AN ANALYSIS OF MARKET INTEGRATION FOR SELECTED VEGETABLES IN INDONESIA

Achmad Munir[1)], S. Sureshwaran, H.M.G Selassie dan J.C.O Nyankori

ABSTRAK

Sayur-sayuran adalah salah satu jenis komoditas penting di Indonesia yang termasuk dalam penyumbang devisa eskpor nonmigas di Indonesia. Studi ini bertujuan untuk menguji konsep integrasi pasar pada komodtas sayur-sayuran terpilih di Indonesia. Spesifikasi model digunakan merupakan aplikasi model yang kembangkan oleh Ravallion (1986). Empat jenis sayur-sayuran di antara 21 sayuran yang diproduksi di Indonesia dipilih untuk pengujian integrasi pasar. Pemilihan tersebut berdasarkan pada urutan rangking luasan tanam dan hasil panen yang diproduksi selama periode 1969-1990. Hasil uji statistik dengan F-test menunjukkan bahwa tidak ada satu pun kombinasi pasar yang tersegmentasi. Hal ini memberikan implikasi penting bagi petani dan pengambil kebijakan di Indonesia. Hanya beberapa kombinasi pasar sayur-sayuran yang terintegrasi dalam jangka pendek. Hasil lain juga menunjukkan bahwa fasilitas sarana transportasi di antara pasar produsen-konsumen dan sifat karakteristik sayur-sayuran yang mudah rusak (*perishable*) adalah hal penting dalam menjelaskan faktor yang mempengaruhi kecepatan transmisi harga. Integrasi pasar yang terjadi bersifat langsung (*directional*) di mana pasar di Jawa Barat dan Jakarta terintegrasi dengan pasar di Sumatera; sedangkan pasar di Jawa Tengah terintegrasi dengan Jawa Timur, Nusa Tenggara Barat dan Sulawesi Selatan.

INTRODUCTION

The horticulture sub-sector in Indonesia offers a viable method to achieve development objectives and diversification of agriculture. High income elasticities and rapid urbanization guarantee the expansion of domestic demand and offers scope for industrialization. Most of the horticulture products can be further processed in Indonesia and have multiplier effects due to inter-industry linkages. Therefore, vegetable production can increase rural employment and generate income.

Vegetable production in Indonesia expanded considerably during the 1980's, as a result of increased demand, changing diets of consumers, and intensification and extensification programs in the agricultural sector. However, the share of vegetables in all agricultural production is small, due to relatively low volumes produced compared to rice and secondary crops. In 1989, vegetables accounted for only 5.5 percent of total agricultural output. However, it was only 3.6 percent in 1983.

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1) Achmad Munir is a research staff at the Institute for Development of Economics and Finance (INDEF) Jakarta.
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In Indonesia, horticulture has largely remained outside the major sectoral models for planning (Ferrari, 1992). This is because the government policy in agricultural development still focuses on food crops sector. However, because of the importance of the horticulture sub sector to the Gross Domestic Product (GDP), specially vegetables, it is important to study the efficiency of the vegetable markets.

An efficient market disseminates information on prices quickly and accurately. The degree of market integration provides evidence of efficiency of pricing (Buccola, 1984 and 1985). According to Takayama and Judge (1971), markets are integrated when prices are determined interdependently, i.e., price changes in one market are passed on to other markets. The speed and accuracy at which price and quantity information is conveyed also promotes efficiency in resource allocation decisions.

Market integration can be difficult to achieve in Indonesia as it consists of 17,000 islands. The five big islands in Indonesia, Java, Sumatra, Kalimantan, Sulawesi and Irian Jaya, are divided into several provinces. Each one of the 27 provinces has a capital city. The wholesale markets for vegetable products are usually located in the capital city of the provinces. The producer areas for vegetables are distributed in other districts called *kabupaten*.

Market integration is also difficult to achieve for agricultural products. This is because the most typical characteristic of a market for an agricultural product is that it is a collection market and also seasonal in nature. Further, because of the agroclimatic needs and seasonality of production, temporal and interregional price differentials are high. Agricultural products also pass through long market channels that sort, grade, process, package and transport.

The primary objective of this study is to evaluate market integration for vegetables in Indonesia. Specific objectives are: (1) to test whether markets for selected vegetables are integrated in the short-run; and (2) to test whether markets for selected vegetables are integrated in the long-run in Indonesia.

THE DATA AND STUDY SETTING

Indonesia, with its 17,000 islands and 182 million people is one of the fastest growing economies in the world. It provides an interesting case study of agricultural markets. In the recent years, there has been an increasing emphasis on building transportation and communication facilities to integrate the islands. Indonesia possesses a wide range of agroecological zones allowing for the production of a great variety of vegetables. Most vegetables are grown in Java. However, the population is concentrated in the 5 large islands, Java, Sumatra, Kalimantan, Sulawasi, and Irian Jaya. The integration of production and consumption markets affect production and pricing decisions.

Data on average area planted and production rankings for 21 vegetables in Indonesia during the years 1969 to 1990 was collected. Based on area and magnitude of production and data availability, chilli, shallot, potato, and cabbage were four vegetables chosen for the analysis. The differences among these vegetables, in terms of the agroecological zone of production and the characteristics of the product (perishability, processability, etc.), also allows for a more in-depth examination of the factors that affect market integration.

Consumer prices in the following nine cities in four different islands were collected from the data published by the Ministry of Agriculture in Indonesia. From the island of Java (Central), the three cities Surakarta, Yogjakarta and Jakarta (capital of Indonesia). Medan, Padang, Pekan Baru and Jambi are in the island of Sumatra. Ujung Pandang is in South Sulawesi and NTB is in West Nusa Tenggara. Producer markets included in the study are: (1) Bandung in West Java produces chilli, potato and cabbage; (2) Semarang in Central Java produces shallot, potato and cabbage; and (3) Surabaya in East Java produces chilli and shallot. To be consistent consumer prices were also used as prices in producer markets.

Chilli

Chilli ranks first in terms of area planted (11.8%) and second in terms of production (8.7%). The characteristics of chilli markets are small size of the plots plated making the interposition of field traders a necessity. These traders are multiproduct and part time traders. Because chilli production is a high input crop, standing crop arrangement (*tebasan system*) are becoming popular as a way in which farmers can reduce some risks. Although chilli is quite perishable, it can be dried and stored or further processed as sauce.

Average consumer price for chillie at major consumer markets in Indonesia during the months of May 1983 to February 1991 is provided in Table 1. Highest average prices and standard deviation were in the producing regions, Bandung and Surabaya, and in the largest consuming region, Jakarta. These large price variations can be because of the seasonal nature of production. Other consuming regions may be more selfsufficient than Jakarta although chillies are imported during the harvest seasons from Bandung and Surabaya.

Table 1. Descriptive Statistics for Consumer Prices for Chillies, by Location, Indonesia

Location	Time Period	Minimum	Maximum	Mean	Standard Deviation
JKT	May 83-Feb 91	268.830	2808.31	973.452	434.870
BDG	May 83-Feb 91	299.740	3265.09	971.335	462.969
SEM	May 83-Feb 91	233.410	2388.20	789.891	386.804
SRK	May 83-Feb 91	227.630	2558.11	821.476	367.822
SUB	May 83-Feb 91	334.010	3395.97	913.864	403.326
UJP	May 83-Feb 91	209.930	2061.25	896.919	389.992

Source : Directorat General of Food Crops (DGFC), Ministry of Agriculture

Shallot

Shallot ranks second in terms of area planted (6.2%) and fifth in terms of production (7.1%), after cabbage, chilli, yardlong bean and potato. Fifty percent of total production is concentrated in seven districts in Java. The farmers prefer the standing crop system (*tebasan system*) and wholesale bulk (*borongan*) system to weighing (*kuintalan*). The

tebasan and the borongan system usually take place near the farm. Therefore, the farmer does not have any extra cost for weighing and transporting. However, shallots can also be further processed and stored. Average consumer prices for major consuming and producing regions are provided in Table 2. The largest price variation is for Surabaya. However, the standard deviation is relatively small for Semarang and Jakarta.

Table 2. Descriptive Statistics for Consumer Prices of Shallot, by Locations, Indonesia

Location	Time Period	Minimum	Maximum	Mean	Standard Deviation
JKT	Jan 86-June 90	336	1900	717.741	291.306□
SUB	Jan 86-June 90	245	1961	787.611	359.997
SEM	Jan 86-June 90	157	1665	583.1667	277.925
YOG	Jan 86-June 90	193	1652	593.704	289.808
BDG	Jan 86-June 90	332	1822	735.278	313.784
PDG	Jan 86-June 90	522	1704	880.481	269.630
SRK	Jan 86-June 90	187	1716	574.815	281.543
NTB	Jan 86-June 90	283	1615	737.648	347.450
MDN	Jan 86-June 90	506	1505	1003.632	34.515
PKB	Jan 86-June 90	534	1990	956.685	329.352
JMB	Jan 86-June 90	429	1772	848.463	315.063

Source : Directorat General of Food Crops (DGFC), Ministry of Agriculture

Potato

Potato ranks sixth in terms of area planted (3.2%) and fourth in terms of production (7.3%). Unlike many other fresh vegetables, potato can be stored. Therefore, potatoes flows through longer market channels changing hand four to six times from farmer to consumer. The role of potato traders is sometimes extended to the input markets, supplying farmers with fertilizers, pesticides, seeds, farm tools, credit, etc. Traders may be potato producers on a share basis or they might buy from other farmers. In addition, unlike chilli and shallot, further processing of potato is not a common practice in Indonesia. Also, processed potato, e.g., chips, are not substitutes for fresh potato. These characteristics induce different pricing arrangements relative to other vegetables. Variation of prices were large in Ujung Pandang, Bandung and Jakarta, see Table 3. Semarang, a producing region, had a low price variation.

Table 3. Descriptive Statistics for Consumer Prices of Potato, by Location, Indonesia

Location	Time Period	Minimum	Maximum	Mean	Standard Deviation
JKT	May 83-Dec 92	200	697	344.991	108.572
SEM	May 83-Dec 92	166	600	302.836	98.985
SRK	May 83-Dec 92	158	591	296.552	91.645
YOG	May 83-Dec 92	198	626	321.776	99.235
BDG	May 83-Dec 92	197	638	338.819	103.649
UJP	May 83-Dec 92	354	1005	555.414	160.897
PLB	May 83-Dec 92	216	571	352.086	83.481
PDG	May 83-Dec 92	179	571	325.922	89.643
PKB	May 83-Dec 92	236	555	367.569	83.707
JMB	May 83-Dec 92	193	578	337.000	93.188
MDN	May 83-Dec 92	117	570	317.414	97.987

Source : Directorat General of Food Crops (DGFC), Ministry of Agriculture

Cabbage

Cabbage is the most important vegetable in Indonesia in terms of production. Cabbage contribute 3.7 percent of area planted and 11.9 percent of total production. Unlike other vegetables included in this study, cabbage is highly perishable and can not be transformed in any other form, therefore, market channels are short. Bandung, a producing region had high price variation, Table 4. Semarang and Jakarta had relatively low variations.

Table 4. Descriptive Statistics for Consumer Prices of Cabbage, by Location, Indonesia

Location	Time Period	Minimum	Maximum	Mean	Standard Deviation
SEM	Jan 88-Dec 92	53	494	151.533	79.556
SRK	Jan 88-Dec 92	54	442	147.150	75.057
YOG	Jan 88-Dec 92	69	484	179.183	89.860
BDG	Jan 88-Dec 92	53	455	188.717	92.238
JKT	Jan 88-Dec 92	113	395	212.792	59.832
MDN	Jan 88-Dec 92	86	389	158.267	71.922
PDG	Jan 88-Dec 92	72	296	168.033	56.217
PKB	Jan 88-Dec 92	133	352	253.050	49.897
JMB	Jan 88-Dec 92	117	435	230.100	66.278

Source : Directorat General of Food Crops (DGFC), Ministry of Agriculture

The only producing region from Central Java that was analyzed in this study was Semarang. Semarang had a lower price variation as compared to producing regions in West and East Java. Cities outside Java tend to have larger price variations. Variation in the monthly consumer prices of vegetables is large. This may be because of the characteristics of the product. It can also be because of inefficiencies in the markets. This is examined in more detail using regression analysis.

METHODOLOGICAL CONSIDERATIONS

Ravallion assumes that there exists a group of regional (local) markets and a single central market. Thus, the static pattern of price formation among N region markets, where market 1 as the central market, can be summarized as follows :

(1) $P_1 = f_1 (P_2 , P_3 , \ldots , P_N , X_1)$

(2) $P_i = f_i (P_i , X_i)$

Where :

P_i = monthly wholesale price (Rp/Kg) in regional (local) markets (i = 1, 2, ..., N)

P_1 = monthly wholesale price (Rp/Kg) in central markets

X_i = is a vector of other influences on regional (local) markets (i = 1, 2, ..., N)

According to Ravallion, static price correlations remain the most common measure of spatial market integration in agricultural products. By using this method, bivariate correlation or regression coefficients are estimated between the time series of spot prices for an otherwise identical good or bundle of goods at different market locations. The static bivariate method can be readily extended in a dynamic model of spatial price differential. Each local price series can be permitted to have its own dynamic structure (allowing for any correlated local seasonality or other characteristics) as well as an interlinkage with other local markets.

A dynamic model also has the advantage that one can distinguish between the concepts of instantaneous market integration and the less restrictive idea of integration as a long run target of the short run dynamic adjustment process. Given enough time, the short-run adjustments might exhibit a pattern that converges to such an equilibrium. If the short run integration is rejected, then it would be better to know if there is any long run tendency toward market integration (Ravallion, 1986).

The model proposed by Ravallion (1986) is designed to test for short-run and long-run integration by correlating price in one region with lagged own prices and lagged prices in another region. It is stated as follows:

$$P = \sum_{i=1}^{4} a_{it} P_{it-j} + \sum_{j=0}^{n} b_{ij} P_{1t-j} + e_{it}$$

Where :

P_{it} = Monthly wholesale price in consumer market "i" and time "t" (Rp/Kg)

Where:

P_{it-j} = Monthly wholesale price (Rp/Kg) in consumer market "i" and time "t-j"

P_{1t-j} = Monthly wholesale price (Rp/Kg) in a producer market at time "t-j"

a, b = regression coefficients

e = disturbance error

This study will test the following hypotheses :

1) Markets are segmented, i.e., price movements in producer markets do not influence the price in consumer markets. This requires: $b_{ij} = 0$, where j = 0, 1, 2, 3, ..., n).
2) Markets are integrated in the short-run, i.e., price movements in the producer market will be immediately transmitted to the consumer market and there are no lagged effect. There are two conditions for short-run integration :

   a) Strong form: $b_{i0} = 1$; and $a_{ij} = b_{ij} = 0$ where, j = 1, 2, 3, ..., n

   b) Weak form: $b_{i0} = 1$; and

$$\sum_{j=1}^{n} a_{ij} = \sum_{j=0}^{n} b_{ij} = 0$$

In this study, only the results for the strong form of the short-run integration condition is reported.

3) Markets are integrated in the long-run, i.e., price transmission takes time and lagged effect are present. This requires :

$$\sum_{i=1}^{n} a_{ij} = \sum_{i=0}^{n} b_{ij} = 1$$

As there is no a priori guide for determining the appropriate lag length and functional form; three lags and log functional form were used. Most of the vegetables studied have a 3 month production cycle. Another concern in estimating the model is that price time series data are more likely to be highly correlated. Therefore to reduce multicollinearity, long-run

market integration restrictions are imposed on those models where the condition is accepted, before the subsequent tests for model segmentation and short run integration are performed. If the long run integration is rejected, then this avenue is not open, the segmentation and short run integration conditions are interpreted with extra caution.

RESULTS

Low land vegetables

Market segmentation tests for chilli and shallot, suggests that all markets are integrated (Table 5). This means that the markets are interdependent. Price changes in one market will be fully passed on to other markets.

Table 5. Results of F-Test for Market Integration of chilli and Shallot in Indonesia, 1982-1992

Depen-dent	Indepen-dent	chilli			Shallot		
		Segmentation	Long - Run	Short - Run	Segmentation	Long - Run	Short - Run
JKT	BDG	52893.838*	0.2118	0.5105*	n/a	n/a	n/a
SEM	BDG	16828.665*	11.6596	2.9799*	n/a	n/a	n/a
SRK	BDG	19507.855*	10.9926*	6.3539*	n/a	n/a	n/a
UJP	BDG	10671.365*	0.0921	29.7989*2	n/a	n/a	n/a
UJP	SUB	10620.552*	0.0363	2.6485*2.	n/a	n/a	n/a
SEM	SUB	9354.967*	2.2207	9812	n/a	n/a	n/a
JKT	SUB	8609.121*	0.9611	2.1864	12128.075*	0.306	3.001
SRK	SUB	12404.660*	3.7679	7.7084*	7500.739*	5.505	1.334
MDN	SUB	n/a	n/a	n/a	32931.574*	2.994	80.854*
PDG	SUB	n/a	n/a	n/a	16596.637*	0.789	14.047*
PKB	SUB	n/a	n/a	n/a	12914.996*	0.143	23.370*
JMB	SUB	n/a	n/a	n/a	17616.835*	0.182	7.872*
YOG	SUB	n/a	n/a	n/a	6646.186*	2.461	1.389
NTB	SUB	n/a	n/a	n/a	23320.241*	1.467	7.853*
JKT	SEM	n/a	n/a	n/a	22736.793*	8.080*	5.990*
YOG	SEM	n/a	n/a	n/a	106267.124*	1.667	1.933
SRK	SEM	n/a	n/a	n/a	75834.716*	2.963	1.274
MDN	SEM	n/a	n/a	n/a	30692.920*	4.970	186.957*
PDG	SEM	n/a	n/a	n/a	26019.600*	6.639*	23.693*
PKB	SEM	n/a	n/a	n/a	24523.160*	3.652	144.679*1
JMB	SEM	n/a	n/a	n/a	29639.222*	8.829*	1.751*
NTB	SEM	n/a	n/a	n/a	23320.241*	18.646*	21.507*

Note : * denotes rejection at 95 percent level of confidence, n/a denotes data is not available

The Semarang-Bandung (SEM-BDG) and Surakarta-Bandung (SRK-BDG) markets for chilli are not integrated in the long-run. For shallot, Jakarta-Semarang (JKT-SEM), Padang-Semarang (PDG-SEM), Jambi-Semarang (JMB-SEM), and Nusa Tenggara Barat-Semarang (NTB-SEM) are not integrated in the long-run. This may be because the logarithmic functional form does not adequately specify the interdependent price formation relationship. No restrictions were imposed to correct for multicollinearity in these models and the results have to be interpreted with caution.

All the chilli and shallot markets are integrated in the long-run with Surabaya, which is in East Java. This is because Surabaya is a large producer of low land vegetables. On the other hand, Semarang, which is in Central Java, is integrated with consumer markets in Central Java and Sumatra. Thus, suggesting that market integration in the long-run is directional.

Very few markets for chillies and shallots are integrated in the short-run. Dried chillies and shallots are good substitutes for fresh vegetables. All markets that are integrated in the short-run are in Java. This suggests that inter-island transportation may have an effect on marketing efficiency. In addition, most markets are integrated with Jakarta. Jakarta does not produce vegetables, however the city has a wholesale market, *Pasar Induk Kramat Jati*. Transportation from Jakarta to other cities is well developed.

High land vegetables

Market segmentation tests for potatoes and cabbage, suggests that all markets are integrated (Table 6). The Yogyakarta-Bandung (YOG-BDG), Surakarta-Bandung (SRK-BDG), Jakarta-Semarang (JKT-SEM), Yogyakarta-Semarang (YOG-SEM) and Pekan Baru (PKB-SEM) markets for potatoes are not integrated in the long-run. For cabbage, only Surakarta-Bandung (SRK-BDG) and Surakarta-Semarang (SRK-SEM) are not integrated in the long-run. As no restrictions were imposed to correct for multicollinearity in these models, results have to be interpreted with caution.

None of the markets for the two highland vegetables are integrated in the short-run. This may be because both are "bulky" and have high transportation costs. In addition, cabbage is highly perishable and potato is the most storable among the four vegetables studied. The costs of inter or intra-island transportation may be greater than the benefits from taking advantage of short run price changes.

The relationship between market integration and degree of perishability is the more perishable vegetables have a higher percent age of market integration in the long-run. For instance, cabbage is the most perishable, 95,7 percent of market combinations are integrated in the long-run. Meanwhile for other vegetables, shallot and chilli (75 %) and potato, the least perishable has 68,8 percent of market combination which is integrated in the long-run. Highland vegetables are least integrated in the short run. This may be because of poor transportation between producer-consumer markets in the highland. Product characteristics are also important factors that affect market integration. The least perishable vegetables, e.g., potato, are less likely to be integrated than the more perishable cabbage.

Table 6. Results of Test Market Integration for Potato and Cabbage in Indonesia, 1982-1992

Depen-dent Variable	Indepen-dent Variable	Potato			Cabbage		
		Segmenta-tion	Long - Run	Short - Run	Segmenta-tion	Long - Run	Short - Run
JKT	BDG	212320.189*	2.8717	12.889*	5408.674*	2.674	38.709*
YOG	BDG	159110.558*	7.7222*	8.740*	8261.096*	0.695	14.921*
SRK	BDG	138418.240*	10.0707*	9.706*	6782.381*	18.729*	8.379*
MDN	BDG	33302.042*	1.5985	41.443*	3583.417*	1.233	15.152*
PDG	BDG	98035.510*	0.3088	61.748*	2706.746*	0.124	14.071*
PKB	BDG	88803.915*	6.1054	92.652*	9746.605*	1.497	104.376*
JMB	SEM	148944.735*	0.1615	85.708*	5906.460*	4.268	38.337*
UJP	SEM	63750.771*	2.5188	429.161*	n/a	n/a	n/a
JKT	SEM	109572.442*	16.4759*	16.055*	5720.716*	3.561	69.148*
YOG	SEM	213088.360*	13.1625*	10.1543*	507.041*	6.583	27.172*
SRK	SEM	174409.442*	0.9350	12.0236*	4632.533*	12.348*	7.106*
MDN	SEM	40445.010*	1.4008	41.6124*	2878.248*	0.288	19.476*
PDG	SEM	99151.227*	3.0047	88.5372*	131.689*	0.007	16.830*
PKB	SEM	84659.896*	12.6811*	94.1784*	10408.048*	1.517	177.398*
JMB	SEM	30741.348*	8.6744*	101.3080*	6339.603*	4.147	77.810*
UJP	SEM	63447.146*	1.9460	639.0180*	n/a	n/a	n/a

Note : * denotes rejection at 95 percent level of confidence

CONCLUSION

This analysis concentrated on evaluating market integration for selected vegetables in Indonesia. Because market segmentation tends to promote inefficient utilization of resources, the challenge is to devise and implement policies that would promote integration. To achieve the objectives of the study, market integration tests developed by Ravallion (1986) are performed with price data for 4 vegetables in 9 consumer and 3 producer markets.

Market segmentation tests were used to evaluate whether the two markets are interdependent, whether price movements in producer markets influence price changes in the consumer markets, i.e., segmentation test. Short run market integration tests were used to evaluate whether price movements in the producer market will be fully and immediately transmitted to the consumer market. Finally, long run market integration tests were used to evaluate whether the price changes take time, i.e., there is lagged effect.

The more perishable vegetables have a higher percent age of market integration in the long run. This means that price changes in one market (producer markets) will be reflected in other markets (consumer markets) with more than one period. Some markets are not integrated in the long run. This may be because storable vegetables may need more than 3 months to fully transmit the price changes.

Only the markets for low land vegetables show some integration in the short run. This may be because of poor transportation between highland and other areas. In addition, shallot and chillies are unique, as their characteristics can be changed by drying and/or

further processing. The dried and/or processed shallot and chilli are good substitutes for the fresh vegetables.

Market integration in Indonesia is also directional. Markets within the same island are more likely to be integrated. Markets in Central Java are more likely to be integrated with those in East Java than with others in West Java. This may be because the producer in West Java supplies consumers in East Java, West Nusa Tenggara (NTB) and South Sulawesi (UJP). The most important vegetable producing cities are in West Java and Central Java.

In summary, the factors that determine market integration appear to be the characteristics of the product (perishability, bulkiness, transformability), location of production (low land and highland) and transportation facilities. The main policy implication of this study is that price information should be made available to producers, as it creates utility. Price information adds place utility by informing producers when to transport vegetables from producing regions (low price) to consuming regions (high price). Price information adds time utility, as storability is important for market integration, especially in Indonesia as archipelago island. An important implication is that transportation affects the flow of vegetables from producer areas to consumer areas. This also affects market integration and product utility. Another implication is that since market integration is directional, policies to address shortage and/or surplus in some consumer regions can focus on selected producer regions.

According to the results of this study and other research, the factors that influence market integration differ widely among commodities. The effectiveness of policies designed to promote market integration will depend heavily on the extent to which such differences are recognized.

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