

EFFICIENCY OF BENGUET VEGETABLE PRICE LINKAGES

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ABSTRACT

This paper examines the efficiency of vegetable price linkages across markets. Two approaches are used to test for market integration: (1) the Ravallion model, and (2) the cointegration analysis. Two sets of prices are used: the wholesale prices collected in La Trinidad, Baguio Hangar, Urdaneta, Pangasinan, Balintawak and Divisoria markets for the three vegetables for the month of November 2003 sourced from the Department of Agriculture-Cordillera Highland Agricultural Resource Management Project (DA-CHARMP) for testing cointegration and farm, wholesale and retail prices from January 1998 to March 2008 for the Ravallion model. The result of the analyses showed that there is market integration between Benguet vegetable trading centers and their market destinations. Wholesale prices from reference markets were immediately transmitted to wholesale markets in Benguet. Local price history has a significant contribution to the formation of current wholesale prices albeit in low amounts. Likewise it has been established that a stable long-term price relationship exists among the pairs of vegetable markets. The market information system and communication facilities had contributed to vegetable market integration in vegetable trading in Benguet and its market destinations. Thus, an efficient marketing information system is important to maintain and enhance the connectedness of Benguet markets with its various market destinations.

Key words: spatially efficient, market information, market integration, connectedness, reference market

INTRODUCTION

Recent advances in marketing point to the need to link farmers to markets to increase farmers' income. This is contingent to the provision of adequate market information to the stakeholders especially small farmers in the marketing system. Awareness of current market conditions and price information increases the farmers' bargaining power. This also guides them in choosing their market outlets and destinations.

As vegetables move from production areas to their market destinations, a variation in price occurs to reflect the value addition of marketing services performed. Farm gate prices are low vis-à-vis prices in central markets. This leaves a big margin that may give the traders in central markets a high profit and the producers a low share of the final retail price. But with an integrated market an efficient flow of market information is possible.

The availability of accurate, reliable and unbiased information and the quick transmission of information between marketing points hinge on the extent to which changes in central market prices are transmitted to local prices. Vegetable farmers in Benguet were mere price takers in the market

(Piadozo, 2007). They accepted whatever price was dictated upon them by their buyers. Thus there is a need to determine how integrated are the vegetable markets in the production areas to their central markets of destinations.

This paper aims to assess the efficiency of vegetable price linkages across markets. Specifically, the paper aims (1) to describe the market areas served by the two vegetable wholesale markets in Benguet; (2) to determine the connectedness of selected Benguet vegetable markets with respect to their market destinations; (3) to determine the degree of integration between Benguet markets and their central markets of destinations; and (4) to identify policy directions to improve the efficiency of vegetable price linkages across markets.

MATERIALS AND METHODS

The degree of market integration is used in this paper to determine whether the vegetable market for cabbage, potatoes and carrots is spatially efficient. It is efficient if prices are fully transmitted between farm-to-wholesale or farm-to-retail levels or if prices changes in geographically separated markets move in unison between market levels that prohibit traders from obtaining abnormal profit (Lantican, 2008). This is only possible when the market is fully integrated. Two approaches are used to test for market integration: (1) the Ravallion model, and (2) the cointegration analysis. Two sets of prices are used: the wholesale prices collected in La Trinidad, Baguio Hangar, Urduyay, Pangasinan, Balintawak and Divisoria markets for the three vegetables for the month of November 2003 sourced from the Department of Agriculture-Cordillera Highland Agricultural Resource Management Project (DA-CHARMP) for testing cointegration and farm, wholesale and retail prices from January 1998 to March 2008 for the Ravallion model.

Ravallion model

The model was developed by Ravallion in 1985 for testing market integration. The first equation is the integration of market from farm-to-wholesale level. The second is the integration of market from farm-to-retail level in the reference markets. The reference markets are Manila, Pangasinan and Benguet where Benguet vegetables are largely bought and sold.

$$FP_t = a_0 + a_1 FP_{t-1} + a_2 (WP_t - WP_{t-1}) + a_3 WP_{t-1} + a_4 DS + e_t$$

where:

- FP_t = vegetable farm price per kg at time t
- FP_{t-1} = vegetable farm price per kg lagged one month
- WP_t = vegetable wholesale price per kg in the reference market at time t
- WP_{t-1} = vegetable wholesale price per kg in the reference market lagged one month
- DS = dummy for season
- e = error term

$$FP_t = b_0 + b_1 FP_{t-1} + b_2 (RP_t - RP_{t-1}) + b_3 RP_{t-1} + b_4 DS + e_t$$

where:

- FP_t = vegetable farm price per kg at time t
- FP_{t-1} = vegetable farm price per kg lagged one month
- RP_t = vegetable retail price per kg in the reference market at time t
- RP_{t-1} = vegetable retail price per kg in the reference market lagged one month
- DS = dummy for season
- e = error term

The estimated coefficients a_1 and a_2 in both models reflect the relative contribution of the local market price history to its current market level and the extent to which the general economic conditions affecting the reference market price level is being transmitted to the local market level, respectively. On the other hand, a_3 reflects the relative contribution of the price history of reference market to the formation of local current price levels. If $a_2=b_2=1$, price changes in the reference market are fully transmitted to the local market in absolute terms.

To capture the relative magnitude of the two effects, the Index of Market Connection (IMC) developed by Timmer (1987) is also used. IMC is the ratio of the lagged local market coefficient to the lagged market coefficient. Algebraically, this is computed using the formula: $IMC_{fw} = a_1/a_2$ and $IMC_{fr} = b_1/b_2$ where IMC_{fw} corresponds to IMC of farm to wholesale, while IMC_{fr} is for farmgate to retail. A value closer to zero indicates a greater degree of market integration. Likewise, $IMC < 1$ implies a high degree of market integration.

Cointegration analysis

This approach is now widely used to examine how two spatially distant vegetable markets are linked together via prices (e.g. farmgate vs. wholesale prices or farmgate vs. retail prices, etc.) This procedure suggested by Engel and Granger (1987) and cited by Pendell and Schroeder (2004) is adopted to test for cointegration. The steps followed are enumerated below.

Step 1. Test individual daily wholesale price series at the La Trinidad Vegetable Trading Post in respective reference markets (Baguio City Hangar Market, Urdaneta, Pangasinan market and Balintawak and Divisoria markets) to determine if these price series are non-stationary using the Augmented Dickey-Fuller (ADF) unit root test. If the null hypothesis, the price series contain a unit root is not rejected, then the price series are nonstationary. This happens when the test statistic is smaller than the critical value at 5% level, otherwise the null hypothesis is rejected and the price series are nonstationary.

If the price series are nonstationary and their 1st differences are stationary then these are used to estimate the cointegration equation.

$$\Delta Y_t = a + b_t + cY_{t-1} + \lambda_1 Y_{t-1} + \lambda_1 Y_{t-k} + e_1$$

where:

Y_t = vegetable price series. If the price series are integrated of order 1, then proceed to

Step 2. Estimate the cointegration regression between individual price series at different market levels

$$Y_t = a_0 + a_1 Z_t + e_t$$

where:

Y_t , Z_t are individual price series, a_0 and a_1 are the intercept and slope coefficients, respectively, and e_t is the error term. Parameter estimates of the regression are used to calculate estimates of the residual errors given the following equation:

$$\hat{e}_t = Y_t - a_0 - a_1 Z_{tt}$$

where $\hat{\epsilon}_t$ is the estimated residual error term of the long-run relationship, a_0 and a_1 are the cointegrating parameters.

Step 3. Determine if the price series are cointegrated by testing for stationarity of the residual series e_t of the equation (4) using the ADF test again.

$$\Delta e_t = \beta_0 e_{t-1} + \sum \beta_i \Delta e_{t-1} + v_t$$

where Δ denotes the first order difference in the estimated residual term (i.e., $\Delta \hat{\epsilon}_t = \hat{\epsilon}_t - \hat{\epsilon}_{t-1}$) and n_i , $i=1,2,..4$ are the lag lengths, and $\hat{\epsilon}_{t-1}$ is the alleged error correction term. If there is a unit root, then the two series are considered nonstationary. If β_0 is statistically different from zero the null hypothesis of no cointegration is rejected.

RESULTS

The Benguet Vegetable Marketing System

Marketing Chain

The marketing channel traces the flow of the vegetables from the producers through the different market intermediaries to the end-consumers. The growers and traders comprise the marketing chain for vegetables. The traders are the major actors in the vegetable marketing system whose major task is to move the vegetables from the production sites to urban or consumption areas. There are different types of traders operating in Benguet, namely: commission agents, input suppliers or financier-wholesalers, assembler-wholesalers or *viajeros*, wholesalers, wholesaler-retailers and retailers

Commission agents. These traders operate in the villages or along the Mountain Trail in Benguet. They can be residents or non-residents of the village. Some of these traders are also farmer-producers who engage in vegetable trading with little or no capital used. They buy on behalf of large traders such as assembler-wholesalers or wholesalers by intercepting the vegetable deliveries to the Trading Post during the lean months to ensure that adequate supply of potatoes will be acquired at relatively lower prices than what is prevailing in the Trading Post. The practice is known as *harang* in Benguet. The agents receive commission fees for products sold to these traders.

Assembler-wholesalers or Viajeros. The assembler-wholesalers in Benguet are generally financially capable. They regularly shipped vegetables out to Metro Manila after obtaining their supply of vegetables from financier-wholesalers, wholesalers and commission agents.

Input suppliers or financier-wholesalers. The input suppliers provide the farmer with interest free cash advances/production inputs with the assurance that the entire harvest will be sold to him. The input supplier sells his vegetables to assembler-wholesalers in the wholesale trading center.

Wholesalers. The wholesalers purchase vegetables from the farmers and sell these in large quantities to *viajeros* or assembler-wholesalers. The wholesaler-retailers operate in wholesale markets or public markets. In Benguet, these are largely found in the La Trinidad Vegetable Trading Post and Baguio City Hangar Market. They occupy permanent stalls and sell in bulk to other wholesale traders.

Retailers. The retailers are the ultimate link to the consumers. They sell on retail basis and in small quantities. They maintain permanent stalls in public markets.

These different key players are shown in the following marketing channel for the province of Benguet. As shown in Figure 1 a substantial volume of the farmer's marketable surplus was delivered to the input suppliers or financier-wholesalers (41%) and commission agents (37%) at the La Trinidad Trading Post. There were also farmers who delivered their produce amounting to 6% at the Baguio City Hangar Market. The vegetables were brought outside of the province to the rest of Luzon via wholesale traders especially *viajeros* or assembler-wholesalers.

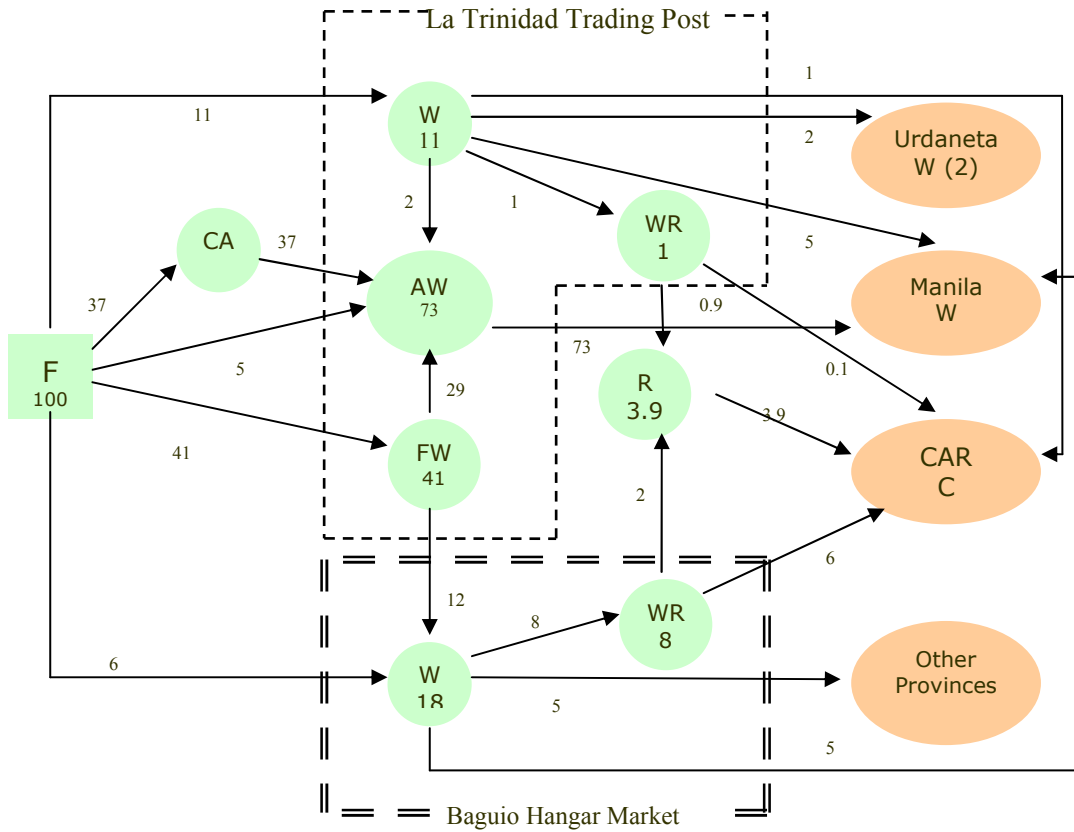


Fig 1. Commodity flow for cabbage, carrots and potatoes grown in Benguet, 2004.

Source: Ma. E. S. Piadozo, Sustainable Development of Highland Agriculture in the Philippines: A Study of Vegetable and Production Systems in Benguet and Laguna Provinces, 2007

Geographic Flow

In Benguet, vegetable farmers brought their produce either directly or through the assembler-wholesalers, commission agents or wholesalers to the La Trinidad Trading Post and Hangar Market. The traders at the trading post initially got a large proportion of the farmers' produce. Subsequent trading activities, however, occurred where vegetables sold at the trading post went to the Hangar market. Some of these vegetables were sold in the domestic market through local wholesaler-retailers and retailers while the major proportion of about 73% and 17% were brought out of the region through the large assembler-wholesalers and wholesalers, respectively (Fig. 2)

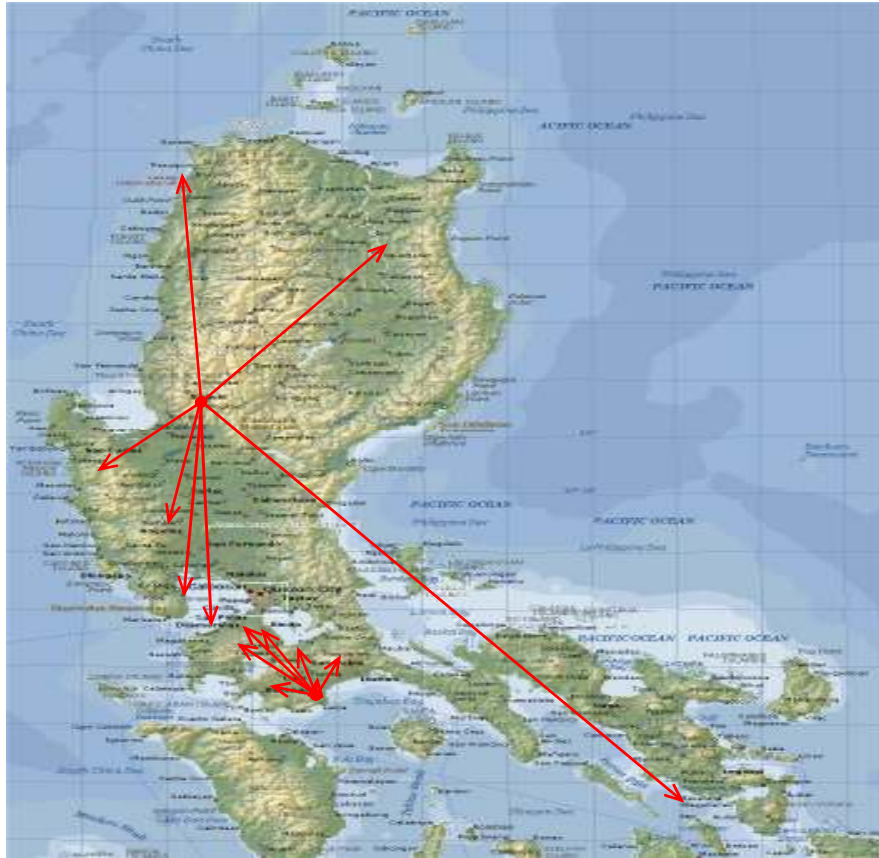


Figure 2. Flow of vegetables from Benguet to its market destinations.

The vegetables were brought to Metro Manila markets through the assembler-wholesalers and to other nearby Luzon provinces such as Pangasinan, Pampanga, Tarlac and Bulacan and also within the Cordillera Administrative Region (CAR) specifically Regions 1, 2 and 3. There were even assembler-wholesalers who came as far as the Bicol Region or Region 5 who went to La Trinidad to purchase these crops notably potatoes and carrots. Being semi-perishable, these vegetables can withstand the rigors of being transported for over 800 kms going to Bicol.

From Metro Manila markets, Benguet vegetables are transported to the Visayas island provinces such as Cebu, Iloilo, Negros Occidental and Leyte; other Luzon outlets such as Region 1, Region 2, Region 3, Region 4, Region 5; and even up to Mindanao areas of Davao City, Cagayan de Oro and Zamboanga.

Benguet Markets

In Benguet, the vegetables grown in the village were largely brought to wholesale trading centers. There are two major wholesale markets that serve the Mountain Trail areas and the neighboring provinces of the Cordillera Autonomous Region (CAR): the La Trinidad Vegetable Trading Post (LVTP) and the Baguio City Hangar Market. Vegetables are grown in homogenous agricultural areas called the “Mountain Trail” covering seven municipalities: Mankayan, Buguias,

Kibungan, Atok, Kabayan, Tublay and Bokod. These municipalities are located along the Halsema Highway that traces the road along the mountain range.

The La Trinidad Vegetable Trading Post. The La Trinidad Vegetable Trading Post is located in the municipality of La Trinidad, the provincial capital of the province of Benguet. It serves as the major trading outlet for temperate vegetables grown in the highlands. Located 5 km from Baguio City, the major consumption area, the structure is a place for bulking vegetables grown in Benguet and Mt. Province for shipment to Metro Manila and other provinces in Luzon

The Trading Post operates round the clock daily. The peak trading months are from December to March. Heavy transactions occur daily during this period involving large volumes of commodities and trade. The major marketing participants transacting business at the Trading Post are farmers and traders. Farmers bring their produce to the markets in hired, owned or public utility vehicles. On the other hand, traders who conduct business at the Trading Post could be classified into two: a) those that buy and sell within the trading post; and b) those who buy at the trading post and then transport the vegetables to distant markets. The first type undertakes additional marketing functions such as cleaning, sorting, and packing before disposing the commodity to another trader in the trading post (Trader B). This trader adds P0.50 to P1.00 per kg to cover his costs plus mark-up. They operate in owned or rented stalls or in the open unloading or *bagsakan* area. The second type of trader are the *viajeros* or assembler-wholesalers who provide additional marketing functions of transporting commodities to distant markets such as Metro Manila, Tarlac, Nueva Ecija, Pangasinan, Palawan, the Bicol Region provinces and La Union. They own vehicles and employ agents who at times intercept vehicles transporting vegetables along the Halsema Highway especially during lean season.

The Baguio City Hangar Market. The Hangar market serves as the bulking center for temperate vegetables in Baguio City and ranks second to the LVTP in terms of volume sold. It has a floor area of 2,116 sq m in a two story building that houses the highland vegetables on the ground floor and the dry goods section at the second floor.

According to market officials, average daily trading for potato, cabbage and carrot are estimated at 2.25, 2.80 and 2.25 tons respectively. These come largely from farmers' and traders' deliveries. If the supply is not enough traders buy from the LVTP for the needed volume of vegetables.

Urdaneta Market

Thirty wholesalers and 300 wholesaler-retailers conduct their vegetable trading business in Urdaneta. More than 95% of the cabbage potatoes and carrots which are sold in Urdaneta are sourced from the Cordillera. Wholesaling activities normally occur from 10:00 am to 3:00 pm of any given day. Deliveries of vegetable sourced from Baguio are normally observed from 10:00 am to 12:30 pm.

Metro Manila Market

The wholesale markets in Metro Manila are in Divisoria, Balintawak, Pasig, Marikina and Pasay. Peak unloading at Divisoria occurs from noon until 2 pm in the daytime and at 6-9 pm at night. Traders who prefer daytime procurement take advantage of the early arrival of some assembler-wholesalers. Divisoria being a terminal market plays an important role in price-setting. Most traders base their wholesale buying price (WBP) on Divisoria wholesale selling prices (WSP). Baguio traders regularly monitor prices by telephone. On the other hand, the Balintawak market is found along the EDSA highway. Because of its location and proximity to the North, it has become a major trading center where vegetables are unloaded for resale to other traders.

Empirical Results

Cointegration Analysis

The results of the unit root test (non-stationary test) on the daily prices of cabbage, carrots and potatoes are shown in Tables 1 to 3. The MacKinnon test critical values at 1%, 5% and 10% levels are compared with the generated ADF statistics. To say that the price series have a unit root or nonstationary, the ADF statistic and first differences must be greater than the critical values. If the results show that the price series are stationary, then it is said to be integrated in the first order. Therefore the price series can undergo the cointegration test.

As shown in Tables 1 to 3, except for Urdaneta for potatoes and Divisoria for cabbage, the original price series are confirmed to be nonstationary or have a unit root. All price series in all reference markets are also stationary in their first differences or integrated in the first order therefore we can proceed to the cointegration test.

Table 1. Result of the Augmented Dickey-Fuller unit root test on daily cabbage prices, November, 2003.

Price Series	Original Price Series		First Differences	
	Test Statistic	Interpretation	Test Statistic	Interpretation
Baguio	-2.348445	Non-stationary	-4.370564	Stationary
Balintawak	-3.423263	Non-stationary	-6.39784	Stationary
Divisoria	-4.121459	Stationary	-2.671187	Stationary
La Trinidad	-3.142783	Non-stationary	-3.160607	Stationary
Urdaneta	-2.580846	Non-stationary	-4.345745	Stationary

MacKinnon test critical values at:

1% -3.679; 5% -2.968; 10% -2.622

Table 2. Result of the Augmented Dickey-Fuller unit root test on daily carrot prices, November, 2003.

Price Series	Original Price Series		First Differences	
	Test Statistic	Interpretation	Test Statistic	Interpretation
Baguio	-2.73560	Non-stationary	-2.827604	Stationary
Balintawak	-2.174358	Non-stationary	-5.079494	Stationary
Divisoria	-1.033545	Non-stationary	-5.68596	Stationary
La Trinidad	-2.427564	Non-stationary	-5.385235	Stationary
Urdaneta	-3.117769	Non-stationary	-4.869031	Stationary

MacKinnon test critical values at:

1% -3.679; 5% -2.968; 10% -2.622

Table 3. Result of the Augmented Dickey-Fuller unit root test on daily potato prices, November, 2003.

Price Series	Original Price Series			
	Original Price Series		First Differences	
	Test Statistic	Interpretation	Test Statistic	Interpretation
Baguio	-3.22372	Non-stationary	-5.672479	Stationary
Balintawak	-1.59816	Non-stationary	-4.735241	Stationary
Divisoria	-2.309112	Non-stationary	-5.379186	Stationary
La Trinidad	-2.948119	Non-stationary	-6.839558	Stationary
Urdaneta	-3.944132	Stationary	-4.872923	Stationary

MacKinnon test critical values at: 1% -3.679; 5% -2.968; 10% -2.622

Relationship of Vegetable Prices (Cointegration Regression)

Results of the cointegration regression show that the paired wholesale market prices are directly related to each other. For cabbage, the wholesale prices at the La Trinidad Vegetable Trading Post hew closely with the wholesale prices at the Baguio City Hangar Market (0.85) and vice versa (0.91). The same thing is true for carrot and potato.

The Baguio City Hangar Market wholesale prices for these vegetables move closely with the wholesale prices at the La Trinidad Vegetable Trading Post (Tables 4 to 6). The wholesale prices for the three vegetables at the Baguio City Hangar Market tend to follow the prevailing market prices at the La Trinidad Trading Post. This only implies that each marketplace keeps the other market as a reference in their wholesale price quotations being the major sources of vegetables in the Cordillera region. Being market competitors, the wholesalers monitor prices set in each market.

Meanwhile wholesale prices in the other reference markets are also observed to move in unison with the other markets. Take note however that Urdaneta markets tend to have insignificant result indicating the small volume of vegetables being bought and disposed to this market unlike Divisoria being the biggest wholesale market for vegetables in Metro Manila. The result of this analysis only shows that the markets served by the Benguet wholesale markets keep abreast with the current prices in Baguio and La Trinidad and vice versa.

Cointegration test for stationarity of the residual series

Almost all of the stationarity tests of the residuals coming from the estimated cointegrating regression in Tables 4 to 6 rejected the null hypotheses at the 1%, 5% and 10% significance levels. The generated ADF statistics are less than the MacKinnon test critical values at all significance levels (Tables 7 to 9).

Except for the price series for cabbage (La Trinidad-Balintawak) and for carrots (Baguio-Urdaneta and La Trinidad-Balintawak price series) all the pairs of markets are cointegrated. A stable long-term price relationship exists among the pairs of vegetable markets. The small volume of carrots and cabbage bought and sold in these markets may have accounted for this phenomenon.

Table 4. Cointegrating vectors in the cointegrating regression, cabbage.

Dependent Variable	Cointegrating Vector	Regressors
La Trinidad	0.87	Baguio
La Trinidad	0.66	Balintawak
La Trinidad	0.77	Divisoria
La Trinidad	0.55	Urdaneta
Baguio	0.72	Balintawak
Baguio	0.83	Divisoria
Baguio	0.91	La Trinidad
Baguio	0.61	Urdaneta
Balintawak	1.23	Baguio
Balintawak	1.11	Divisoria
Balintawak	1.18	La Trinidad
Balintawak	0.82	Urdaneta
Divisoria	1.02	Baguio
Divisoria	0.79	Balintawak
Divisoria	0.99	La Trinidad
Divisoria	0.67	Urdaneta
Urdaneta	1.36	Baguio
Urdaneta	1.06	Balintawak
Urdaneta	1.20	Divisoria
Urdaneta	1.27	La Trinidad

Table 5. Cointegrating vectors in the cointegrating regression, carrots.

Dependent Variable	Cointegrating Vector	Regressors
La Trinidad	0.75	Baguio
La Trinidad	0.36	Balintawak
La Trinidad	0.60	Divisoria
La Trinidad	0.23	Urdaneta
Baguio	0.53	Balintawak
Baguio	0.71	Divisoria
Baguio	0.91	La Trinidad
Baguio	0.51	Urdaneta
Balintawak	1.32	Baguio
Balintawak	0.95	Divisoria
Balintawak	1.07	La Trinidad
Balintawak	1.04	Urdaneta
Divisoria	0.68	Baguio
Divisoria	0.37	Balintawak
Divisoria	0.70	La Trinidad
Divisoria	0.25	Urdaneta
Urdaneta	0.52	Baguio

Dependent Variable	Cointegrating Vector	Regressors
Urdaneta	0.43	Balintawak
Urdaneta	0.27	Divisoria
Urdaneta	0.29	La Trinidad

Note: Bold figures are the insignificant results.

Table 6. Cointegrating vectors in the cointegrating regression, potato.

Dependent Variable	Cointegrating Vector	Regressors
La Trinidad	0.97	Baguio
La Trinidad	0.87	Balintawak
La Trinidad	0.68	Divisoria
La Trinidad	0.04	Urdaneta
Baguio	0.60	Balintawak
Baguio	0.59	Divisoria
Baguio	0.60	La Trinidad
Baguio	0.15	Urdaneta
Balintawak	0.82	Baguio
Balintawak	0.70	Divisoria
Balintawak	0.73	La Trinidad
Balintawak	0.30	Urdaneta
Divisoria	0.83	Baguio
Divisoria	0.73	Balintawak
Divisoria	0.60	La Trinidad
Divisoria	0.02	Urdaneta
Urdaneta	0.24	Baguio
Urdaneta	0.36	Balintawak
Urdaneta	0.02	Divisoria
Urdaneta	0.04	La Trinidad

Note: Bold figures are the insignificant results.

Table 7. Augmented Dickey-Fuller test of cointegrating equations, cabbage.

Price Series	ADF test statistic	Conclusion	
Baguio-Balintawak	-4.913406	Stationary	Cointegrated
Baguio-Divisoria	-5.002574	Stationary	Cointegrated
Baguio-La Trinidad	-4.577114	Stationary	Cointegrated
Baguio-Urdaneta	-5.080152	Stationary	Cointegrated
La Trinidad-Baguio	-5.349121	Stationary	Cointegrated
La Trinidad-Balintawak	-1.592017	Non-stationary	
La Trinidad-Divisoria	-4.88373	Stationary	Cointegrated
La Trinidad-Urdaneta	-4.272568	Stationary	Cointegrated

MacKinnon test critical values at: 1% -3.679; 5% -2.968; 10% -2.622

The presence of communication facilities or the advent of cell phones and good road networks connecting Benguet, Pangasinan and the Metro Manila had tremendously facilitated the flow of communication between markets. Moreover, the large volume of vegetables bought and sold in Divisoria generated significant results as compared with Balintawak and Urdaneta markets. The large bulk of vegetables sold in Benguet are largely unloaded in Divisoria, being the largest wholesale or *bagsakan* market in Manila.

Table 8. Augmented Dickey-Fuller test of cointegrating equations, carrots.

Price Series	ADF test statistic		Conclusion
Baguio-Balintawak	-4.033664	Stationary	Cointegrated
Baguio-Divisoria	-3.159065	Stationary	Cointegrated
Baguio-La Trinidad	-3.578257	Stationary	Cointegrated
Baguio-Urdaneta	-2.541569	Non-stationary	Cointegrated
La Trinidad-Baguio	-4.264166	Stationary	Cointegrated
La Trinidad-Balintawak	-0.222501	Non-stationary	
La Trinidad-Divisoria	-3.782903	Stationary	Cointegrated
La Trinidad-Urdaneta	-2.729058	Stationary	Cointegrated

MacKinnon test critical values at: 1% -3.679; 5% -2.968; 10% -2.622

Table 9. Augmented Dickey-Fuller test of cointegrating equations, potato.

Price Series	ADF test statistic		Conclusion
Baguio-Balintawak	-4.426107	Stationary	Cointegrated
Baguio-Divisoria	-3.767858	Stationary	Cointegrated
Baguio-La Trinidad	-6.266198	Stationary	Cointegrated
Baguio-Urdaneta	-3.629625	Stationary	Cointegrated
La Trinidad-Baguio	-3.242835	Stationary	Cointegrated
La Trinidad-Balintawak	-5.049462	Stationary	Cointegrated
La Trinidad-Divisoria	-3.146767	Stationary	Cointegrated
La Trinidad-Urdaneta	-3.009648	Stationary	Cointegrated

MacKinnon test critical values at: 1% -3.679; 5% -2.968; 10% -2.622

Result of the Ravallion Model Analysis

The test for market integration at the farm wholesale and farm retail market levels using the Ravallion model showed a pronounced presence of market integration at the farm and reference wholesale markets (Tables 10 to 12). For all vegetables, a_1 are statistically significant for all market pairs indicating that the local price history has a significant contribution to the formation of current wholesale prices in the reference markets (i.e., Manila, Benguet and Pangasinan), albeit in low amounts. Although the “CHARM on the Air” had helped in the provision of price information to farmer beneficiaries in the Cordillera Region the result of the study done by Piadozo (2007) revealed that 70% of the farmers interviewed still relied on their buyers for price information. As such the traders were the ones who determined prices for vegetables. Nonetheless even if the project only operated from July 1999 to June 2004, the success of the program hitherto affected the formation of

wholesale prices in the major wholesale markets in Benguet where much of vegetable trading takes place.

Likewise, the wholesale prices from the reference markets were immediately transmitted to the wholesale markets in Benguet, i.e., La Trinidad Vegetable Trading Post and the Baguio City Hangar Market. A similar conclusion can also be said of the coefficient a_3 . Previous prices from the wholesale prices of reference markets outside of Benguet had a significant effect on the formation of current prices in the vegetable production areas. As these are the market areas served by Benguet wholesale markets, prices therefore wield an influence on prices in the local markets.

The estimated coefficient a_2 of DWP and b_2 of DRP for cabbage and potatoes are almost close to one, indicating a faster price transmission such that changes in wholesale or retail prices for these three vegetables have an impact on farm prices. These results are further supported by IMC values that are less than one for cabbage and potatoes. This implies that the previous price in the reference market has an impact on the present price in the local market. In other words, wholesale prices from reference markets were immediately transmitted to wholesale markets in Benguet. The Benguet vegetable trading centers and their market destinations are therefore cointegrated.

As cited earlier the ownership of communication facilities such as cell phones and the presence of good road networks linking Benguet wholesale markets with Metro Manila markets facilitated the transmission of prices among the market participants. The large wholesalers must be assured of the volume and delivery of vegetables they require thus they have to carry on close coordination with their agents and buyers in Benguet and vice versa through cell phones.

Table 10. Results of market integration analysis of monthly cabbage prices, 1998-2008.

MARKET	REGRESSION RESULTS						
	a_0	a_1	a_2	a_3	a_4	IMC	R^2
Farm-to-wholesale							
Benguet-Benguet	-1.85	0.25	0.84	0.65	0.69	0.38	0.78
Benguet-Manila	-2.79	0.17	0.91	0.75	0.35	0.23	0.79
Benguet-Pangasinan	-3.23	0.27	0.98	0.69	0.33	0.40	0.72
Farm-to-retail							
Benguet-Benguet	-6.56	0.14	0.66	0.53	-0.48	0.26	0.67
Benguet-Manila	-6.20	0.18	0.59	0.43	0.26	0.42	0.76
Benguet-Pangasinan	-3.67	0.24	0.63	0.45	-0.54	0.52	0.56
Wholesale-to-retail							
Benguet-Benguet	-4.13	0.13	0.75	0.57	-1.25	0.22	0.79
Benguet-Manila	-3.90	0.22	0.66	0.44	-0.43	0.51	0.90
Benguet-Pangasinan	-2.07	0.18	0.75	0.56	-1.48	0.32	0.68
Manila-Benguet	-3.05	0.22	0.70	0.50	-0.77	0.44	0.81
Manila-Benguet	-4.35	0.08	0.64	0.53	-0.20	0.14	0.93
Manila-Benguet	-0.51	0.25	0.64	0.47	-0.82	0.52	0.62
Pangasina-Benguet	-0.59	0.19	0.56	0.44	-0.44	0.44	0.72
Pangasinan-Manila	-0.58	0.39	0.52	0.29	0.06	1.34	0.86
Pangasinan-Pangasinan	0.69	0.23	0.57	0.44	-0.68	0.52	0.63

Note: Highlighted figures are those with significant results.

Table 11. Results of market integration analysis of monthly carrot prices, 1998-2008.

MARKET	REGRESSION RESULTS						
	a ₀	a ₁	a ₂	a ₃	a ₄	IMC	R ²
Farm-to-wholesale							
Benguet-Benguet	0.62	0.38	0.51	0.35	1.26	1.09	0.70
Benguet-Manila	1.38	0.54	0.55	0.24	1.21	2.27	0.63
Benguet-Pangasinan	-1.50	0.49	0.91	0.48	0.39	1.03	0.63
Farm-to-retail							
Benguet-Benguet	-3.05	0.43	0.45	0.28	1.10	1.51	0.65
Benguet-Manila	-6.24	0.29	0.48	0.40	0.81	0.71	0.69
Benguet-Pangasinan	-4.24	0.41	0.68	0.38	0.51	1.06	0.600
Wholesale-to-retail							
Benguet-Benguet	-6.17	0.37	0.79	0.53	-0.09	0.71	0.83
Benguet-Manila	-4.29	0.55	0.82	0.36	-0.09	1.50	0.84
Benguet-Pangasinan	-5.47	0.52	1.11	0.50	-1.22	1.04	0.74
Manila-Benguet	0.45	0.78	0.64	0.10	1.19	7.64	0.82
Manila-Benguet	-0.34	0.74	0.66	0.14	0.47	5.14	0.84
Manila-Benguet	0.43	0.70	0.92	0.19	-0.7	3.75	0.79
Pangasina-Benguet	2.47	0.38	0.33	0.23	1.19	1.69	0.69
Pangasinan-Manila	1.97	0.45	0.35	0.20	1.10	2.20	0.69
Pangasinan-Pangasinan	-1.27	0.23	0.58	0.46	0.46	0.50	0.73

Note: Highlighted figures are those with significant results.

Table 12. Results of market integration analysis of monthly potato prices, 1998-2008.

MARKET	REGRESSION RESULTS						
	a ₀	a ₁	a ₂	a ₃	a ₄	IMC	R ²
Farm-to-wholesale							
Benguet-Benguet	-0.15	0.28	0.72	0.59	0.01	0.46	0.79
Benguet-Manila	0.17	0.39	0.70	0.46	0.09	0.86	0.80
Benguet-Pangasinan	-2.21	0.49	1.00	0.62	0.63	0.79	0.72
Farm-to-retail							
Benguet-Benguet	-0.01	0.54	0.54	0.23	0.30	2.33	0.72
Benguet-Manila	-2.25	0.41	0.62	0.33	0.06	1.23	0.78
Benguet-Pangasinan	-0.15	0.48	0.47	0.28	0.63	1.71	0.56
Wholesale-to-retail							
Benguet-Benguet	0.62	0.46	0.61	0.31	0.68	1.47	0.78
Benguet-Manila	-2.57	0.38	0.78	0.42	0.17	0.89	0.93
Benguet-Pangasinan	1.41	0.61	0.54	0.21	0.77	2.88	0.66
Manila-Benguet	0.16	0.46	0.67	0.35	0.60	1.34	0.79
Manila-Benguet	-2.68	0.45	0.85	0.40	-0.03	1.11	0.95
Manila-Benguet	0.61	0.55	0.57	0.29	0.85	1.92	0.63
Pangasina-Benguet	2.73	0.43	0.40	0.21	-0.11	2.03	0.74
Pangasinan-Manila	1.63	0.45	0.46	0.22	-0.40	2.07	0.82
Pangasinan-Pangasinan	1.97	0.38	0.41	0.28	0.08	1.36	0.61

Note: Highlighted figures are those with significant results.

CONCLUSION

The results of the analysis showed that there is market integration between Benguet vegetable trading centers and their market destinations. Wholesale prices from reference markets were immediately transmitted to wholesale markets in Benguet. The local price history has a significant contribution to the formation of current wholesale prices although in small amounts. The market information system and communication facilities had contributed to vegetable market integration.

Suggested Policy Recommendation

An efficient marketing information system is important to maintain and enhance the connectedness of Benguet markets with its various market destinations. The following recommendations can improve the connectedness between markets.

1. Establishment of communication facilities in production areas.

For production areas to be really connected to market areas in La Trinidad and Baguio, they should have access to market information. Local government units can set aside funding for the purchase of communication facilities so that market information can be easily relayed to the farmers at anytime of the day. Since there are no price broadcasts on Saturdays and Sundays, such communication facilities can provide the needed market information to the growers.

2. Adequate budget should be given to the Bureau of Agricultural Statistics (BAS) so prices can be disseminated at the right time and right place.

Timing is very critical for the users of market information. It should be made available at the earliest possible time. The peak trading at the La Trinidad Trading Post is from 5:00 am to 7:00 am and from 6:00 am at the Baguio City Hangar Market. On the other hand, the CHARM on the Air used to air relevant market information daily from Mondays to Friday at 6:00 to 6:45 and 6:45 to 7:00 in the morning from Mondays to Fridays. For the Mountain Province, especially Bontoc, prices were aired daily every 8:00 to 8:30 am. The airing of market information does not match the needs of the market players since the airing of prices will not be very useful anymore to the farmers and other market players as the peak trading had already started in these markets. Secondly, there are no price broadcasts during Saturday and Sunday which are also peak trading days.

2. Market reporters should be trained on quality monitoring of prices and other relevant market information. The success of an efficient and effective market information system lies in the provision of good quality market information. In this regard funding support must be given to BAS for this purpose.
3. Contingent to an efficient market information system is a good grading system for vegetables as it increases the meaningfulness of price quotations and the precision of the price formation process through greater knowledge. There are no adequate standards being followed in the grading of vegetables in Benguet as this is purely done through ocular inspection. Furthermore, the postharvest practices adopted by traders in the study areas also need further improvement. In this connection, traders and farmers should be trained on the proper postharvest practices and the sorting according to acceptable standards in the market.

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