Marketing of Pigs in Malaysia: An Evaluation of Market Integration

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ABSTRACT

This paper examines the pricing efficiency of the pig market in Peninsular Malaysia through measuring the degree of market integration. Specifically, this paper examines the price linkages between Kuala Lumpur (which is considered the market centre for price discovery) and five major local markets (Ipoh, Johor Bahru, Penang, Malacca and Seremban). The findings indicate, with the exception of Johor Bahru, the other market regions show high level of market linkage with Kuala Lumpur.

ABSTRAK

Kajian ini meneliti kecekapan letakharga pasaran khinzir di Semenanjung Malaysia melalui pengukuran darjah integrasi pasaran. Secara khusus, kajian ini mengkaji jalinan harga antara Kuala Lumpur (yang dianggap sebagai pasaran pusat untuk proses penemuan harga) dan lima pasaran tempatan untuk (Ipoh, Johor Bahru, Penang, Melaka dan Seremban). Penemuan kajian menyarankan bahawa, terkecuali Johor, pasaran tempatan yang lain menampilkan darjah jalinan pasaran yang kuat dengan pasaran Kuala Lumpur.

INTRODUCTION

The pig production is an important sub-sector in the livestock industry. In 1991, pork accounted for approximately 40% of the total meat produced in Malaysia with an ex-farm value of live pigs of RM922.58 million or 31% of the total ex-farm value of livestock products. Pig population has increased from 1.843 mn in 1980 to approximately 2.678 mn in 1990, indicating an increase of more

than 50%. Pig production is one of the industries which achieved a rapid growth compared to other sub-sectors in agriculture (Lim 1991).

Despite its rapid growth in production, its marketing system has not shown a similar progress. The system is characterised by a long distribution chain, significant post harvest losses and inefficient market structure (Tan Siew Hoey et al. 1989). The marketing channel of pig depicted in Figure 1 indicates that the product goes through at least three intermediaries before it reaches the consumers. At the farm level, the butchers/dealers purchase the pigs direct from the farms. The price is based on body weight, visual grading of the animals and the prevailing demand for pork. These pigs are transported live to the abattoirs or wholesale markets in cages - often over long distances especially if they are headed for the export markets from farms in the North of the Peninsular. It is during the transportation that weight losses occur and casualty rates are high due to heat stress (Tan Siew Hoey et al. 1989). This situation is even more serious in remote areas where road system is rudimentary (for instance in East Malaysia). Goh and Chew (1986) observed that the marketing of pigs is relatively competitive at the farm level but less so at the retail level. The other major pig marketing issue is the temporal and spatial price relationships. Prices of pig are highly unstable over time (Figure 2) and varies according to location. Besides, there appears to be asymmetric pricing at the market levels. According to Tan Siew Hoey et al. (1989), a fall in the ex-farm price is seldom followed by commensurate fall in the retail prices. Clearly, these observations are suggesting that marketing of pig suffers structural inefficiency particularly in the area of pricing.

In a perfect market, the price differentials in time, place and form would be equivalent to the corresponding differences in costs (Shephard, Futrell and Strain 1976). Prices at any time, therefore would be uniform over geographical areas, plus or minus the cost of getting supply from the deficit area. Few literature is available on the nature of pricing efficiency of the Malaysian pig market. This study aims at providing some empirical analysis on the extent of price integration in the pig market, i.e. the degree to which price formation in one pig market is related to price formation in other regional markets. An integrated market is synonymous with pricing efficiency, that is the prices discovered, as defined by Fama (1970),
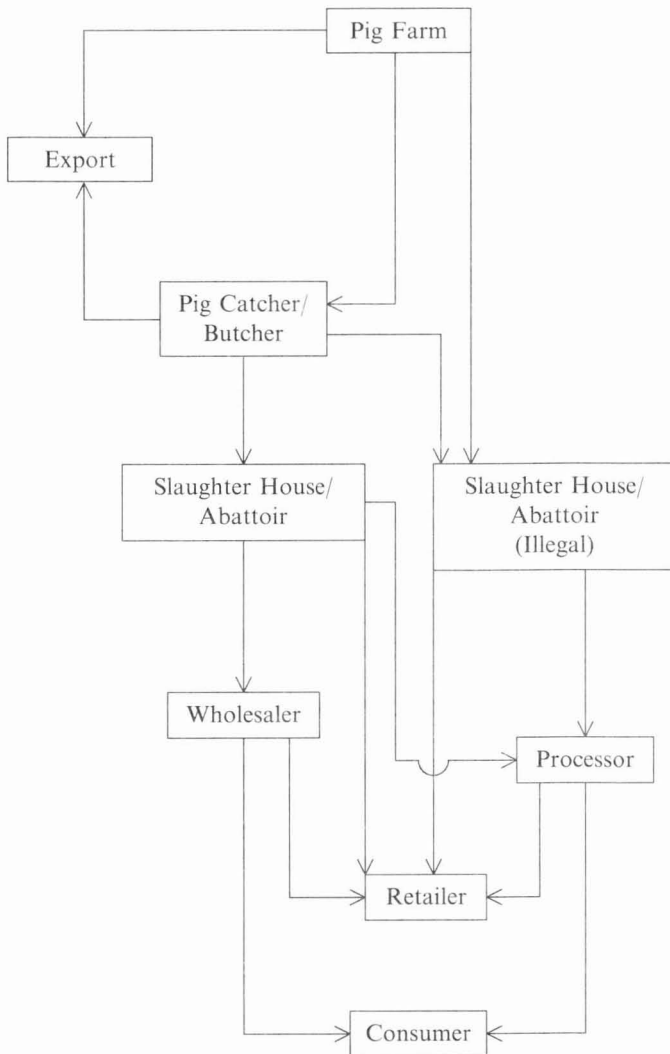
FIGURE 1. Marketing channel for pig
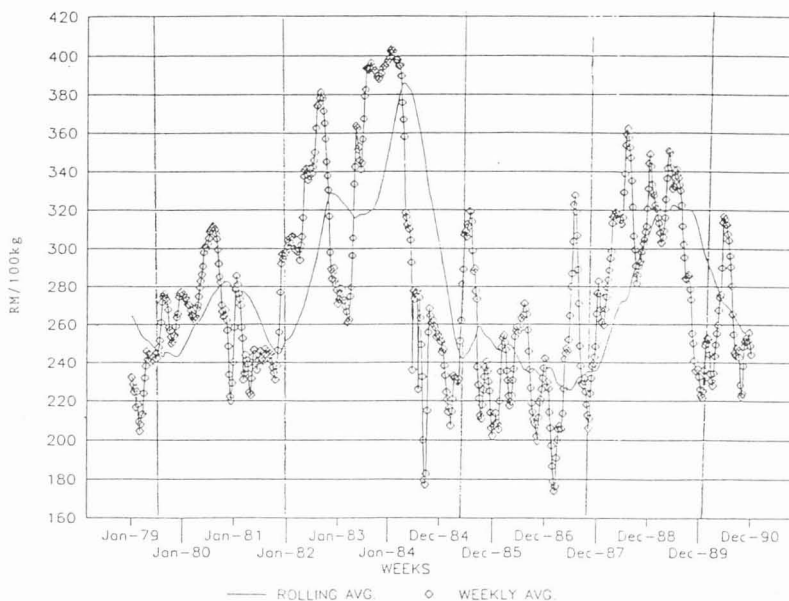*Source*: Department of Veterinary Services

FIGURE 2. Ex-farm monthly prices of live pigs, 1979-90

"should always reflect all information." According to few writers (Ward 1982; Gupta and Mueller 1982, Punyawadee et al. 1991) pricing efficiency reflects a situation where no market is working in isolation and able to exert influences, markets are interdependent with each other, and there exists a smooth price dissemination among traders. Competitive conditions will force the price to adjust instantaneously to any new piece of information so all available information is reflected in prices.

The objective of the study is to examine the pricing efficiency of the pig marketing in Peninsular Malaysia through measuring the degree of market integration. Specifically this paper examines the price linkages between Kuala Lumpur (which is considered the market centre for price discovery) and five major local markets (Ipoh, Johor Bahru, Penang, Malacca and Seremban). This study is hoped to provide some empirical evidence of the nature of price relationship among the selected market centres. This could be used as basic data for an understanding of how specific markets work (Fatimah Mohd. Arshad 1990). This study would also

provide some indications as to the extent of price variations among regions and factors contributing to it.

The paper is organised as follows. The consequent paragraphs discuss the methodology employed in the study. This is followed by the results and discussion in the last few paragraphs.

METHODOLOGY

Pricing efficiency analysis in terms of spatial price differentials allows evaluation of how markets are spatially interrelated by trade. Ravallion (1986) developed a general approach to modelling market integration that attempts to measure the extent to which prices at local markets are influenced by prices elsewhere. In this regard, Ravallion's model starts with the autoregressive distributed lag relationship between each local price of pig and appropriate reference (central) price level. The general equation for this is as follows:

$$\alpha_i (L)P_{it} = \beta_i(L)\overline{P}_t + G_i(L)X_{it} + u_{it} \tag{1}$$

where:

P_{it} = price in local market i at time t
(i = 1,....,m number of local markets)
(t = 1,....,n number of observation)

$\overline{P}_t$ = reference price at time t

X_{it} = vector of seasonal and other relevant variables in local market i at time t

u_{it} = error term

$\alpha_i(L)$, $\beta_i(L)$ and $G_i(L)$ denote polynomials in the lag operator ($L^iP_t = P_{t-i}$), defined as:

$$\alpha_i(L) = 1 - \alpha_{i1} - L\ldots\alpha_{in} L^n$$

$$\beta_i(L) = \beta_{io} + \beta_{i1} L + \ldots + \beta_{im} L^m$$

$$G_i(L) = G_{io} + G_{i1} L + \ldots G_{in} L^n$$

Following Heyten (1986) equation (1) can be expressed so that the dependent variable P_{it} would be the first difference of the local

market price and consequently reducing the equation to one lag each for local and reference market price differential will yield:

$$(P_{it} - P_{it-1}) = (\alpha_i - 1)(P_{it-1} - \overline{P}_{t-1}) + \beta_{io}(\overline{P}_t - \overline{P}_{t-1})$$

$$+(\alpha_i + \beta_{io} + \beta_{i1} - 1)\overline{P}_{t-1} + G_i X + u_{it} \qquad (2)$$

The model summarized by equation (2) specified the local price as a function of the change in the reference price for the same period, last period's spatial price margin, last period's reference market price, and local market characteristics. In this equation, β_{io} measures the extent to which local market participants (wholesalers, retailers and farmers) know the conditions in the reference market quickly enough for local prices to be influenced in the same time period. The term, $(\alpha_i - 1)$, measures the extent to which last period's spatial price differential is reflected in this period's local market price change. For instance, if the margin widened in the last time period, i.e., the central market price rose, and transactions costs remained the same, traders would have an incentive to move the commodity away from the local market to another part of the system, thus pushing up prices in the current time period. Other factors such as seasonal fluctuations in supplies or disruption of communication could dominate local price changes and severe the link with the central market. Finally, the general level of prices in the reference market might provoke price change in the local market (Heyten, 1986).

Thus the specific model for the pig market would be as follows:

$$(P_{it} - P_{it-1}) = (\alpha_i - 1)(P_{it-1} - \overline{P}_{t-1}) + \beta_{io}(\overline{P}_t - \overline{P}_{t-1})$$

$$+(\alpha_i + \beta_{io} + \beta_{i1} - 1)\overline{P}_{t-1} + G_{iv} X_{ivt} + U_{it} \quad (3)$$

Where :

$(P_{it} - P_{it-1})$ = change in the price in market i at time t, (i = 1...5 local markets, and t = 1...120 monthly observations)

$(P_{it-1} - \overline{P}_{t-1})$ = last period's spatial price margin between local market i and Kuala Lumpur (reference market)

$(\overline{P}_t - \overline{P}_{t-1})$ = change in the price in Kuala Lumpur from period t – 1 to period t

$\overline{P}_{t-1}$ =   last period's market price in Kuala Lumpur

X_{ivt} =   monthly volume of pig production in local market i at time t

U_{it} =   error term

$(\alpha_i - 1)$, β_{io}, $(\alpha_i + \beta_{io} + \beta_{i1} - 1)$ and G_{iv} are regression constants which measure the extent to which the respective variables in the equation influence the change in price in the local market i in the same time period t.

Various market relationships can be derived and tested from the above model. This can be done directly by imposing restrictions on the appropriate regression parameters with an F-test:

$$F_{q, n-k} = \frac{(SSE_R - SSE_{UR})/q}{SSE_{UR}/(n - k)} \tag{4}$$

where:

SSE_R	=	sum of squared residual of the restricted model
SSE_{UR}	=	sum of squared residual of the unrestricted model
n	=	number of observations in the series
k	=	number of parameters in the unrestricted series
q	=	difference in the number of parameter between the unrestricted and restricted models

This study tests four main market relationship namely, market segmentation, short run integration, long run integration and absence of local characteristics.

MARKET SEGMENTATION

The hypothesis of market segmentation states that local market i is segmented, that is, changes in the reference market price level will have no effect, immediate or lagged, on prices in each local market, i.e.

$$\beta_{io} = \beta_{i1} = 0 \tag{5}$$

Hence, the restricted model for market segmentation becomes:

$$(P_{it} - P_{it-1}) = (\alpha_i - 1)(P_{it-1}) + G_{iv}X_{ivt} + U_{it} \tag{6}$$

The acceptance of equation (4) suggest that the price in local market i depends only on its own lagged values and local market characteristics specified in the restricted model. In functional form:

$$P_i = f\,(P_{it-1},\ X_i) \tag{7}$$

SHORT-RUN INTEGRATION

The short-run integration hypothesis states that the price changes in reference market (Kuala Lumpur) is immediately and fully reflected in the local price level in each market i.e.

$$\beta_{io} = 1,\ \beta_i(L) = 1 \tag{8}$$

The hypothesis also requires that there be no lagged effects on prices in the future such that:

$$\alpha_i = 0 \text{ implying that } (\alpha_i - 1) = -1 \tag{9}$$

The restricted model, therefore, for short-run market integration becomes :

$$(P_{it} - P_{it-1}) = (\overline{P}_t - \overline{P}_{t-1}) + G_{iv}X_{ivt} + U_{it} \tag{10}$$

The acceptance of equation (10) suggests that the price in local market i is influenced bythe current period's reference market price change, and the various local market characteristics stated in the above model. In functional form:

$$\overline{P}_{it} = f\,(P_t,\ X_i)$$

LONG-RUN INTEGRATION

The hypothesis of long-run integration states that prices in reference market (Kuala Lumpur) and any one of the local market are constant over time, that is, undisturbed by any local stochastic effects. Hence, $P_{it} = P^*_t$; $P_t = P^*$, and $e_{it} = 0$ for all t, where P^*_i and P^* denotes the equilibrium price in the local market and central market, respectively. This condition implies that:

$$\alpha_{ij} + \beta_{ij} = 1 \qquad (j = 0 \ldots n)$$

The restricted model for long-run integration therefore, becomes :

$$(P_{it} - P_{it-1}) = (\alpha_i - 1)(P_{it-1} - \overline{P}_{t-1}) + \beta_{io}$$

$$(\overline{P}_t - \overline{P}_{t-1}) + G_{iv}X_{ivt} + U_{it} \tag{11}$$

If F-test is insignificant, the acceptance of equation (11) suggests that the price in local market i is influenced by the last periods spatial price differential, the current price change in the central market and the local market characteristics stated in the model. In functional form:

$$P_{it} = f(\overline{P}_{t-1}, \overline{P}_t, P_{it-1})$$

ABSENCE OF LOCAL CHARACTERISTICS

In the same manner, the hypothesis that the vector of local market i characteristics do not significantly influence prices in market i that is $G_i = 0$ will be tested using the restricted model shown below:

$$(P_{it} - P_{it-1}) = G_o + (\alpha_i - 1)(P_{it-1} - \overline{P}_{t-1}) + \beta_{io}$$

$$(P_t - \overline{P}_{t-1}) + (\alpha_i + \beta_{io} + \beta_{il} - 1) + U_{it} \tag{12}$$

Acceptance of equation (12) using F-test suggest price changes in local market i are independent of the local market characteristics such as seasonality, and changes in the monthly volume of production. Hence, acceptance of equation (12) also suggest different seasonality between the local market i and the central market. In functional form, the relationship would be:

$$P_{it} = f(P_{it-1}, \overline{P}_{t-1}) \tag{13}$$

This suggests that the local market i is integrated with the central market although the extent to which these price series affects the formation of the local price level will depend on the magnitude of the respective regression coefficients.

MEASURES OF INTEGRATION

Index of Market Connection (IMC) For integrated markets, the relative magnitude of the effects of the central market and the local price series on price formation in the current period will be measured using the Index of Market Connection (IMC) proposed by Timmers (1974). The index is a ratio of the lagged local market coefficient to the lagged reference market coefficient.

$$IMC_i = \frac{1 + b_1}{b_3 - b_1} \tag{14}$$

where:

b_1 $=$ $\alpha_i - 1$

b_3 $=$ $\alpha_i + \beta_{io} + \beta_{i1} - 1$

IMC_i $=$ index of market connection between market and central market ($i = 1,...5$ local markets)

The IMC suggests that the closer the index is to zero, the greater the degree of integration between the local market i and the central market in one time period. Timmers also considers that an IMC of less than 1 reflects a high degree of market integration in the short-run. On the other hand, market segmentation exists when of IMC approach infinity, $IMC = \infty$.

Index of Market Linkage (IML) A modified form of the called the Index of Market Linkage (IML) was proposed and applied by Ishak (1988). IML measures the relative contribution of the lagged effects of reference prices to the lagged effects in the determination of current prices in the local market. The index can be obtained by:

$$IML = \frac{(b_3 - b_1)}{(1 + b_1) + (b_3 - b_1)} = \frac{(b_3 - b_1)}{(1 + b_3)} \tag{15}$$

In contrast to IMC, the IML takes the value of 1 when markets are perfectly linked to each other since $(1 + b_1) = 0$. IML equals 0 when there is complete absence of integration since $(b3 - b1) = 0$. Hence, the value of IML ranges from 0 to 1 where within these limits, the higher the value of the index, the higher the degree of market linkage.

DATA

This study utilises secondary data on pig prices and production for the six market centres mentioned earlier. Monthly data on ex-farm prices for the period of 1981 - 1990 (120 months) in each market were collected from Federal Agricultural Marketing Authority (FAMA) and Federation of Livestock Farmer Association of Malaysia (FLFAM).

Time series data of pig production in each producing area are obtained from the various reports and bulletins available in Department of Veterinary Services (DVS), Ministry of Agriculture and Federal Livestock Farmer Association Malaysia (FLFAM).

RESULTS AND DISCUSSION

Determinants of Price Differential Prices in Kuala Lumpur are taken to represent the "reference" market price because of the city's importance as a consuming centre and the high correlations of its prices with those local markets (Table 1). All prices are specified in actual form. An intercept term is to capture overall differences in price levels between the major cities and market towns reflecting the varying distances that live pig had to be transported.

Result of estimating the relationship between the central market and any one of the local markets defined in equation 3 are shown in Table 2. For all local markets, the last period's period's price differential between the central market and local markets, denoted as $(P_{it-1} - P_{t-1})$, significantly affect ex-farm price changes in the markets. Besides, all of the coefficients for $(P_{it-1} - P_{t-1})$ have negative signs. This implies that a decrease in the last period's spatial price differential is associated with an increase in the local price changes. This finding seems plausible as decreases in spatial price differentials would be a disincentive to farmers or traders to dispose their goods to the central market, especially if local price changes seems to increase compared with last period's local price level. On the other hand, if the margin widened as a result of price increase while transactions costs remained the same, this would motivate traders to sell in the central market.

Since the coefficient of $(\alpha_i - 1)$ measures the extent to which last period's spatial price differential is reflected in the current period's local price change, examination of the magnitude of the coefficients

TABLE 1. Actual Price in Selected Pig Producing and Consumption
Centres. Peninsular Malaysia, 1981-1990

	Local Markets				
	Penang	Ipoh	Seremban	Melaka	Johor Bahru
Distance to K.L. (km)	395	217	68	148	367
Ex-farm Price Series					
Average price (RM/kg)	2.797	2.753	2.772	2.781	3.052
Mean monthly price differential[1]	-0.037	-0.078	-0.059	-0.050	0.218
Standard deviation of price differential	0.180	0.136	0.053	0.119	1.173
Simple correlation of price with K.L.	0.947	0.971	0.996	0.977	0.956

[1]Compared using formula $[\sum (P_{it} - \overline{P}_t)]/n$ Coefficients with negative signs suggest that $\overline{P}_t$ is generally higher than P_{it}. P_{it} is the price in the local market while $\overline{P}_t$ is the price in the Kuala Lumpur.

indicate a strong lingkage between Melaka and Kuala Lumpur. For instance, one percent decrease in the last period's spatial price changes between Melaka and Kuala Lumpur is associated with a proportionate 0.957 percent increase in the ex-farm price changes in Melaka. In the same manner, a proportionate decrease in (α_i-1) value is associated with about 0.65 percentage increase in local ex-farm price changes for Seremban. A smaller price changes of 0.404 was recorded for Johor Bahru.

Similarly, the coefficient of (βio) measures the extent to which local market participants are aware of the conditions in the central and make the necessary response within the same time period. This study shows that price changes in the central market significantly affect the localprice changes. For instance, one percent increase in the central market price will lead to 0.987 percent increase in

TABLE 2. Determinants of Price Differentials in Selected Pig Producing Centres with
Reference to Prices in Kuala Lumpur, Peninsular Malaysia, 1981-1990

	Penang	Ipoh	Seremban	Melaka	J. Bahru
C	0.146	-0.128	-0.053	-0.117	0.036
	(1.248)	(-1.388)	(-1.007)	(-0.931)	(0.533)
$P_{it-1} - \overline{P}_{t-1}$	-0.45	-0.434	-0.650	-0.957	-0.404
	(-6.490)***	(-6.332)***	(-7.545)***	(-10.707)***	(6.682)***
$P_t - \overline{P}_{t-1}$	-0.746	0.847	0.987	0.865	0.687
	(15.850)***	(24.017)	(56.115)***	(20.772)***	(23.555)***
$\overline{P}_{t-1}$	-0.009	0.040	0.014	0.007	-0.033
	(-0.364)	(2.198)**	(1.568)	(0.327)	(-1.857)
X_i	-0.00014	-0.00001	-0.00005	0.00013	0.00013
	(-1.782)	(-0.290)	(-0.669)	(0.521)	(3.420)***
R^2	0.734	0.864	0.968	0.836	0.857
IMC	1.242	1.194	0.527	0.045	1.606
IML	0.446	0.456	0.655	0.957	0.384

*** Significant at 1% level
** Significant at 5% level
Figures in parentheses are t-values

Seremban price. This result seems plausible because the local market has to adjust to increases in the price level in the central market so that it can compete for the supply of pig marketed by the local traders. Otherwise, most if not all of the production in the local markets would be traded in the central as long as prices in the central market is higher than the local.

LEVEL OF INTEGRATION

The Indices for Market Connection (IMC) and Market Linkage (IML) suggest that the highest level of market linkage prevail between Kuala Lumpur and Melaka, with IMC is 0.045 and IML is 0.957. Seremban which is the largest producer of live pigs in recent years ranks second with IMC is 0.527 and IML is 0.655 (Table 3). Despite its proximity to the central market, Seremban shows a lower level of market linkage compares to Melaka. This may due to the fact that most of the pigs in Seremban are marketed to the southern part of Peninsular, including Singapore, which offer a higher market price. Compares to Seremban, Melaka has less established commercial farms. The local producers have difficulty in complying to specific requirements by the Singapore veterinary authority. However, its geographical proximity to the central market (next to Seremban) and the accessibility of transport facilities justify the stronger relationship between these two markets.

Ipoh ranks third with IMC at 1.194 and IML 0.456. This is followed closely by Penang with IMC and IML 1.242 and 0.446 respectively. The findings seem logical since Ipoh is nearer to Kuala Lumpur compared to Penang (Table 1). In other words, Ipoh exhibits stronger market linkage with Kuala Lumpur. In addition, there are possibilities that Penang trades with other local markets in the southern part of northern Peninsular such as Kedah and Perlis.

The standard deviation of price differential with the central market also shows realistic situation, i.e., the nearer the distance to the central market, the lower deviation of price differential observed. For instance, since the distance between Kuala Lumpur and Ipoh (217 km) is shorter than the distance between Kuala Lumpur to Penang (395 km), therefore it is expected that the standard deviation of price differential of Ipoh is lower than that of Penang (Table 1).

TABLE 3. F-values used in the determination of market relationships between Kuala Lumpur and selected pig producing centres, Peninsular Malaysia, 1981-1990

Hypothesis	Penang	Ipoh	Seremban	Melaka	J. Bahru
Market Segmentation	144.467***	340.551***	1625.562***	272.146***	323.589***
Market Integration 1. Short-run	21.940***	23.687***	28.947***	58.534***	25.748***
2. Long-run	0.134	4.873**	2.481	0.108	3.477
Absence of Local Market Characteristics	3.203	0.085	0.452	0.274	11.798***

*** Significant at 1% level
** Significant at 5% level

As expected, Johor Bahru exhibits the weakest market lingkage with Kuala Lumpur with IMC of 1.606 and IML of 0.384. These findings suggest that firstly, the long distance between Johor Bahru and Kuala Lumpur results in spatial separation of two markets. Secondly, the generally high prices of live pigs in Johor Bahru make this city as an expensive source for supply for other regions particularly Kuala Lumpur. Besides, Johor's proximity to Singapore encourages export of live pigs to this country. The strong demand from Singapore also encourages traders to source their supplies either form local as well as imports live pigs from other states both for internal consumption and exports.

TYPES OF MARKET RELATIONSHIPS

The hypothesis of segmentation has been rejected since the computed F-values all significantly greater than the tabular value of F_q, n – k equal to 4.79 at 1 percent level of significance. The rejection of segmentation implies that central market prices influence prices in all of the local markets (Table 3).

While the hypothesis of local market segmentation is universally rejected, so is full short-run integration. This implies that not one of the local markets is integrated with the central market within a time period, that is one month period in this study. In other words, prices in the local market may require more than one month to adjust to the central market price.

The failure of the short-run process of price adjustment from the central market to any of the regional markets may be attributed to the characteristics of the pig distribution system itself and to the status of infrastructure and price information facilities existing in the country. Transfer of price information likewise is subjected to delays due to these barriers. As a results, price adjustment in the local markets does not tend to be fully influenced by the central market.

Despite the absence of short-run integration, the hypothesis of market integration in the long-run are almost accepted for all local markets exclusive of Ipoh. The computed F-values ranged 0.108 in the case of Melaka to 4.873 for Ipoh while the tabular value of F_q, n – k is equal to 3.92 at 5 percent level. The acceptance of long-run integration suggests that although the short-run process of price

adjustment described by the model is not consistent with an equilibrium in which a unit increase in the central market is passed on fully to local prices within one time period, on equilibrium price between the two markets which remains constant over time, can be attained over a longer period of time. In this case, the model does not delimit the period covered by the long-run process except that it exceeded one month time period.

The hypothesis of absence of local market characteristics are accepted in Penang, Ipoh, Seremban and Melaka since the computed F-values are all smaller than the tabular value of F_q, $n-k$ equals to 3.92 at 5 percent level of significance. These findings tend to imply that localseasonality or changes in the non-price characteristics is not evident in these local markets. For example, changes in the volume of pig production in Ipoh, does not reflect the functional relationship between Kuala Lumpur and Ipoh since the computed value of F is only 0.085 while F_q, n-k equals 3.92. Therefore sudden changes in the volume of pig production do not affect the market relationships prevailing between the central market and the local market. Nevertheless, this hypothesis cannot be accepted in Johor Bahru.

The rejection of segmentation confirms with the conclusion derived from the acceptance of long-run integration despite the absence of short-run integration. In most cases, short-run relationships do not prevail especially for spatially separated markets where barriers on transfer of price information persist. Thus the autoregressive model served to identify the existence of long-run integration between the central market and all of the regional markets considered in the study. However, the process of price adjustment may take place in a longer time period such that unit increase in the central price is passed on fully in local prices.

CONCLUSION

The purpose of this study is to examine the pricing efficiency of the pig marketing in Peninsular Malaysia through measuring the degree of market integration. Based on the results of the Ravallion model, it is shown that the last period's price differential between the central market and the regional market significantly affect ex-farm price changes in the regional market. The negative coefficients imply

an inverse relationship between last period's spatial price differential and ex-farm price changes in the local market, while the magnitude of these estimated coefficients indicate the stronger linkage between Melaka and Kuala Lumpur.

The IMC and IML also suggest that highest levels of market linkage prevail between Melaka and Kuala Lumpur. Seremban, the largest producer of live pigs among the regional markets studied, ranks second followed by Ipoh and Penang. Johor Bahru exhibits the weakest linkage with Kuala Lumpur which could be traced to its distance to Kuala Lumpur coupled with the possibilities that it is one of the major suppliers of live pigs to Singapore.

The hypothesis of market segmentation was rejected for all markets suggesting that central market prices influenced prices in all of the local markets. The hypothesis of short-run integration were likewise rejected while market integration in the long-run were accepted for all local markets, except Ipoh at 5 percent level of significance. These suggest that although the short-run process of price adjustment described by the model is not passed on fully to local prices within one month, an equilibrium price between the two markets which remain constant over time, can be attained over a longer period of time.

The acceptance of the hypothesis of absence of local market characteristics for all the markets (except Johor Bahru) imply that local seasonality, specifically, changes in the volume of pig production, do not significantly affect the market relationship prevailing between the central market and any one of the local markets.

Compared with Seremban and Melaka, Penang, Ipoh and Johor Bahru showed a lower level of integration. This suggests that price changes in Kuala Lumpur is not fully passed on to these local markets, and vice versa, at the shortest time period so that an equilibrium price could be achieved. Regional price differences between Kuala Lumpur and any one of the local markets do not only represent the transport cost and other marketing cost incurred by moving the productbetween the two markets. Price differences in excess of transport and other marketing costs are reflective of the presence of non-economic profit that may accrue to market intermediaries. This happens when information regarding price difference were used profitably by a few traders who are equipped with adequate price information.

The results of Ravalion's autoregressive distributed lag modelling as test of market relationship lead to a conclusion that generally the pig marketing system in Peninsular Malaysia is moderately integrated. Hence, marketing policies and regulations should be geared at attaining higher level of integration, specifically between production and consumption centers. Price and other relevant market information in the consumption centers should be made available to the producers in the local markets so that production and slaughtering would be consistent with market conditions. This will require very close liaison, and precise coordination and cooperation between the producers, marketing intermediaries and the consumer.

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