processing plants	CRn				HHI	
		CR1	CR4	CR8	CR20	(HHI)	(1/HHI)
2006	140	%13	%44	%62	%85	0.232	4.30
2007	152	%13	%44	%62	%87	0.228	4.39
2008	139	%13	%45	%64	%83	0.232	4.30
2009	131	%13	%46	%63	%80	0.232	4.30
2010	139	%14	%46	%58	%77	0.239	4.17
Average	140	%13.2	%45.2	%62	%82.4	0.233	4.29

Source: Reserch Findings

It is concluded that the market power of a limited number of tea processing plants and the multilateral monopoly structure of the Iranian tea market are among the most important reasons for asymmetrical price transmission of tea from the on-garden and the wholesale to the retail market levels.

5- Conclusions

The structure of the Iranian tea market, in which shortages caused by receivable and payable prices are experienced by tea producers and consumers respectively, results in increases in the market margin for tea. The following suggestions are offered to improve Iran's tea market mechanism.

The asymmetric price transmission of the tea market is due to the presence of a non-competitive structure as well as market power of some tea processing plants. Considering the large number of producers in the tea industry and their dispersion, as well as their lesser bargaining power against market dealers and tea processing plants, it is proposed that influential institutions such as producer cooperatives marketing tea at the producer's level be established in an attempt to harmonize tea farmers and tea processing plants in each region. In addition to decreased marketing costs, this will give more power to tea farmers over tea plants and consequently lower the plant industries' market power and aid price transmission symmetry in the Iranian tea market.

Regarding the point that only a few tea processing plants produce high quality tea, which is sold at a higher price at the retail level, government can provide assistance such as a low interest loans to other plants to create incentives to enter the tea market and consequently prepare the ground for competition.

An important point in protecting local production is to improve the quality of dried-tea produced by supporting tea farmers and encouraging them to harvest high quality green leaves. This will lead to a decrease in production costs through its reflection on the producer's price. On the other hand, it can also provide for local tea consumption by ensuring appropriate conditions for consumers such as good packaging, publicizing information about how tea is produced in Iran, and offering positive reasons for consumption of local tea. This, in combination with taking increased advantage of tea gardens, will lead to competitiveness in local products and consequently a limitation of asymmetry in the price transmission mechanism. The empirical findings in this study suggest the potential for lower retail prices of tea with more competition in tea marketing.

To summarize, we can say that the empirical validity of the APT with the application of the method mentioned above (despite the robustness of the data and the method employed) provides us with a strong indication for the inefficiency in the Iranian tea market (asymmetry in the price transmission mechanism) allowing the policy makers to take measures aiming at the limitation of this problem.

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