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VERTICAL INTEGRATION OF TEA MARKETS IN VIETNAM

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ABSTRACT

Tea is one of the strategic agricultural export commodities in Vietnam. This crop is highly concentrated in the north and part of the Central Highlands in the southern region of the country. The major players in the tea industry include tea farmers, processors, exporters and retailers. Using time-series data on prices in the different levels/stages of the tea marketing channels, vertical integration of the tea markets was analyzed. For black tea channels, price pressure on the tea growers was a result of uncoordinated pattern among tea processors and inefficient coordination mechanism among tea growers. For green tea channels, the retailers played an important role in price formation and in channeling price information, while the tea processors did not play a central role in price transmission in the tea markets. Furthermore, the export price of tea to Russia was highly integrated with the world tea commodity price index (TCPI), while those to Taiwan and Poland were not, implying that the export prices in the latter markets were not fully integrated with the world price. In order to enhance the integration of the tea markets, it is recommended to establish a tea auction center, improve the tea trade in the domestic markets, and enhance the market power of the tea growers and processors.

Key words: price transmission, marketing channel, black tea, green tea

INTRODUCTION

Historically, Vietnam's involvement in tea cultivation dates back a thousand year. The French first began to produce tea commercially in the late 19th century, after occupying Indochina. By 2003, Vietnam had about 400,000 tea-growing households that were mainly concentrated in large tea producing regions such as the Northeast (65%), Northwest (18%), North Central (9%) and the Central Highlands (8%). Tea is considered as one of the strategic agricultural export commodities by the Government of Vietnam. In 1999, the Prime Minister issued Decision No.43/1999/QD-TTg approving tea development orientations towards 2005-2010. In 2001, the Ministry of Agriculture and Rural Development (MARD) implemented a project on tea and fruits development funded by ADB. In 2008, the Prime Minister issued Decision No. 107/2008/QD-TTg on policies supporting production, processing and marketing of vegetables, fruits, and tea towards 2015. The tea sector in Vietnam is highly export-oriented. By 2008, Vietnamese tea was marketed in about 107 countries and territories. Although affected by the world financial crisis, in 2008, the volume of Vietnamese tea exports (excluding small shipments) was 95,375 MT, accounting for 57.8% of the total production. The export value was estimated at about $133.1 M USD in the same period (VITAS, 2009).

In the world tea market, the world tea price contrasted with the average price of Vietnam's export tea. The world tea price has fluctuated sharply, depending mainly on climatic conditions in large producing countries (Oxfam, 2002). However, because of low quality and unsteady markets, when the world price falls, the Vietnamese export price falls more sharply. In contrast, when world price rises, Vietnam's tea price typically demonstrates a minimal increase.

The degree to which market shocks are transmitted up and down the marketing chain has long been considered to be an important indicator of the market performance (Goodwin, 1996). Vertical price linkages are often considered to be relevant to structure, conduct, and performance issues. In particular, the extent to which shocks at one level of the market are realized at another market levels is often taken to be an important indicator of the exercise of market power. In specific markets, this issue has been of particular interest in light of the considerable consolidation and concentration of the industry by processors and wholesalers. Barret (1996) provided a more general interpretation of vertical, spatial and intertemporal market integration. Vertical market integration involves stages in marketing and processing channels, spatial integration relates to spatially distinct markets, and intertemporal integration refers to arbitrage across periods. If two markets are integrated, a shock to the price in one market should be manifested in the other market's price as well. Among perfectly segmented markets, price series should be independent. Co-movement of prices has thus become synonymous with market integration. Furthermore, the theory of derived demand indicates that there should exist a relationship between prices at different stages of a marketing channel, although the prices are not expected to be proportional giving full price transmission (Asche et al. 2007). On the other hand, in vertically integrated markets, imperfect substitutes as well as constant relative prices are observed.

In examining vertical price relationships, literature focused on determining the linkages among farm, wholesale, and retail prices. Three aspects of vertical price transmission have been of particular importance in the applied literature: *(i)* the extent of adjustment (i.e., how big of a response is triggered by a shock of a given size); *(ii)* the timing of the adjustment (i.e., are there significant lags in adjustment), and *(iii)* the extent to which adjustments are asymmetric (i.e., do positive shocks trigger different adjustments from the negative shocks). Much of the motivation underlying this line of research has involved concerns about market power and the potential effects that increased market concentration may have on price adjustment processes. It is noted that a range of empirical results regarding price transmission among different levels of the market can be consistent with a variety of competitive structures, from perfect competition to monopoly (Goodwin, 1996).

Rapsomanikis et al. (2003) stated that given prices for a commodity in two spatially separated markets P_{1t} and P_{2t}, the Law of One Price and the Enke-Samuelson-Takayama-Judge model postulate that at all points of time, allowing for transfer costs c, for transporting the commodity from market *1* to market *2*, the relationship between the prices is as follows:

$$P_{1t} = P_{2t} + c \qquad (1)$$

In a vertical structure, the coefficient c is considered as the price margin between the market levels. If a relationship between two prices, such as equation (1) holds, the markets can be said to be integrated. However, this extreme case may be unlikely to occur, especially in the short-run. At the other end of the spectrum, if the joint distribution of two prices were found to be completely independent, then one might feel comfortable in saying that there is no market integration and no price transmission.

Depending on market characteristics, or the distortions to which markets are subjected, the two price series may behave in a plethora of ways, having quite complex relationships with prices adjusting less than completely, or slowly rather than instantaneously and according to various dynamic structures or being related in a non linear manner. According to Rapsomanikis et al. (2003), given the wide range of ways prices may be related, the concept of market integration and price transmission can be thought of as being based on three notions, or components, namely: (1) complete market integration; (2) market price adjustment; and (3) market price asymmetry. In addition to the case of complete price transmission, if price changes are not passed through instantaneously, but after some time, price transmission is incomplete in the short-run, but complete in the long-run. The

distinction between short-run and long-run price transmission is important and the speed by which prices adjust to their long-run relationship is essential in understanding the extent to which markets are integrated in the short-run. Cointegration can be considered as the empirical counterpart of the theoretical notion of a long-run equilibrium relationship. If two separated price series are cointegrated, there is a tendency for them to co-move in the long-run according to a linear relationship. In the short-run, the prices may drift apart, as shocks in one market or level may not be instantaneously transmitted to the others; these divergences from the underlying long-run (equilibrium) relationship are transitory and not permanent.

The main objective of this paper is to analyze the degree of market integration at different levels of the marketing channels of tea products of the country. The paper is divided into four sections. The first section presents a brief review of related literature. The second one highlights the methodology used including data collection and analytical procedure. The third section discusses the empirical findings and the last one focuses on conclusions and recommendations.

METHODOLOGY

Study areas and data collection

Since tea production is endowed in the North and a part of the Central Highlands in the Southern region of the country, the time-series data on prices from various sources covered six selected provinces of the country, namely; Phu Tho, Thai Nguyen, Tuyen Quang, Yen Bai, Son La, and Nghe An. These provinces occupied almost a half of the total country's tea production area (47.76%) and output (53.70%) in 2008 (Dang, 2009). The study focused only on two types of tea, namely; black and green tea. The black tea is produced for exports only, while the green tea is traded both in the domestic and export markets. However, these two types of tea products are not produced simultaneously by all processors in each designated market boundary, depending on sources of fresh tea leaves and buds. In general, green tea is only produced in regions where it is endowed with more favorable conditions to yield higher quality of tea products. Therefore, in the six selected markets covered in the study, black tea is not produced by processors in Son La province, while green tea is not available in Phu Tho and Yen Bai provinces. Hence, in the next section, vertical integration analysis is done separately for each type of the tea product.

There are only five marketing channels for black tea product and four channels for the green tea in the local markets. Integration pattern between the local and world markets was analyzed based on the local tea export prices of three typically selected importers, namely; Russia, Taiwan, and Poland and the world tea market price, which is referred as a World Composite Price Index for Tea Commodity (TCPI). Russia was the top black tea importer, the third most important export market of Vietnam in terms of both quantity and value during 2001-2008. Taiwan was the second most important export market of Vietnam in the same period, while Poland was a medium-sized traditional export market (Dang, 2009).

Monthly farm-gate and processor's tea prices were collected from tea processors in the respective provinces covering the period from January 1994 to December 2008. Monthly retail prices were collected from the General Statistical Office of Vietnam (GSO) available in a shorter period from January 2000 to December 2008. Monthly export prices were collected from the Center of Informatics and Statistics (CIS) under Vietnam Ministry of Agriculture and Rural Development (MARD). The TCPI, which was provided by the World Bank - Commodity Price Data, was computed based on quantity of tea commodity and prices traded in three major tea auction centers of the world, namely; Colombo, Kolkata, and Mombasa Auction Centers.

Analytical tools

Multi-variate Autoregressive Distributed Lags (ADL) test for market integration. Johansen (1988) and Johansen and Juselius (1990) develop a test for multivariate cointegration with a representation in the form of Vector of Error Correction Model (VECM), which is used to examine the speed of adjustment of variables to its long-run equilibrium with others in the system. Suppose that a set of g variables ($g \geq 2$) are under consideration that are $I(1)$ and which are thought to be cointegrated. A VAR with k lags containing these variables was set up as follows:

$$\underset{(gx1)}{P_t} = \underset{(gxg)(gx1)}{\beta_1 P_{t-1}} + \underset{(gxg)(gx1)}{\beta_2 P_{t-2}} + \ldots + \underset{(gxg)(gx1)}{\beta_k P_{t-k}} + \underset{(gx1)}{u_t} \quad (2)$$

In order to use the Johansen test, the VAR in equation (2) was written in the form of vector error correction model as follows:

$$\Delta P_t = \Pi P_{t-k} + \Gamma_1 \Delta P_{t-1} + \Gamma_2 \Delta P_{t-2} + \cdots + \Gamma_{k-1} \Delta P_{t-(k-1)} + u_t \quad (3)$$

where, $\Pi = (\sum_{i=1}^{k} \beta_i) - I_g$ and $\Gamma_i = (\sum_{j=1}^{i} \beta_j) - I_g$.

This VAR contains g variables in the first differenced form on the LHS and $k-1$ lags of the dependent differenced variables on the RHS, each with a Γ coefficient matrix attached to it. The test of cointegration between the P_t is calculated by looking at the rank of the Π matrix via its Eigenvalues. Let the rank of Π is r, if $1 < r < g$, it implies that there are r cointegrating vectors. Then, the number of markets that integrates in the long-run is $(r+1)$. The Eigenvalues, denoted λ_i are put in ascending order as follows:

$$\lambda_i \geq \lambda_2 \geq \ldots \geq \lambda_g$$

The matrix Π is defined as the product of two matrices, α and β', of dimension (g x r) and (r x g), respectively, i.e. $\Pi = \alpha\beta'$ (4)

The matrix β is interpreted as the matrix of cointegrating vectors, representing the long-run relationships. The matrix α is the matrix of adjustment parameters, representing the speed of adjustment towards long-run equilibrium. There are two test statistics for cointegration, which are formulated as:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{g} \ln(1 - \hat{\lambda}_i), \text{ and} \quad (5)$$

$$\lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_i) \quad (6)$$

λ_{trace} is a joint test where the null hypothesis is that the number of cointegrating vectors is less than or equal to r against an unspecified or general alternative that there are more than r. It starts with p Eigenvalues, and then successively the largest is removed.

$\lambda_{trace} = 0$ when all $\lambda_i = 0$, for $i = 1, \ldots, g$.

λ_{max} conducts separate tests on each Eigenvalue, and has as its null hypothesis that the number of cointegrating vectors is r against an alternative of $r+1$. The determination of the rank of Π is to conduct the testing in a sequence and under the null hypothesis, $r = 0, 1, \ldots, g-1$ so that the hypotheses for λ_{max} are:

H_0: r = 0 versus H_1: 0 < r ≤ g

H_0: r = 1	versus	H_1: 1 < r ≤ g
H_0: r = 2	versus	H_1: 2 < r ≤ g
…		
H_0: r = g - 1	versus	H_1: r = g

If the test statistic is greater than the critical value from Johansen's table, the null hypothesis, that there are *r* cointegrating vectors, is rejected implying that there are *r+1* (for λ_{trace}) or more than *r* (for λ_{max}) cointegrating vectors.

Law of One Price (LOP) test using Johansen framework. Johansen procedure allows a wide range of hypothesis testing on the coefficients α and β, using likelihood ratio tests (Johansen and Juselius, 1990). LOP test was based on restrictions on the parameters in the cointegration vectors β. In the context of multivariate cointegration, in which *r* cointegration vectors are identified, the price series are cointegrated in pairs. Thus, in a set of *n* markets, there must be *n-1* cointegrating vectors. As the cointegration vectors are identified only up to a nonsingular transformation, any set of restrictions that makes the columns of β sum to zero was done. A natural procedure is to normalize upon one price. This makes all cointegration vectors (1, -1) with respect to this price. Therefore, the null hypothesis was formulated as:

H_0: $\beta = \begin{bmatrix} 1 & 1 & \dots & 1 \\ -1 & 0 & \dots & 0 \\ 0 & -1 & \dots & 0 \\ \dots & \dots & \dots & \dots \\ 0 & 0 & \dots & -1 \end{bmatrix}$, LOP holds in pairs of the markets in the system

H_1: LOP does not hold in pairs of the markets in the system.

The likelihood ratio test, which is χ^2 distributed, could be used with $\sum_{i=1}^{r}(n_i - (r-1))$ degree of freedom. A failure to reject the null hypothesis means that the unrestricted model is significant, and the imposition of LOP is insignificant.

Bi-variate Autoregressive Distributed Lags (ADL) test for Granger causality. The ADL test was formulated to test for a causal relationship between the two price series based on the following equation:

$$P_{i,t} = w(t) + \sum_{l=1}^{L} \alpha_l P_{it-l} + \sum_{k=1}^{K} \beta_k P_{jt-k} + e_t \qquad (7)$$

The null and alternate hypotheses for Granger causality test can be formulated as follows:

H_0:	$\beta_1 = \beta_2 = \dots = \beta_k = 0$,	P_j does not Granger cause P_i
H_a:	$\beta_1, \beta_2, \dots, \beta_k \neq 0$,	P_j does Granger cause P_i

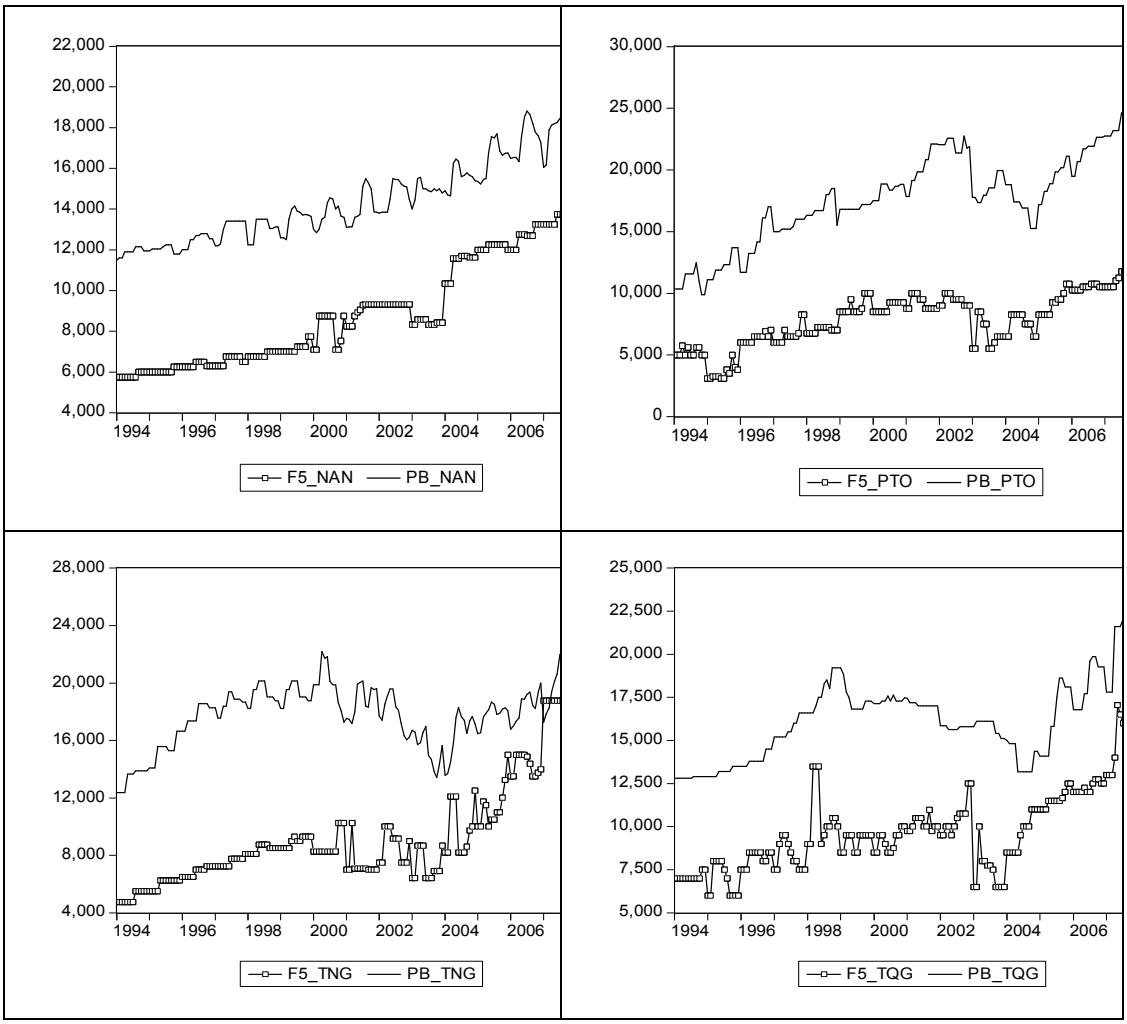
The null hypothesis can be rejected or not by using the F-test. If the absolute value of the computed F-statistic is smaller than the critical value, which is obtained from the F-table, the null hypothesis would not be rejected.

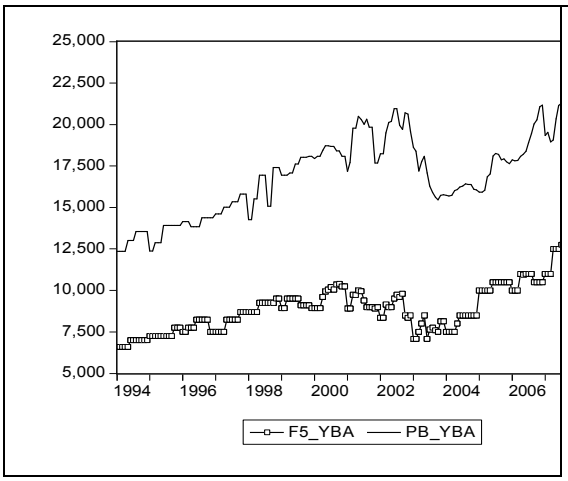
In a vertical structure, the ADL was conducted for four types of price relationships in each market location, namely; *(i)* farm-gate and processor levels; *(ii)* processor and retail levels; *(iii)* farm-gate and retail levels; and *(iv)* the local export price and the world tea price.

RESULTS AND DISCUSSION

Vertical integration in marketing channels for black tea of Vietnam

In this section, vertical structure of market integration for black tea was examined between two marketing levels, namely; farm-gate and processor levels, since retail price for black tea in the local market was not available. Using monthly price series as illustrated in Fig. 1, vertical cointegration and Granger-causality analyses were conducted accordingly.





Notes: F5: Tea price at farm-gate level, PB: Black tea price at processor level,
NAN: Nghe An, PTO: Phu Tho, TNG: Thai Nguyen, TQG: Tuyen Quang, YBA: Yen Bai

Fig. 1. Market prices along marketing channels for black tea, Vietnam, 1994-2008 (in VND/kg)

Vertical integration of black tea price series. Johansen cointegration test results showed that among five market locations that produce and supply black tea, there were four market locations yielding with one cointegration vector; one market location, Thai Nguyen, yielding no cointegration vector. There was no market location yielding with two cointegrating vectors (Table 1). The test results indicated that farm-gate and processor prices for black tea were highly cointegrated, implying that the price margin was stable over time (Fig. 1). In other words, it is said that the margin received by the processor was almost fixed in any market situations with an assumption that the operational costs incurred by the processors were constant. That is the reason why when market prices go up, both tea growers and processors get a higher price, while when the market prices go down, both farm-gate and processor prices decrease. However, the processor's margin is almost unchanged, since the farm-gate price, which is the price of its key input, has decreased. For the tea growers, when the farm-gate price decreases, tea production cost cannot be decreased, therefore, loss is shouldered by the tea growers. Over the last 15 years, after a price recession, hundreds of hectares of tea were cut down and replaced by other cash crops in the North of Vietnam.

For the case of Thai Nguyen, the farm-gate and processor prices were not cointegrated, since black tea is not a major product of the province. Most of high quality fresh tea leaves and buds in the province are used for green tea production, while the rest with lower quality is used for black tea production. It indicates that high quality fresh leaves and buds produce high quality green tea rather than high quality black tea.

Pattern of interdependence. The pattern of interdependence between farm-gate and processor prices was examined using Granger-causality test. Selection of lag length for the price pairs was done using a VAR framework in such a similar manner with Johansen cointegration test.

The test results show that in all of the five markets, farm-gate prices Granger-caused processor prices, while bi-directional causal relations are found only in three markets, indicating that farm-gate price was the core component for processor's price formation (Table 2). Moreover, according to Dang (2009), in spatial context, most of the farm-gate price series were cointegrated, therefore, the contribution of farm-gate price to processors' price formation was strengthened. Nevertheless, the cointegration pattern among the farm-gate prices was just to maintain minimum

Table 1. Results of bi-variate cointegration test between farm-gate and processor prices for black tea at different market locations, Vietnam, 1994-2008

Ho: Rank=p	Eigenvalue	Trace Test	Max Test
1. Nghe An (lag 2)			
P=0	0.1872	37.1939***	36.7054***
P≤1	0.0027	0.4885	0.4885
2. Phu Tho (lag 1)			
P=0	0.0899	17.0803**	16.7806**
P≤1	0.0017	0.2997	0.2997
3. Thai Nguyen (lag 3)			
P=0	0.0571	10.7402	10.3495
P≤1	0.0022	0.3907	0.3907
4. Tuyen Quang (lag 3)			
P=0	0.1125	21.2368***	21.0027***
P≤1	0.0013	0.2340	0.2340
5. Yen Bai (lag 5)			
P=0	0.0707	13.8409*	12.7720*
P≤1	0.0061	1.0689	1.0689

Notes: The critical values for the Trace test at 5% are 15.4947 (rank=0) and 3.8414 (rank≤1).
The critical values for the Max test at 5% are 14.2646 (rank=0) and 3.8414 (rank≤1).
***, **, *: Significant at 1%, 5%, and 10% levels, respectively.

living standards for the tea growers, not for enhancing their market power. On the other hand, the bi-directional relations between the two stages reveal that the impact of processor's price on the farm-gate price was inevitable. The threat of depressing effect of the processor price on the farm-gate price could be seen clearly when the black tea prices at the processor level were not cointegrated (Dang, 2009), therefore, the black tea processors did not coordinate but competed with one another to get sale contracts by offering lower prices. Thus, in order to maintain its fixed margin as discussed, pressure on farm-gate prices was a consequence.

Table 2. Granger causality relations between farm-gate and processor levels for black tea prices, Vietnam, 1994-2008.

Market Place	Null Hypothesis		Direction
	F↛P	P↛F	
• Nghe An (lag 2)	17.255***	0.248	Unidirectional: F → P
• Phu Tho (lag 1)	6.560**	5.700**	Bidirectional: F ↔ P
• Thai Nguyen (lag 3)	4.072***	2.541*	Bidirectional: F ↔ P
• Tuyen Quang (lag 3)	6.106***	2.241*	Bidirectional: F ↔ P
• Yen Bai (lag 5)	3.616***	1.783	Unidirectional: F → P

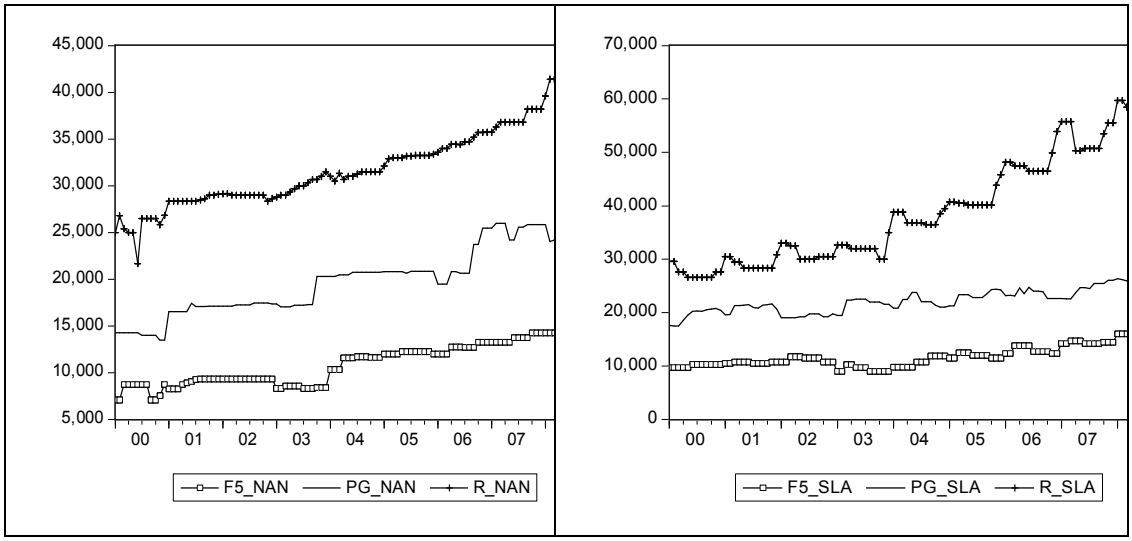
Notes: Figures presented in the table are F-statistic;
F: Farm-gate price; P: Processor price;
***, **, *: Significant at 1%, 5%, and 10% levels, respectively.

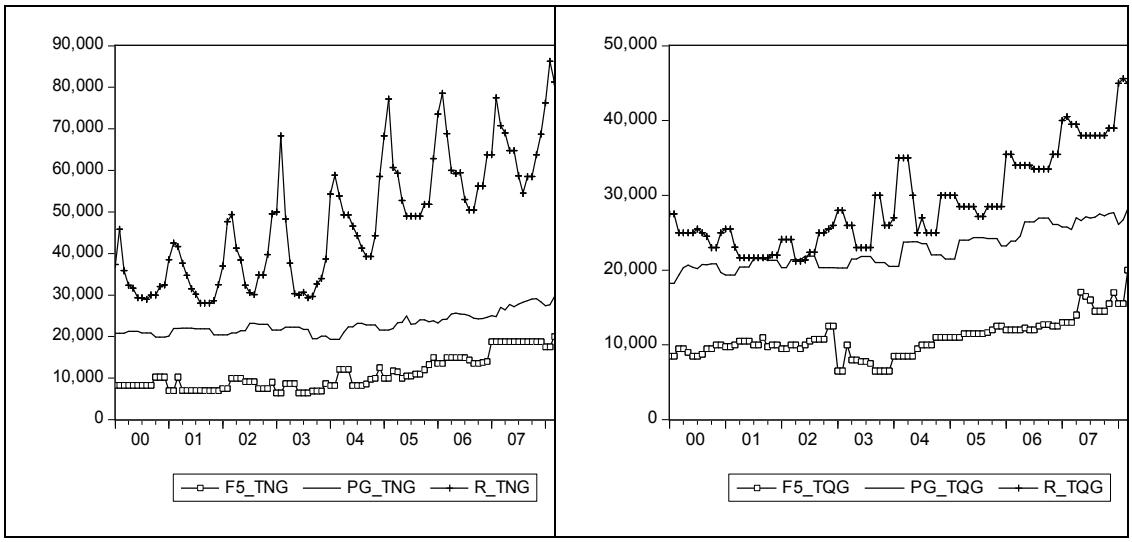
In an unorganized domestic tea market, the foreign tea buyers take advantage of this problem and continue to lower the local tea prices. As a result, prices have become a unique criterion for tea to be sold and the tea quality is no longer of interest to either the sellers or the buyers. Finally, Vietnam is only considered as a low-value and low price tea supplier. Since tea quality is not the major interest of the buyers, overuse of chemical and inorganic fertilizers by the growers was found in some tea plantations of the country. At the processor level, quality management and hygienic practices are not given due attention. In 2007, Vietnam Tea Association (VITAS) had 150 members, of which, only 15 processors were certified with ISO 9001-2000 and HACCP while the rest of the processors were operating without a certification (Gia, 2007). However, VITAS, alongside scientists and policy makers, have raised issues regarding the hygienic practices and safety regulations in tea production and processing in Vietnam. Unfortunately, no concrete and effective measures have been done about this situation.

In sum, under cointegrated pattern between farm-gate and processor levels for black tea prices and bi-directional relations between the two levels in respective marketing channels, price pressure on the tea growers was a consequence of uncoordinated pattern among the tea processors and inefficient coordination mechanism among the tea growers.

Vertical integration along marketing channels for green tea of Vietnam

In this section, vertical structure of market integration for green tea is examined along each marketing channel from farm-gate, processor to retail levels. The market for green tea is different from that of the black tea in terms of the number of market levels. In the local market, green tea is widely traded and consumed by the local consumers at the retail level, hence, the retail price series for green tea in the local market is available, but in a shorter period (Fig. 2). Therefore, the longer series of tea prices at farm-gate and processor levels were cut down to match with the retail price series. Then, vertical cointegration and Granger-causality analyses were adopted for the vertical structure.





Note: F5: Tea price at farm-gate level, PG: Green tea price at processor level,
NAN: Nghe An, SLA: Son La, TNG: Thai Nguyen, TQG: Tuyen Quang

Fig. 2. Market prices along marketing channels for green tea, Vietnam, 1994-2008. (in VND/kg)

Vertical integration of green tea price series. Johansen cointegration test results showed that among the four market locations that produce and supply green tea, there were six pairs of price series out of 12 price pairs yielding with one cointegration vector (Table 3). There was no price pair yielding with two cointegrating vectors.

Table 3. Bi-variate cointegration test along marketing channels for green tea, Vietnam, 2000-2008.

Ho: Rank=p		Eigenvalue	Trace Test	Max Test
1. Nghe An:	Null: P=0			
F – P (lag 1)		0.1032	12.0179	11.5501
P – R (lag 1)		0.0628	7.8343	6.8725
F – R (lag 6)		0.0564	8.4268	5.8641
2. Son La:	Null: P=0			
F – P (lag 1)		0.0874	9.8021	9.6999
P – R (lag 2)		0.1729	19.9448**	19.9299***
F – R (lag 1)		0.1334	15.1947*	15.1751**
3. Thai Nguyen:	Null: P=0			
F – P (lag 3)		0.2058	24.0398***	23.9630***
P – R (lag 3)		0.2506	30.1588***	30.0052***
F – R (lag 3)		0.1832	21.4854***	21.0410***
4. Tuyen Quang:	Null: P=0			
F – P (lag 3)		0.1084	12.1710	11.9328
P – R (lag 4)		0.1628	18.9558**	18.3093**
F – R (lag 3)		0.0822	8.9329	8.9258

Notes: The critical values for the Trace test at 5% are 15.4947 (rank=0) and 3.8414 (rank≤1).
The critical values for the Max test at 5% are 14.2646 (rank=0) and 3.8414 (rank≤1).
***, **, *: Significant at 1%, 5%, and 10%, respectively.
F: Farm-gate price; P: Processor price; R: Retail price

In Thai Nguyen market, which is the most important green tea producer of the country, the market prices at all levels were highly integrated with one another. The interpretation is similar with that for the black tea market. It implies that the price margin is stable over time at the processor and retail levels (Fig. 2). In other words, the margin received by the processor is almost fixed in any market situations with an assumption that the operational and marketing costs incurred by the processors and retailers are constant. However, unlike the case of the black tea market, in which tea growers may subject to price pressure under unfavorable market situations, both green tea processors and retailers are competing for the products produced by the tea growers, therefore, the tea growers have more opportunity to command higher prices.

Similarly, two cointegration vectors were found in Son La, which is the second most important green tea producer under the study, between the retail – processor prices and retail – farm-gate prices. The findings imply an important role of the retailers in shaping the market price for green tea. In Tuyen Quang, the less important tea producer, only one cointegrating vector was found between the retail and processor prices, while in Nghe An, no cointegrating vector was found in its marketing channel. Thus, cointegration analysis along marketing channels in selected markets included in the study showed that retailers played an important role in market price formation and in channeling market price information. For spatial integration of tea markets at the retail level, retail market prices were found to be highly cointegrated, especially among the four market places for green tea production (Dang, 2009). Therefore, it is concluded that tea retailers were important marketing operators in the local markets.

Analysis also showed that tea processors in the country did not play a central role in shaping the tea markets, even though, the State has invested much money in running the State-owned enterprises (SOE) involved in tea processing in the tea industry. Only one cointegrating vector was found in Thai Nguyen between farm-gate and processor prices. Spatially, at the processor level, only 50% of the market pairs were cointegrated, however, no cointegrating relation was found between Thai Nguyen and Son La, the two important green tea producers. Furthermore, only one cointegrated price pair was found in black tea markets at the processor level (Dang, 2009).

Pattern of interdependence. Granger-causality test was also used to examine the pattern of interdependence between different levels of a marketing channel. The test results showed that in all of the four markets, farm-gate prices Granger-caused processor prices; only in Nghe An, bi-directional causal relation between farm-gate and processor prices was found, indicating that farm-gate price was the core component of processor's price formation (Table 4). This finding is similar to what was found in the last section for black tea marketing channels. Thus, farm-gate tea price was an important factor contributing to the price formation at the processor level in both black and green tea markets.

The test results also showed that unidirectional Granger-causality relations from the retailers to the farmers were found in all marketing channels. Only one bi-directional Granger-causality relation between the retailers and the farmers was found in Thai Nguyen market, in which its market prices at all levels were highly cointegrated as found earlier. This once again confirms an important role of the tea retailers in the local tea markets.

In combination with the previous findings, two important Granger-causality relations were found: *(1)* the tea retail price Granger-caused farm-gate price; and *(2)* the tea farm-gate price Granger-caused the processor price. Thus, using a mathematical property of transitivity, the tea retail price Granger-caused both farm-gate and processor prices. In other words, the tea retail market played a central role in influencing the local tea markets. Furthermore, considering the combination of the black and green tea markets, it indicates that the tea retail price in the local market Granger-caused the processor price for both black and green tea since the retail price Granger-caused the farm-gate price that once again Granger-caused processor price in both black and green tea products. Thus, one

important source of any fluctuations in tea export prices was from the domestic tea retail market itself. This finding is further confirmed in Table 4, in which retail and processor prices were bi-directionally Granger-caused; or unidirectionally Granger-caused from the retailers to the processors as in the case of Nghe An market.

Table 4. Granger causality relations along marketing channels for green tea, Vietnam, 2000-2008.

Market Place		**Null Hypothesis**		**Direction**
	(1) (2)	(1) ⇥ (2)	(2) ⇥ (1)	
Nghe An	F – P	3.063*	8.590***	Bidirectional: F ↔ P
	P – R	2.185	5.165**	Unidirectional: R → P
	F – R	0.383	6.641***	Unidirectional: R → F
Son La	F – P	3.361*	1.172	Unidirectional: F → P
	P – R	4.325**	11.758**	Bidirectional: P ↔ R
	F – R	1.067	17.014***	Unidirectional: R → F
Thai Nguyen	F – P	9.951***	1.692	Unidirectional: F → P
	P – R	5.438***	10.478***	Bidirectional: P ↔ R
	F – R	9.072***	4.795***	Bidirectional: R ↔ F
Tuyen Quang	F – P	3.742**	0.546	Unidirectional: F → P
	P – R	3.243**	7.154***	Bidirectional: P ↔ R
	F – R	1.843	2.700**	Unidirectional: R → F

Notes: Figures presented in the table are F-statistic
F: Farm-gate price; P: Processor price; R: Retail price
***, **, *: Significant at 1%, 5%, and 10% levels, respectively.

Dynamic market integration between Vietnam and the world

In this section, vertical structure of market integration is examined between the monthly world market price (TCPI) (1980:01-2009:05) and monthly Vietnam export prices, namely; the export prices to Poland (VN_Poland) (1999:01-2009:02), Russia (VN_Russia) (1999:01-2008:12), and Taiwan (VN_Taiwan) (1996:01-2008:12).

Vertical integration of Vietnam tea export prices and the world. Johansen cointegration test results showed that among the three market locations that imported tea from Vietnam, there was only one market pair, the TCPI and VN_Russia, yielding with one cointegration vector (Table 5). There was no market pair yielding with two cointegrating vectors. It indicates that Vietnam export price to Russia was highly integrated with the TCPI, implying price changes in the world and Vietnam export price to Russia are closely related. However, when imposing a restriction of LOP between TCPI and VN_Russia in the corresponding Vector of Error Correction (VEC), the restriction was rejected with the Chi-square statistic of 10.426 at 5% significant level. However, Vietnam export price to Taiwan was not cointegrated with the TCPI. Similarly, the tea export price to Poland was not cointegrated with the TCPI either. Thus, Vietnam tea export prices were not fully integrated with the world market price.

The disintegration of the Vietnamese tea export prices with that of the world is caused by a fact that, at present, there is no organization or association of tea sellers or buyers and no tea auction center in Vietnam unlike in other key tea producers and exporters in the world. Each tea sale or periodic sale contract is based on personal negotiation between the seller and the buyer. This kind of deal results in small transactions, discreet deals between a single buyer and a single seller, and lack of

market information. Although the deal is simple and easy, the cost of such transactions is high whereas the tea quality is also not guaranteed. In such a trading manner, the seller always has disadvantages since he/she is not a marketing professional as compared with the buyer. Most of the time, sellers are not aware of the market trend and the prevailing prices of tea products offered by other suppliers within or outside the study area. On the other hand, tea buyers, especially those who come from the Middle East and have good negotiation skills to lower tea prices, are at an advantage.

Table 5. Bi-variate cointegration test between Vietnam export prices and TCPI

Ho: Rank=p	Eigenvalue	Trace Test	Max Test
1. TCPI - VN_Poland (lag 3)			
P=0	0.0805	10.2648	9.9084
P≤1	0.0030	0.3564	0.3564
2. TCPI - VN_Russia (lag 1)			
P=0	0.2026	29.6525***	26.7254***
P≤1	0.0245	2.9271	2.9271
3. TCPI - VN_Taiwan (lag 3)			
P=0	0.0647	12.6990	10.1782
P≤1	0.0162	2.4908	2.4908

Notes: The critical values for the Trace test at 5% are 15.4947 (rank=0) and 3.8414 (rank≤1). The critical values for the Max test at 5% are 14.2646 (rank=0) and 3.8414 (rank≤1).
***, **, *: Significant at 1%, 5%, and 10% levels, respectively.

Pattern of interdependence. Granger-causality test was also used to examine the pattern of interdependence between Vietnam export prices and the TCPI. The test results showed that the TCPI unidirectionally Granger-caused the Vietnam export prices to Poland and Russia (Table 6). Furthermore, the short-run dynamics indicate that the changes in the TCPI were transmitted to the Vietnam export prices to Russia and Poland simultaneously since the coefficients of their first lagged term were significant at 5% level (Dang, 2009). It indicates that the world tea prices strongly affect Vietnam tea export prices. Domestic market in Vietnam can be strongly affected by the world market while the local market does not have any impact on the world market. This finding is plausible since Vietnam's export share was truly modest at about 6% of the total world tea export, even though Vietnam was the fifth largest tea exporter in the world during 2005-2006 (Dang, 2009).

Table 6. Granger causality relations between Vietnam export prices and the TCPI

Market Place (1)	Null Hypothesis		Direction
	TCPI↛(1)	(1)↛TCPI	
• VN_Poland (lag 3)	**5.462*** **	2.085	Unidirectional: TCPI→VN_Poland
• VN_Russia (lag 1)	**6.187** **	0.973	Unidirectional: TCPI→VN_Russia
• VN_Taiwan (lag 3)	0.331	1.267	None

Notes: Figures presented in the table are F-statistic
***, **: Significant at 1% and 5% levels, respectively.

Surprisingly, Vietnam export price to Taiwan had no Granger-causality and no cointegration relation with the TCPI. Furthermore, the short-run dynamics revealed that the changes in the TCPI were not transmitted to the Vietnam export price to Taiwan simultaneously since the coefficients of its lagged terms were not significant at 5% level. However, the changes of the lagged one to lagged three

of the export price to Taiwan were transmitted to the export price in Taiwan. It indicates that Vietnam tea export price to Taiwan is totally independent from the world price, implying disadvantages for Vietnam tea exports.

CONCLUSIONS AND RECOMMENDATIONS

For black tea marketing channels, farm-gate and processor prices were highly cointegrated, implying that the price margin received by the processor is almost fixed in any market situations, with an assumption that the operational costs incurred by the processors are constant.

In examining the pattern of interdependence, the Granger causality test results showed that in all five markets, farm-gate price Granger-caused processor price, implying that the farm-gate price is the core component of the processor's price. Nevertheless, the cointegration among the farm-gate prices is just for maintaining the tea growers' minimum living standards and not for enhancing their market power. Therefore, under cointegrated pattern between the farm-gate and processor black tea prices, and bi-directional relations, which were found in the three markets with the two levels of the respective marketing channels, the price pressure on the tea growers was a result of uncoordinated pattern among the tea processors and inefficient coordination mechanism among the tea growers. Forming a strong tea growers' marketing association can increase the bargaining power of grower-members in negotiating for a better farmgate price for their produce with processors.

For green tea marketing channels, cointegration analysis indicated that retailers played an important role in market price formation and in disseminating market price information. Since the retail market prices were highly cointegrated spatially in four market places for green tea production, it is concluded that tea retailers are important marketing operators in the local markets. However, tea trade in the domestic market still needs improvement to increase the role of retailers in tea price transmission. Involving key tea producing provinces in the country such as Thai Nguyen in the North and Lam Dong in the South could lead to market and price information integration and enhance local tea demand.

Tea processors in the country did not play a central role in shaping the tea markets, even though the state invested heavily in running the state-owned enterprise (SOE) for processors in the tea industry. Quality management and hygienic practices are not given much attention at the processor level, implying the need to enhance the market power of the tea processors through privatization of the tea SOE processors to make them more adaptive to the market economy and renovation of the organization and management of VITAS to improve the image of Vietnam as tea producing country, the export capability of the tea processors and exporters, and the competiveness of Vietnamese tea products.

Granger-causality analysis showed that the tea retail price Granger-caused the processor price for both black and green tea, since the retail price Granger-caused the farm-gate price. Thus, one important source of fluctuation in tea export prices was from the domestic tea retail market.

The Vietnam export price to Russia, the third most important export market in terms of . export quantity and value, was highly integrated with the World Tea Commodity Price Index (TCPI). This implies that price changes in the world and in the Russian export market are closely related. However, Vietnam export price to Taiwan was not cointegrated with the TCPI. Similarly, the tea export price to Poland was also not cointegrated with the TCPI. The lack of tea auction center aside from highly disorganized tea sellers and buyers in the country could have contributed to the disintegration of the Vietnamese tea exports prices with that of the world. This requires an establishment of a tea auction center in the country after the key stakeholders in the tea industry are

organized to make the tea prices more competitive in the domestic market and fully integrated with the world price.

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