Chapter 4

DESCRIPTION OF RESEARCH AND ANALYTICAL METHODS

4.1 Introduction

The procedures used in the research are discussed in this chapter. Firstly, the model of market integration which was employed by Heytens (1986) and Ravallion (1986) is discussed. Secondly, the functional form of the model, data and general problems in the model are detailed. Finally, the testing of the model and hypotheses, and estimation of the model are discussed.

4.2 The Model

A model can be defined as 'a formalised presentation of ideas or of a certain amount of knowledge about a specific phenomenon' (Malinvaud in Schilderinck 1977, p. 2). Reynolds (1977, p. 50) states that the model is the set of structures, which a set of economic facts is believed to generate, that are compatible with prior assumptions about the statistical inverse from which data are drawn. There are numerous definitions of the model by other authors. All these definitions of a model are characterised by a number of common elements, such as: the assumption of knowledge of an empirical nature; the possibility of making a hypothesis; the simplification of a complex reality to a comprehensive system of fundamental relations; and a mathematical method of presenting a hypothesis made about the assumed relations (Schilderinck 1977, p.2).

The measurement of price integration is undertaken using the concept of market integration which was adopted by Ravallion (1986) and

Heytens (1986). The market integration model was constructed in 1985 by Ravallion, and Timmer (1985) (in Heytens 1986) improved the model. Heytens (1986) provided a broader interpretation for examining questions relating to market integration.

The market integration model can be employed to measure the extent to which local prices are influenced by prices elsewhere (Ravallion 1986). In the beginning, one postulates an autoregressive distributed lag relationship between each local price of a commodity and an appropriate reference price level (either some set of national prices or the price at a central location or a set of locations) (Heytens 1986). The structure of the model is presented below (Heytens 1986, pp. 27-30).

$$\alpha_i(L)P_{it} = \beta_i(L)P^{*}_{t} + \delta_{-i}(L)X^{*}_{-it} + \mu_{it} \qquad (1)$$

$$(i = 1,2,...,k)$$

$$(t = 1,2,....n)$$

Where:

P_{it} = Price in market i at time t;

P^{*}_{t} = Reference price at time t;

X^{*} = Vector of seasonal and other relevant variables in market i at time t (with the same collection of variables used in all vector X^{*}_{-it}, over all markets and all time periods); and

μ_{it} = an error term.

$\alpha_i(L)$, $\beta_i(L)$ and $\delta_i(L)$ denote polynomials in the lag operator ($L^{i}P_t = P_{t-1}$), defined as:

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

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

$$\delta_i(L) = \delta_{io} + \delta_{i1}L + \ldots + \delta_{in}L^n$$

Because equation 1 lacks a proper dependent variable for econometric estimation, to be of use empirically, the equation must be re-specified. Equation 1 will be rewritten with the difference of the local market as the dependent variable, where $\Delta P_t = P_t - P_{t-1}$ and Δ^i as the spatial price differential, i.e., $\Delta^i = P_{it} - P^*_t$. For the $n \leq m$ case, equation 1 becomes:

$$\Delta P_{it} = [(\sum_{j=1}^{n} \alpha_{ij}L^j)]\, \Delta^i P_t + \sum_{j=0}^{m-1} (\sum_{k=0}^{j} \alpha_{ik} + \sum_{k=0}^{j} \beta_{ik} - 1)L^j \Delta P^*_t$$

$$+ (\sum_{j=1}^{n} \alpha_{aij} + \sum_{j=0}^{m} \beta_{ij} - 1)P^*_{t-1} + \delta_{-i-}(L)X^* + \mu_{it} \qquad (2)$$

where $\beta_{io} = 1$. Equation 1 can be arranged to display the current period's price change as a distributed lag of past years' spatial and temporal price differentials. The price variables can be defined in either absolute or logarithmic terms, making the Δs either absolute or percentage price changes. Intuition and ease of calculation are aided by reducing it to one lag each for local and reference market price differences (n=m=1).

$$\Delta P_{it} = (\alpha_{i1}L - L)\, \Delta^i P_t + \beta_{io}\Delta P^*_t + (\alpha_{i1} + \beta_{io} + \beta_{i1} - 1)P^*_{t-1}$$

$$+ \delta_{-i-}X^* + \mu_{it} \qquad (3)$$

Removing the Δs, equation 3 reduces to:

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

$$+ (\alpha_i + \beta_{io} + \beta_{i1} - 1)\, P^*_{t-1} + \delta_{-i-}X^* + \mu_{it} \qquad (4)$$

Equation 4 can also be arranged to yield an indirect but more stable and general indicator of market integration. To this end, it is helpful to simplify the coefficients in equation 4 thus:

$$\alpha_i - 1 = b_1$$

$$\beta_{io} = b_2$$

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

$$\delta_{-i-} = b_{-4-}$$

so:

$$(P_{it} - P_{it-1}) = b_1\,(P_{it-1} - P^*_{t-1}) + b_2\,(P^*_t - P^*_{t-1})$$

$$+ b_3 P^*_{t-1} + b_{-4-}X^* + \mu_{it} \qquad (5)$$

and then to reorder the variables :

$$P_{it} = (1 + b_1)P_{it-1} + b_2(P^*_t - P^*_{t-1}) + (b_3 - b_1)P^*_{t-1}$$

$$+ b_{-4-}X^* + \mu_{it} \qquad (6)$$

From equation 4, the change in local price as a function of the change in the reference price for the same period, the last period's spatial price margin, the last period's reference market price, and the local market characteristics can all be explained. Furthermore, β_{io} measures the extent to which local market participants, i.e., wholesalers, retailers and farmers, know the conditions in the reference market quickly enough for local prices to be influenced in the same period. $(\alpha_i - 1)$ measures the extent to which the last period's spatial price differential is reflected in this period's local price change.

Equation 4 can be used to test some general hypotheses, i.e., market segmentation, short-run market integration and long-run market integration (Ravallion 1986). Market segmentation means that central market prices do not influence prices in the i^{th} local market, if $\beta_{io} = \beta_{i1} = 0$. Short-run market integration means that a price increase in the central market will be immediately passed on in the ith market price, if $\beta_{io} = 1$ and $\beta_i(L) = 1$, so $\beta_{i1} = 0$.

Long-run market equilibrium means that market prices are constant over time and undisturbed by any local stochastic. If the reference market is in long-run equilibrium, so $P^*_t - P^*_{t-1} = 0$ and also $b_{-4-} = 0$, then $(1 + b_1)$ and $(b_3 - b_1)$ remain, and reflect, respectively, the relative contribution of local reference market history to the formation of the current local price level.

Timmer (in Heytens 1986) constructed an index of market connection (IMC) which he defined as the ratio of the lagged local market coefficient to the lagged reference market coefficient as stated below.

$$IMC = \frac{1 + b_1}{b_3 - b_1}$$

If Ravallion's hypothesis that the short-run integration is substantial is accepted, then $b_1 = 1$ and IMC = 0. Furthermore, if Ravallion's hypothesis that market segmentation exists is accepted, then b_1 and b_3 are equal and IMC = ∞. Based on those specifications, b_1 is between 0 and -1 under normal conditions, and the index is normally positive. In general, the closer the index of market connection (IMC) is to 0, the greater the degree of market integration.

4.3 The Functional Form of the Model and the Choice of an Estimation Technique

In section 4.2 above, it was shown that the model has three specified equations, i.e., equations 4, 5 and 6. Heytens (1986) used equation 4 as the specified model in order to keep interpretation and estimation simple. Before he used equation 4, he calculated price correlation between local and reference markets. If the price correlation was high, it was expected the IMC would be high.

The price variables can be defined in either absolute or logarithmic terms. In this case, the decision to use logged or actual price is made on a priori grounds (Heytens 1986). Marketing costs can be calculated either as fixed per unit of volume or ad valorem in nature. Actual costs typically comprise a number of factors (like transport, finance and storage). Therefore, their overall nature is difficult to determine. Both Ravallion and Heytens chose to estimate the model in logarithmic terms. The preliminary work of Heytens suggests that the data in percentage relations are the more accurate conceptualisation; however, the same quantitative results were obtained either in logarithmic or absolute terms. Equation 6 was adopted as the specified model in this study and was estimated in absolute forms.

4.4 Data and General Problems in the Model

4.4.1 The data

The research was conducted in two consumer markets and several producer markets based on the definitions in sections 1.6.1 and 1.6.2 above. Based on the definitions of reference and producer markets in section 4.2 above, the consumer markets can be seen as the reference markets and the producer markets as the local markets in the marketing system of vegetables.

With the availability of appropriate data, potatoes were studied in two reference markets (Jakarta and Bandung) and three local markets (Pangalengan, Cikajang and Ciwidey) over the period 1986-1988. Cabbages were studied in two reference markets (similar to potatoes) and four local markets (Pangalengan, Cikajang, Cipanas and Lembang) during 1987-1988. In Figure 4.1, the flow of commodities, from local markets to the reference markets in West Java can be seen.

Local characteristics, such as quantity of transaction and transportation costs, should be taken into account in the model. Transportation costs between local and reference markets can be seen in Table 3.6. Transportation costs appear to differ only on the basis of distance. Moreover, the government regulates the transportation costs, particularly for the large capacity truck. Therefore, the contribution of the transportation costs in the model is probably not very important.

It has been argued that the relationship between the price and quantity is very close, especially for a product which has a significant fluctuation in the production system. Heytens (1986) found that the dummy variables of processed cassava were not significant in the model, but they were significant for yam. Therefore, the quantity probably is very important in the model. However, the data of the daily quantity of the potatoes and cabbages sold through the markets are not available. Due to the availability of the data, it is assumed that there is absence

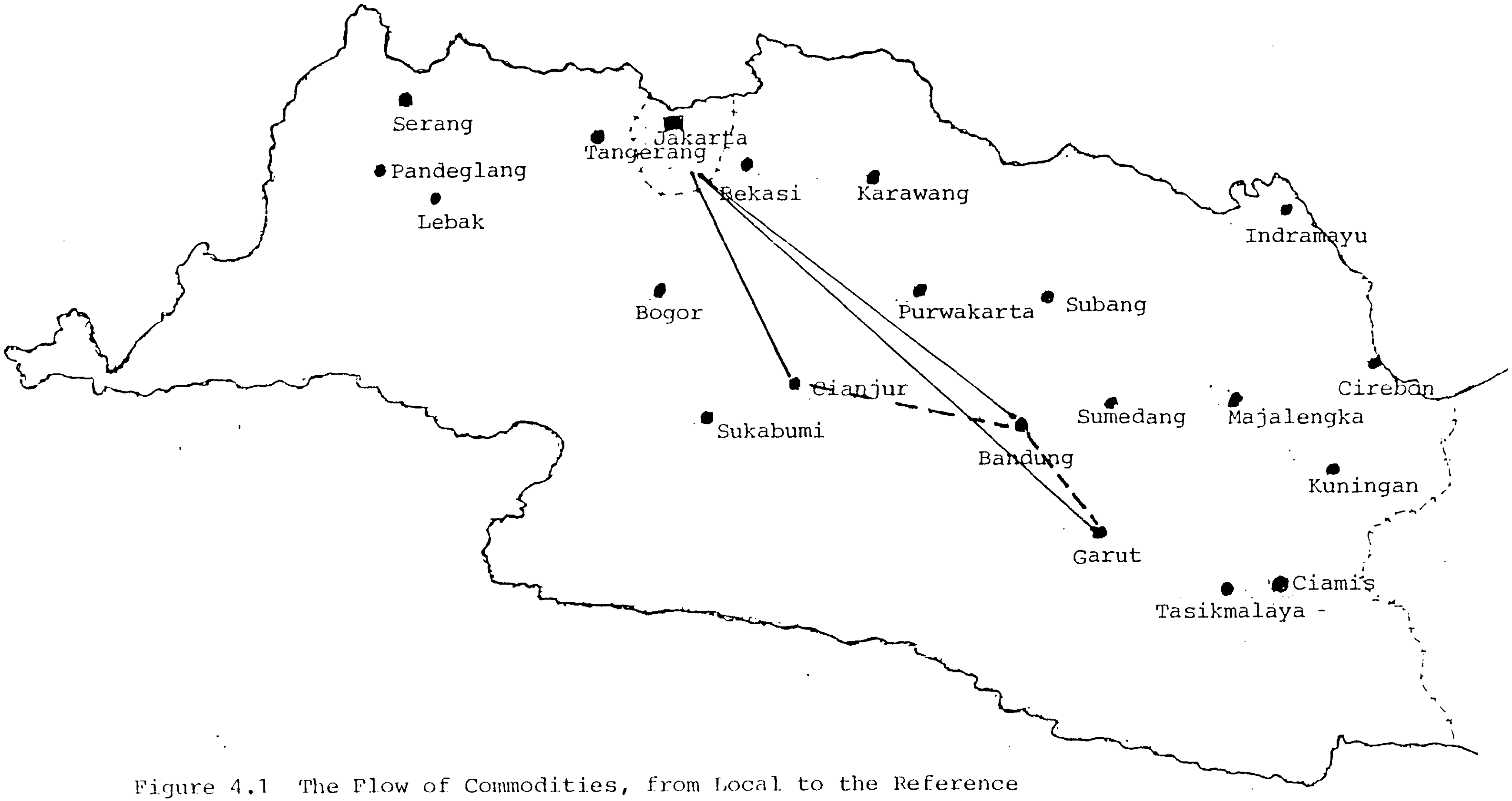

Figure 4.1 The Flow of Commodities, from Local to the Reference Markets in West Java

Notes : ____________ from local markets to the reference market of Jakarta

------------- from local markets to the reference market of Bandung of local characteristics, i.e., ($b_{-4-} = 0$). Thus equation 6 becomes:

$$P_{it} = (1 + b_1)\ P_{it-1} + b_2\ (P^{*}_{t} - P^{*}_{t-1}) + (b_3 - b_1)\ P^{*}_{t-1} + \ddot{U}_{it} \quad (7)$$

and, rearranging:

$$P_{it} = \beta_1 P_{it-1} + \beta_2 (P^{*}_{t} - P^{*}_{t-1}) + \beta_3 P^{*}_{t-1} + \ddot{U}_{it} \quad (8)$$

4.4.2 Data preparation

As mentioned in section 4.4.1 above, the analysis was undertaken in two reference markets, i.e., Jakarta and Bandung. The local markets which are connected to the reference market in Jakarta are Pangalengan, Ciwidey and Cikajang (for potatoes) and Pangalengan, Lembang, Cipanas and Cikajang (for cabbages). The local markets which are connected to the reference market in Bandung are the same markets connected to the reference market in Jakarta (see Figure 4.1).

The number of observations during the period of the study is not similar for all those markets. The data exist in one or two of the markets, but not for others. This is called a missing observation. The missing observations occurred because of insufficient information (below five wholesalers) on the day the price was reported. To overcome this problem, the missing observations were predicted using regression as described below.

Let us concentrate on potatoes which used data from Jakarta, Bandung, Pangalengan, Ciwidey and Cikajang. In this discussion, they are called X, Y, A, B and C, respectively. If X or Y did not exist, or A, B, and C did not exist (at the same time), the observation was dropped from the regression. However, if one or two of A, B and C did not exist, they will be predicted by a regression.

If the datum A did not exist, it will be predicted by the regression:

A = f (B, C).

If the R square and F test of the regression were satisfied, A was predicted by using the regression. The same procedure was used if B or C did not exist. Moreover, if two of the three markets did not exist, for example, A and B, they were predicted using the regression :

A = f (C); and B = f (C).

If the R square and F test of the regression were satisfied, A and B were predicted. The same procedure was used if observations for two other markets did not exist.

The number of missing observations for every case can be seen in Table 4.1. From the table, for potatoes, it can be seen that Ciwidey only had 99 missing observations (11.2 per cent of the total sample), followed by Pangalengan, 37 (or 4.2 per cent) and Cikajang, 25 (or 2.8 per cent). The number of times there were missing observations in two markets varied between 2 and 13 (0.2 and 1.5 per cent). On 12 occasions observations were missing in all three markets, in Pangalengan, Ciwidey and Cikajang and they will be dropped in the regression.

For cabbages, observations were missing for Pangalengan only, 40 times (6.7 per cent), followed by Cipanas, 24 (or 4.0 per cent), Lembang, 16 (or 2.7 per cent) and Cikajang, 15 (or 2.5 per cent). There are observations missing in two markets between 1 and 8 (0.2 and 1.4 per cent) and missing in all four markets, Pangalengan, Ciwidey, Cipanas and Cikajang 11 times (1.9 per cent). None were missing in three markets.

The regressions which were used to predict the missing observations can be seen in Appendix 13. From the appendix, it can be seen that the R squared values were between 0.85 and 0.93, and all F tests are significant at the 1 per cent level. Based on those criteria, the

Table 4.1

The Number of Missing Observations for Every Cases for Potatoes and Cabbages

Commodity/ Case	Number of Missing	Percent- age	Notes
Potatoes (n=887)			
Pangalengan	37	4.17	
Ciwidey	99	11.16	
Cikajang	25	2.82	
Pangalengan & Ciwidey	13	1.47	
Pangalengan & Cikajang	2	0.23	
Ciwidey & Cikajang	8	0.90	
Pangalengan, Ciwidey & Cikajang	12	1.35	They will be dropped
Cabbages (n=594)			
Pangalengan	40	6.73	
Lembang	16	2.69	
Cipanas	24	4.04	
Cikajang	15	2.53	
Pangalengan & Lembang	1	0.17	
Pangalengan & Cipanas	8	1.35	
Pangalengan & Cikajang	2	0.34	
Lembang & Cipanas	1	0.17	
Cipanas & Cikajang	1	0.17	
Pangalengan, Lembang, Cipanas & Cikajang	11	1.85	They will be dropped

regressions were used to predict the missing observations in the data set.

4.4.3 General problems in the model

Time series data (daily prices) for 2 and 3 years for cabbages and potatoes, respectively, were used to estimate the model.

There are five assumptions in the classical linear regression, i.e., the dependent variables can be calculated as a linear function of a specific set of independent variables; the expected value of the disturbance terms is zero; the disturbance terms all have the same variance and are not correlated with one another; the observations on independent variables can be considered fixed in repeated samples; and the number of observations is greater than the number of independent variables and there are no linear relationships between the independent variables (Kennedy 1985, pp. 41-42).

All the basic assumptions of the classical linear regression above can be applied in the model, except for the assumption that the disturbance terms all are not correlated, and the assumption that the observations or independent variables can be considered fixed in repeated samples, i.e., it is possible to repeat the sample with the same independent variable.

The first exception can be understood because the model will use time series data. The problem here is called an autocorrelated error (the disturbances are correlated with one another). The second exception can also be understood because the model will use a lagged value of the dependent variables. The problem here is called autoregression. If the model is an autoregression model, it will be also an autocorrelation model. The autocorrelation disturbance can be evaluated by using the ρ value and the autoregression model can be evaluated by using Durbin's h statistic value (Kennedy 1985, Koutsoyiannis 1973, Judge et al. 1985 and 1988, and Doran and Guise

1984).

4.5 Testing the Model and Hypothesis

4.5.1 Testing the model

The suitability of the model can be evaluated by using R square and F test criteria. Firstly, the model will be estimated by using the OLS (ordinary least squares) method. Based on the results, adjusted R square, F calculated and Durbin's h statistics will be found. Acceptance of the model will be based largely on the values of these calculated statistics.

When the OLS is applied to a model with an autocorrelation disturbance, there are two main effects (Doran and Guise 1984, and Pokorny 1987). There is a loss of efficiency (the larger the absolute value of ρ the greater will be the loss efficiency); and if there is positive autocorrelation (and this nearly always happens when dealing with economic data) then the standard errors of the $\hat{\beta}$s will be biased downwards. ρ will arise when the autocorrelation exists and it is defined as below (Doran and Guise 1984, pp. 203-04) below:

$$u_t = \rho u_{t-1} + v_t$$

where:

(a) u_t = an error term of an autocorrelated regression;

(b) ρ is a constant such that $-1 < \rho < 1$;

(c) V_t is a random variable having the properties, $E(v_t) = 0$, $E(v^2{}_t) = \delta^2 v$, and $E(v_t\ v_s) = 0\ (s \neq t)$; and

(d) $E(v_t\ u_{t-s}) = 0$ for all s and t.

To overcome the problem of autocorrelation above, it will be assumed that the ρ is known (although in practice this is never the case). OLS is then used on the new model to produce estimators of the ßs which are BLUE (Best Linear Unbiased Estimator) (Doran and Guise 1984 and Koutsoyiannis 1973). Suppose that:

$$Y_t = \beta_o + \beta_1 X_{1t} + \dots + \beta_k X_{kt} + \mu_t \qquad (9)$$

Where μ_t is generated by the first-order Markov process. Then, if equation 9 is lagged by one period and multiplied by the known parameter ρ , it becomes:

$$\rho\, Y_{t-1} = \rho\, \beta_o + \beta_1\, \rho\, X_{1,\ t-1} + \dots + \beta_k\, \rho\, X_{k,t-1} + \rho\, \mu_t \qquad (10)$$

$$(t = 2,3, \dots, N)$$

By subtracting equation 9 from equation 10, the following equation will be obtained:

$$Y^*_t = \beta_o\ (1 - \rho\ ) + \beta_k X^*_{1t} + \dots + \beta_k X^*_k + (\mu_t - \rho\mu_{t-1}) \qquad (11)$$

$$(t = 2,3, \dots, N)$$

Where $Y^*_t = Y_t - \rho\ Y_{t-1}$ and $X^*_{it} = \rho\ X^*_{it,\ t-1}$, for i = 1,2,...k., equation 11 can be estimated by the OLS method.

Another way is by using the GLS (generalised least squares) method which has been developed by A.C. Atkiens (Koutsoyiannis 1973). By using the GLS method, the result will be unbiased and efficient, and will have smaller sampling variances than OLS or other unbiased linear estimates. Therefore, the GLS estimates are BLUE under circumstances that OLS estimates are not.

Heytens (1986) did not indicate whether or not autocorrelation was present. However, Ravallion (1986) assumes that the model was auto regression one error (AR (1) error) method. Kennedy (1985) states that moving average one error (MA (1) error) method process is plausible as a priori plausible as the AR(1) error process, because the AR (1) error method takes the forms $\varepsilon_t = \rho\varepsilon_{t-1} + \mu_t$, whereas an MA(1) error process takes $\varepsilon_t = \mu_t + \phi_{t-1}$, where the μ_t are independently and identically distributed errors and ρ and ϕ are parameters. Based on the discussion above, the model will be estimated by using the MA(1) error method if autocorrelation exists in the model.

4.5.2 Testing the hypotheses

The hypotheses of the study will be examined based on the index of market connection (IMC). Before using the IMC, the model was tested in relation to the evidence of market segmentation and strong short-run integration between local and reference markets. Heytens (1986) tested the market segmentation by using the regressions :

$$(P_{it} - P_{it-1}) = (\alpha_{i-1})\ P_{it-1} + \delta_{-i-}X^{*} + E_{it} \qquad (12)$$

and the strong short-run integration by using the regression:

$$(P_{it} - P_{it-1}) = (\alpha_i + \beta_{io} + \beta_{i1} - 1)\ P^{*}_{t-1} + \delta_{-i-}X^{*} + Z_{it} \qquad (13)$$

If R square and F test of those models are satisfied, the equation

12 or 13 above will be used instead of equation 4.

This study will use the test of market segmentation by testing that the β_1 coefficient is equal to zero, and the test of short-run market integration by testing that the β_3 coefficient is equal to zero (see equation 8 above). Heytens (1986) also tested the β_2 by using the value of standardised coefficient equal to one, because if β_2 is close to one, this means the model is suspected of strong short-run integration. Therefore, β_1, β_2, and β_3 will be tested in the study, which will be known in this study as the test of parameters.

In relation to the first hypothesis, based on the IMCs which are significant, the IMC will be discussed based on the movement of the IMCs over time and tested in relation to the reference markets. The objective of the test is to determine which reference market has the lower IMC. Every local market has two IMCs, i.e., one is between the local market and the reference market in Jakarta and the other is between the local market and the reference market in Bandung. These can be seen as 'paired samples'(Kvanli, Guynes and Pavur 1986, p. 319).

The statistical test employed for the test of market reference is as follows:

$$t = \frac{\overline{Y} - \overline{X}}{Sd/\sqrt{n}} \quad ; \text{ and } \quad Sd = \frac{\Sigma d^2 - (\Sigma d)^2/n}{n - 1}$$

Where:

$\overline{Y}$ = mean of reference market Y;

$\overline{X}$ = mean of reference market X;

Sd= standard deviation; and

d = difference of within pairs.

In relation to the second hypothesis, the IMC of potatoes will be compared with the IMC of cabbages. The IMC of potatoes and cabbages from one local market can be seen as a 'paired sample'. Therefore, those IMCs will be tested by using the same procedure as for the test of the reference markets in the first hypothesis.

4.6 Estimation of the Model

The SHAZAM Version 6.1 package (White, Haun and Horsman 1987) was employed for estimating missing observations, estimating parameters and testing the model and hypotheses. The package is available on the UNE Gara system.

Based on the description of research and analytical method above, the next section will discuss research findings.

Chapter 5

RESEARCH FINDINGS

5.1 Introduction

As stated in Chapter 1, the main objective of the research is to identify the price integration among markets for selected vegetables. An additional objective is to study the price integration of market places for major perishable and non-perishable vegetables.

This chapter will firstly discuss the appropriateness of the model. Secondly, the interpretation of the model output is overviewed. Thirdly, the results from the analysis of the whole period of study are presented and then provided on a year by year basis. Finally, the the results are summarised.

5.2 Appropriateness of the Model

Firstly, the model was estimated using the OLS method where the R squared values were satisfactory and F tests were satisfied. However, the Durbin h statistic indicated that autocorrelation was present in most of the models (positive or negative). The results can be seen in Appendices 14 to 21.

From the appendices, it can be seen that the R squared values were between 0.86 and 0.96, all F tests were significant at the 1 per cent level and most parameters were also significant at the 1 per cent level. R squares and adjusted R squares were not very different because sample sizes were quite large. However, the regressions could not be used in the research because of the presence of autocorrelation.

The problem of autocorrelation was discussed in section 4.5. The model was re-estimated using the MA(1) error method. The results can be seen in Table 5.1 and Appendices 22 to 28.

From the table and appendices, it can be seen that the R squares were calculated to be between 0.88 and 0.98, adjusted R squares were between 0.88 and 0.98, all F tests were significant at the 1 per cent level, and most parameters were also significant at the 1 per cent level. Based on these criteria, it was decided the parameters could be used for the analysis of market integration.

Before the IMCs were calculated, the model was tested using the test of parameters mentioned in section 4.5.2. All the parameters were tested using the student's t-test at the 1 per cent level. The hypotheses tested were that $\beta_1 = 0$, $\beta_2 = 1$ and $\beta_3 = 0$. The results of these tests are shown as notes on the coefficients of the parameter at the bottom of Table 5.1 and Appendices 22 to 28.

If, on the basis of the tests, the parameters were not significant, they were ignored in the subsequent analysis. The tests of significance for the IMCs are discussed in the next section.

5.3 Interpretation of the Model Output

The model which was used in this study is based on equation 8 below:

$$P_{it} = \beta_1 P_{it-1} + \beta_2(P^*_t - P^*_{t-1}) + \beta_3 P^*_{t-1} + \ddot{U}_{it} \qquad (8)$$

Where P_{it} = price in a local market i at time t and P^*_t = price in a reference market at time t.

It is assumed that in the long-run equilibrium, $P^*_t - P^*_{t-1} = 0$, β_1

Table 5.1

Coefficients of the Models of Potatoes by Using the MA (1) Error Method for the Reference Market of Jakarta, 1986

Local Market	β_1 Coef.	β_1 t-cal.	β_2 Coef.	β_2 t-cal.	β_3 Coef.	β_3 t-cal.	R^2	Adj. R^2	F-cal
Commodity : Potatoes (n=294)									
1. Pangalengan	0.96	38.45	0.25	3.45	0.03	1.50*	0.96	0.96	2453.91
2. Ciwidey	0.92	37.20	0.18	2.72	0.07	3.41	0.96	0.96	2481.11
3. Cikajarg	0.91	34.18	0.14	1.98*	0.07	3.31	0.96	0.96	2307.93

* Not significant at $\alpha = 0.01$

Notes : t_{table} at the 1 per cent level = 2.33
F_{table} at the 1 per cent level = 3.78

F-calculated is found by using the formula (Doran and Guise 1984, p. 134):

$$F = \frac{R^2 / k}{(1 - R^2)/(n - k - 1)}$$

Where: n = number of observations
k = number of explanatory variables

This formula will be applied for Appendices 22 - 28 and β_3 remain, and reflect, respectively, the relative contribution of past local and reference market prices to the formation of the current local price. Timmer (in Heytens 1986) constructed an index of market connection (IMC) which is the ratio of β_1 and β_3. If previous reference prices in markets are the primary determinants of local price (rather than previous local prices), the markets are well connected in the sense that supply and demand conditions in the reference market are communicated effectively to local markets and influence prices there, irrespective of previous local conditions (Heytens 1986, p. 30). Timmer states that an IMC of less than one reflects a relatively higher degree of short-run market integration.

The model was used to examine the degree of market integration. However, in situations where it was indicated that the markets were to be segmented or in strong short-run integration, these could not be used for the study. Therefore, the model was used also to examine whether or not the markets were segmented, or in strong short-run integration.

As was discussed earlier, if the β_1 coefficient is equal to zero and the β_3 is greater than zero, the IMC will be zero and the markets are in strong short-run integration. If the β_1 is greater than zero and the β_3 coefficient is equal to zero, the IMC will be infinite and the markets are segmented. If the model indicated that the markets were neither in strong short-run integration or segmented, the IMC was ignored for purposes of analysis of the degree of market integration.

In situations where the β_1 coefficient is lower than that of β_3 then the IMC will be between zero and one. It can be expected that the local and reference markets are relatively highly integrated. In this situation, the β_2 coefficient will be quite high, or close to one. However, if the β_2 is equal to one, it means markets are in strong short-run integration, where a price increase in the reference market will be immediately reflected in the local market price.

Before the results of the model were used, they were tested to see whether or not the markets were in strong short-run integration (i.e.,

$\beta_1 = 0$, or $\beta_2 = 1$), or segmented (i.e., $\beta_3 = 0$). If the markets were found to be in neither strong-short integration nor segmented, the IMC value was calculated and used in the subsequent analysis.

The next section provides a discussion of market integration through the analysis of the IMC and β_2 values calculated for the whole period of the study. In section 5.5 the discussion focuses on the IMC and β_2 values calculated on a year by year basis.

5.4 Analysis of Whole Period Market Integration

This section will discuss the market integration between the reference markets of Jakarta and Bandung and the local markets (for potatoes, 1986-1988, and for cabbages, 1987-1988). The calculation of the IMC, for example, for the local market of Pangalengan and the reference market of Jakarta ($\beta_1 = 0.21$ and $\beta_3 = 0.70$, Appendix 27) is calculated to be 0.30. By using the same procedure, the IMCs for other local markets can be calculated. The IMCs calculated for the reference markets are shown in Table 5.2.

5.4.1 Comparison of the reference markets

From the Appendices 27 and 28, it can be seen that all estimated β_1 and β_3 coefficients are significantly different from zero. Therefore, market segmentation and strong short-run market integration, respectively, do not exist. Furthermore, the β_2 coefficients range from 0.19 to 0.48 in the reference market of Jakarta, and from 0.45 to 0.71 in the reference market of Bandung. The β_2 coefficients are statistically different from one and their standardised coefficients are below one. This indicates that strong short-run integration does not exist. Therefore, the IMCs can be calculated and used in the analysis of market integration.

Table 5.2

The Index of Market Connection (IMC) of Potatoes and Cabbages for the Reference Markets of Jakarta and Bandung, for all Periods

Local Market	Jakarta		Bandung	
	IMC	β_2	IMC	β_2
Commodity : Potatoes				
1. Pangalengan	0.30	0.46	4.16	0.71
2. Ciwidey	0.17	0.44	1.79	0.71
3. Cikajang	0.21	0.35	2.24	0.65
Commodity : Cabbages				
1. Pangalengan	4.22	0.19	6.31	0.52
2. Lembang	0.91	0.32	2.48	0.50
3. Cipanas	0.50	0.48	0.89	0.59
4. Cikajang	2.00	0.24	6.08	0.45

In general, in both the reference markets, it was found that if the β_2 coefficient was high, the IMC would be low. Moreover, the β_2 coefficients between the local markets and the reference market of Jakarta were lower than those of Bandung.

The β_2 coefficients show the proportion of the last period's price differential between the reference market and the previous local price. The β_2 coefficients in the reference market of Bandung are higher than those of Jakarta. To understand this phenomenon, we should consider the movement of the prices of the potatoes and cabbages in both the reference markets.

For convenience, the movement of the prices of commodities are discussed in terms of the monthly prices (calculated from the average of the prices in a particular month). The monthly prices in Jakarta and Bandung for potatoes and cabbages can be seen in the figures in Appendices 29 and 30. From the appendices, it can be seen that the prices in Jakarta are generally lower than or equal to those in Bandung. Appendix 31 shows the number of times prices in Bandung are equal to or greater than those in Jakarta.

In Table 3.6 it was shown that the transportation costs from the local markets to the reference market for Bandung are lower than those for Jakarta. The transportation costs from local markets to the reference market in Bandung are only half the costs of transportation from the local markets to the reference market of Jakarta. However, the prices in the reference market of Jakarta are generally lower than or equal to those in the reference market of Bandung.

Therefore, the prices in the reference market of Bandung encourage buyers in the local markets to sell their commodities in the reference market of Bandung. However, buyers cannot sell all their commodities in the reference market of Bandung. This is caused by the fact that the size of the reference market of Bandung in 1988 was only 2840 tons and 2898 tons, for potatoes and cabbages, respectively (see Appendices 32 and 33). In the same year, the production of potatoes and cabbages in West Java was 11 063 tons and 271 677 tons (see appendices 6 and 7).

Therefore, the farmers must look for another market at which to sell the rest of their commodities. The appropriate choice is the reference market of Jakarta which has absorbed the production of potatoes and cabbages, 4042 tons and 2539 tons, respectively (see Appendices 34 and 35).

From the discussion above, it is clear that the β_2 coefficients in the reference market of Bandung are higher than those of Jakarta.

The IMCs in the reference market of Jakarta range between 0.17 and 4.22, and between 0.89 and 6.31 in the reference market of Bandung. It can be seen that the IMCs in the reference market of Jakarta are below one, but in the reference market of Bandung, the IMCs are greater than one. This means that the degree of market integration between the local markets and the reference market of Jakarta is maximal and relatively higher than that of Bandung.

The statistical significance of the IMCs for the whole study period from the reference markets of Jakarta and Bandung will be tested by using the 'paired test' as mentioned in section 4.5.2 above. The results of the tests are shown in Appendices 36 and 37. The results, in summary, are as follows:

1. For potatoes, the IMCs for the reference market in Jakarta and Bandung are significantly different from each other. Further, the IMCs for the reference market in Jakarta are statistically lower than those for the reference market in Bandung. The degree of market integration in the reference market of Jakarta is higher than that of Bandung.

2. For cabbages, the IMCs for the reference market in Jakarta and Bandung are also significantly different from each other. Again the IMCs for the reference market in Jakarta are statistically lower than those for the reference market in Bandung. The degree of market integration in the reference market of Jakarta is higher than that of Bandung.

From the tests above, it can be concluded that the degree of market integration for the reference market in Jakarta is higher than that for Bandung.

Based on the discussion in Table 3.6 and Appendices 29 to 31, there is an interesting phenomenon where the prices of the commodities in the reference market in Bandung are generally equal to or higher than those in Jakarta. The transportation costs from the local markets to Bandung are only half the costs to Jakarta. However, the degree of market integration for Jakarta is higher than that for Bandung.

Bandung is the closer of the two reference markets for the local markets in West Java. Therefore, the prices in Bandung should be lower than in Jakarta. Because the price in Bandung is generally equal to or greater than Jakarta's, the price in Bandung is likely to be the first consideration for the wholesalers and the farmers in the local markets. This phenomenon may explain the greater variability in supply in Bandung compared to that in Jakarta. Evidence of this can be seen in Appendices 32 to 35. The monthly quantity of potatoes in 1988 in Bandung for example, varied between 55.5 tons and 763.7 tons and between 84.0 tons and 620.5 tons for cabbages. However, in Jakarta the monthly quantity varied only between 152.5 tons and 561.0 tons for potatoes and between 85.5 tons and 455.0 tons for cabbages. In general, the monthly quantity of the commodities in Jakarta is more stable than in Bandung. Therefore, this phenomenon may be one of the explanations for the fact that the β_2 coefficient of the reference market of Bandung is higher than that for Jakarta, while the integration (measured by the IMC) between the local markets and the reference market in Jakarta is higher than that for the reference market in Bandung.

5.4.2 Comparison of local markets

In the reference market of Jakarta, the highest IMC for potatoes and cabbages is the local market of Pangalengan. The lowest IMC for potatoes is the local market of Ciwidey, and the local market of Cipanas (for cabbages). In the reference market of Bandung, this phenomenon is quite similar. The highest IMC for potatoes and cabbages is the local market of Pangalengan. The lowest IMC is the local market of Ciwidey (for potatoes) and Cipanas (for cabbages). It can be concluded that the degree of market integration of the local market of Pangalengan and the reference markets of both Jakarta and Bandung is the lowest. Moreover, the highest degree of market integration between the reference markets is the local markets of Ciwidey (for potatoes) and Cipanas (for cabbages).

In the reference market of Jakarta, the monthly prices for potatoes in each local market can be seen in the figure in Appendix 38. From the appendix, it is shown that in general the highest prices are in Pangalengan, followed by Ciwidey and Cikajang. If this is compared with the transportation cost (Rp/kg) from those local markets to the reference market of Jakarta, it can be understood, because the transportation costs from Cikajang are the highest. For cabbages, the monthly prices of each local market can be seen in the figure in Appendix 39. From the appendix, it is shown that in general the highest price is Pangalengan followed by Lembang, Cipanas and Cikajang. If this is compared with the the transportations costs (Rp/kg) from those local markets to the reference market of Jakarta, the highest cost is Cikajang, followed by Pangalengan, Lembang and Cipanas.

In the reference market of Bandung, for potatoes, the monthly prices of each local market can be seen in the figure in Appendix 40, and in Appendix 41 for cabbages. The highest and the lowest prices for the commodities in the reference market of Bandung are similar to the reference market of Jakarta (see Appendices 38 and 39).

For both the reference markets, the β_2 coefficients of potatoes and cabbages in the local market of Pangalengan are relatively high compared to other local markets. That means the proportion of the last period's price differential in the reference markets of Jakarta and Bandung to the previous price in Pangalengan is the highest (compared to the other local markets). Pangalengan is the biggest supplier of potatoes (for both reference markets), and the biggest and the second biggest supplier of cabbages, respectively, for the reference markets of Bandung and Jakarta (see Appendices 32 and 34). However, the degree of market integration between the local market of Pangalengan and the reference markets of Jakarta and Bandung is the lowest. Pangalengan subregency has the biggest production of potatoes and cabbages in West Java (see Appendices 10 and 11). From the biggest production, it may be that the variability of supply of the commodities will be absolutely higher in Pangalengan than in the other subregencies. This may explain why the β_2 coefficient in the local market of Pangalengan does not give a similar response as in the other local markets. For example, in the reference market of Bandung, for potatoes, the β_2 coefficient in the local markets of Pangalengan and Ciwidey is similar (0.71). However, the IMC of the local markets of Pangalengan and Ciwidey is quite different (4.16 and 1.79, respectively). Pangalengan subregency produced more than twice the quantity of potatoes as Ciwidey subregency (see Appendices 10 and 11).

From the discussion above, it can be concluded that the degree of market integration between the local markets and the reference markets shows similar behaviour. This can be seen from the highest and lowest degree of market integration are in the same local markets.

The highest degree of market integration for potatoes is the local markets of Ciwidey and Cipanas (for cabbages). From Table 3.6, it can be found that the transportation costs (Rp/kg) from the local market of Ciwidey to the reference markets of Bandung and Jakarta are average (compared to other local markets). The transportation costs (Rp/kg) from the local market of Cipanas to the reference market of Bandung are average, but the transportation cost from the local market of Cipanas to the reference market of Jakarta are the lowest (compared to other local markets). Moreover, the transportation costs to both reference markets are quite similar. This may be caused by the fact that the local market of Cipanas is almost equidistant from the reference markets. A similar degree of market integration with each of the reference markets would therefore be expected.

5.4.3 Comparison of commodities

From Table 5.2, it can be seen that the IMCs for potatoes in the reference market of Jakarta are lower than those in Bandung. Moreover, the IMCs in Jakarta are generally below one, which indicates a high degree of market integration. The lowest IMC is in the local market of Ciwidey. The other IMCs vary between 0.21 (Cikajang) and 0.30 (Pangalengan) for the reference market in Jakarta, and between 1.79 (Ciwidey) and 4.16 (Pangalengan) for the reference market in Bandung. It can be concluded that the IMCs of potatoes from the local markets to both reference markets show similar behaviour. For example, if the IMC for the reference market in Jakarta is the highest, then the IMC for the reference market in Bandung is also the highest. Therefore, the degree of market integration of potatoes shows similar behaviour for both reference markets, and the degree of market integration is maximal for the reference market of Jakarta.

Comparing the IMCs of cabbages, it can be seen that the IMC for the reference market of Jakarta is generally below one, lower than for the reference market of Bandung. The lowest IMC in the reference market in Jakarta is Cipanas, followed by Lembang, Cikajang and Pangalengan. These phenomena are quite similar to the reference market in Bandung (the lowest is Cipanas, followed by Lembang, Cikajang and Pangalengan). From the phenomena above, a similar conclusion can be drawn to that for the behaviour of the IMCs for cabbages.

For testing the IMCs of the commodities, only the local markets which have the IMCs for both potatoes and cabbages will be used. Therefore, the number of samples will become 4 (2 from the reference market of Jakarta, i.e., Pangalengan and Cikajang, and 2 from the reference market of Bandung, i.e., Pangalengan and Cikajang). The results of the test can be seen in Appendix 42.

In the appendix, it is shown that the IMCs of potatoes are between 0.17 and 4.16, and between 0.89 and 6.31 for cabbages. The results show that the IMC of potatoes is statistically different from and lower than that of cabbages. Therefore, the degree of market integration of potatoes from the local markets to the reference market of Jakarta is higher than that to Bandung.

5.4.4 Summary

Comparing the IMC and the β_2 values, it was found that when the β_2 coefficient is high, the IMC will be high in the reference markets of both Jakarta and Bandung. However, when the IMC and β_2 values of the market of Jakarta are compared to the reference market of Bandung, the phenomenon is difference (the β_2 of the reference market of Bandung is higher than that of Jakarta, while the IMC for the reference market of Bandung is lower than that of Jakarta). This is probably caused by the fact that the prices in the reference market of Bandung are sometimes greater than or equal to those in the reference market of Jakarta. This can be inferred to indicate that the model cannot explain clearly the relationship between the IMC and the β_2 values.

Comparing the IMCs of the local markets, the local market of Pangalengan is the highest for both the reference markets of Jakarta and Bandung. However, for both the reference markets of Jakarta and Bandung, the β_2 coefficient of the local market of Pangalengan is relatively high. This probably occurs because the Pangalengan subregency is the biggest producer for both potatoes and cabbages.

The degree of market integration of the reference market of Jakarta is higher than that of Bandung. Moreover, the degree of market integration of the reference market of Jakarta is maximal (generally the IMCs are below one). In relation to the local markets, the lowest degree of market integration is Pangalengan for the reference markets of both Jakarta and Bandung. The performance of the degree of integration of other local markets are quite similar for both the reference markets. In relation to the commodities, the degree of market integration of potatoes is higher than that of cabbages.

From the discussion above, it can be concluded that hypothesis 1, that the price integration among market places for selected vegetables is maximal, is only accepted for the reference market of Jakarta. Moreover, it can be concluded that hypothesis 2, that the price integration among market places for non-perishable vegetables is identical to that for market places for perishable vegetables, is rejected for both the reference markets. The next section will discuss market integration on the year by year basis.

5.5 Analysis of Year by Year Market Integration

This section will discuss the market integration by comparing the reference markets of Jakarta and Bandung, the local markets and commodities. The IMCs of potatoes and cabbages for the reference markets of Jakarta and Bandung can be seen in Tables 5.3 and 5.4.

5.5.1 Comparison of the reference markets

In Table 5.3 it is shown that many IMCs will be ignored because of the test of parameters. For potatoes, in 1986, in the local market of Pangalengan, the β_3 coefficient is not significantly different from zero: market segmentation exists. Therefore, the IMCs which can be discussed are only from the local markets of Ciwidey and Cikajang. In 1987, the β_1 coefficients for the local markets of Ciwidey and Cikajang are not significantly different from zero: strong short-run integration in those local markets exists. Therefore, in 1987, the IMC which can be discussed is only that from the local market of Pangalengan. However, in 1988, all of the IMCs can be used in discussion because the β_1 and β_3 coefficients are significantly different from zero.

Moreover, from the table it can be seen that for cabbages, all of the IMCs can be discussed, because the β_1 and β_3 coefficients are significantly different from zero: neither strong short-run market

Table 5.3

The Index of Market Connection (IMC) of Potatoes and Cabbages for the Reference Market of Jakarta, 1986-1988

Local Market	1986		1987		1988	
	IMC	β_2	IMC	β_2	IMC	β_2
Commodity : Potatoes						
1. Pangalengan	32.00[a]	0.25	0.06	0.52	1.04	0.38
2. Ciwidey	13.14	0.13	0.06[c]	0.47	0.69	0.42
3. Cikajang	13.00	0.14[b]	0.01[c]	0.43	1.30	0.20
Commodity : Cabbages						
1. Pangalengan	---	---	2.00	0.16c	7.55	0.17
2. Lembang	---	---	0.35	0.31	1.64	0.24
3. Cipanas	---	---	0.19	0.36	2.87	0.53
4. Cikajang	---	---	0.69	0.23	3.83	0.18

[a] : β_3 is not significantly different from zero at $\alpha = 0.01$
[b] : β_2 is not significantly different from zero at $\alpha = 0.01$
[c] : β_1 is not significantly different from zero at $\alpha = 0.01$

Table 5.4

The Index of Market Connection (IMC) of Potatoes and Cabbages for the Reference Market of Bandung, 1986-1988

Local Market	1986		1987		1988	
	IMC	β_2	IMC	β_2	IMC	β_2
Commodity : Potatoes						
1. Pangalengan	-5.00[a]	0.13	0.72	0.79	6.00	0.82
2. Ciwidey	49.00[a]	0.36[b]	0.21	0.81	6.07	0.78
3. Cikajang	32.00	0.15	0.06[c]	0.78	8.80	0.66
Commodity : Cabbages						
1. Pangalergan	---	---	4.47	0.52	12.86	0.64
2. Lembang	---	---	2.24	0.57	1.71	0.31
3. Cipanas	---	---	1.15	0.65	0.62	0.45
4. Cikajang	---	---	2.36	0.46	4.69	0.46

a : β_3 is not significantly different from zero at $\alpha = 0.01$
b : β_2 is not significantly different from zero at $\alpha = 0.01$
c : β_1 is not significantly different from zero at $\alpha = 0.01$

integration nor market segmentation exists.

For the reference market of Bandung (Table 5.4), it is shown that many IMCs will be ignored because of the tests of parameters. For potatoes, in 1986, in the local markets of Pangalengan and Ciwidey, the β_3 coefficients are not significantly different from one; the markets are segmented. Therefore, in 1986, the IMCs which can be discussed are only those from the local market of Cikajang. In 1987, in the local market of Cikajang, the β_1 coefficient is not significantly different from zero: the markets are in strong short-run integration. Therefore, in 1987, the IMCs which can be discussed are only those from the local markets of Pangalengan and Ciwidey. However, in 1988, all of the IMCs can be used in discussion because the β_1 and β_3 coefficients are significantly different from zero.

Moreover, Table 5.4 shows that, for cabbages, all of the IMCs can be discussed because the β_1 and β_3 coefficients are significantly different from zero.

The β_2 coefficients vary between 0.14 and 0.53 for the reference market of Jakarta, and between 0.06 and 0.82 for the reference market of Bandung. Most of the β_2 coefficients are significantly different from one and their standardised coefficients below one. However, a few of the β_2 coefficients are not significantly different from zero; that means the coefficient can be ignored in the model. This was found in 1986 for potatoes, in the local market of Cikajang (for the reference market of Jakarta) and Ciwidey (for the reference market of Bandung), and for cabbages it is only the local market of Pangalengan (for the reference market of Jakarta). This indicates that the local markets and the reference markets are not well integrated. It can be seen that from those markets, the IMC is quite high; this means the degree of market integration is quite low. Moreover, the β_3 coefficient of one of those local markets (Ciwidey) is not significantly different from zero: market segmentation exists. However, the IMCs of the local markets of Cikajang and Pangalengan will still be used in the discussion below because their β_1 and β_3 coefficients are significantly different from zero.

In general, in both reference markets, it was found that if the β_2 coefficient is high, the IMC will be low. Moreover, the β_2 coefficients between the local markets and the reference market of Jakarta are lower than those of Bandung.

The β_2 coefficients show the proportion of the last period's price differential in the reference market to the previous local price. The β_2 coefficients in the reference market of Bandung are higher than those of Jakarta. This phenomenon is also found in the discussion for the whole study period.

Let us concentrate the discussion on the comparison of the market integration between the reference markets of Jakarta and Bandung. For potatoes, the IMC in 1987 is the lowest, followed by 1988 and 1986. In the reference market of Jakarta, the IMCs range between 0.06 (in 1987 for the the local market of Pangalengan) and 13.14 (in 1986 for the local market of Ciwidey), and between 0.21 (in 1987 for the local market of Ciwidey) and 32.00 (in 1986 for the local market of Cikajang) for the reference market of Bandung. The range of the IMCs for the year by year analysis is higher than that for the whole period. However, for cabbages, the range of the IMCs is not quite as high as for potatoes, but it is still higher than for the whole period. The IMCs range between 0.19 (in 1987 for the local market of Cipanas) and 7.55 (in 1988 for the local market of Pangalengan) for the reference market of Jakarta, and between 0.62 (in 1988 for the local market of Cipanas) and 12.86 (in 1986 for the local market of Pangalengan) for the reference market of Bandung. In general, for the reference markets, the IMCs in 1987 are lower than the IMCs in 1988.

From the discussion above, it can be concluded that the IMCs in 1987 are the lowest for both potatoes and cabbages, and for both reference markets.

In this section the 'paired test' as employed for section 5.5.1 cannot be used, because the number of observations of the IMCs every year is different. However, in general, it can be concluded that the

IMC in the reference market of Jakarta is lower than that of Bandung. Therefore, the degree of market integration on the year by year basis for the reference market of Jakarta is higher than for that of Bandung.

5.5.2 Comparison of local markets

In the reference market of Jakarta, in 1986, the highest IMC for potatoes is in the local market of Ciwidey and the lowest is Cikajang, and in 1988, the highest is in the local market of Cikajang and the lowest is in Ciwidey. For cabbages, the highest IMC is in the local market of Pangalengan (in 1987 and 1988). In 1987, the lowest IMC for cabbages is in the local market of Cipanas, followed by the local markets of Lembang and Cikajang, and in 1988, the lowest is in the local market of Lembang, followed by the local markets of Cipanas and Cikajang.

In the reference market of Bandung, for potatoes, the IMC of the local market of Pangalengan is higher than that of Ciwidey (in 1987). In 1988 the highest IMC is in the local market of Cikajang, and the lowest is in the local market of Pangalengan, followed by the local market of Ciwidey. For cabbages, in 1987 and 1988, the highest IMC is in the local market of Pangalengan, and the lowest is in the local market of Cipanas, followed by Lembang and Cikajang.

In the reference market of Jakarta, the highest and the lowest of the IMCs for cabbages are not in the same local markets. However, for the reference market of Bandung, the phenomenon is in the same local market.

From the discussion above it can be concluded that, for the reference market of Jakarta, for potatoes, the lowest degree of market integration is in the local markets of Ciwidey (1986) and Cikajang (1988), the highest is in the local markets of Cikajang (1986) and Ciwidey (1988); for cabbages, the lowest is in the local market of Pangalengan (1987 and 1988) and the highest is in the local markets of Cipanas (1987) and Lembang (1988). For the reference market of Bandung, for potatoes, the lowest degree of market integration is in the local markets of Pangalengan (1987) and Cikajang (1988), the highest is in the local markets of Ciwidey (1987) and Pangalengan (1988); for cabbages, the lowest is in the local market of Pangalengan (1987 and 1988) and the highest is in the local market of Cipanas (1987 and 1988).

5.5.3 Comparison of commodities

From Tables 5.3 and 5.4 it is shown that for the reference market of Jakarta, the IMCs range between 0.06 and 13.14 for potatoes, and between 0.19 and 7.55 for cabbages. For the reference market of Bandung, the IMCs range between 0.21 and 32.00 (for potatoes) and between 0.62 and 12.86 (for cabbages). It can be seen that in the reference market of Jakarta, the IMCs of potatoes are generally lower than the IMCs of cabbages. From this it can be concluded that the degree of market integration of potatoes is higher than that of cabbages in the reference market of Jakarta. However, this phenomenon is not quite similar to the reference market of Bandung.

In relation to the IMC values of potatoes and cabbages, it can be seen that the range of the IMC of potatoes is higher than that for cabbages; the degree of market integration of potatoes fluctuates relatively more than for that of cabbages.

5.5.4 Summary

Comparing the IMC and the β_2 values on the year by year basis, the same phenomenon was found as for the whole study period. The highest IMC is in 1986 (for potatoes) and 1988 (for cabbages), and the lowest is in 1987 (for potatoes and cabbages) for the reference markets of both Jakarta and Bandung.

The range of the IMCs is higher on the year by year basis than for the whole study period. This means that the degree of market integration on the year by year basis fluctuates more widely than for the whole period study. This indicates that on the year by year basis the markets are segmented rather than integrated. Heytens (1986) states that the number of observations will have a significant role in estimating the parameters of the model.

The degree of market integration in the reference market of Jakarta is higher than that for Bandung. In relation to the local markets, the lowest degree of market integration is Pangalengan for both reference markets (except in 1988 for potatoes in the reference markets of both Bandung and Jakarta), and the highest is Ciwidey (for potatoes for both reference markets) and Cipanas (for cabbages for both reference markets). In relation to commodities, the highest and the lowest degree of market integration for cabbages are in the same local markets, but for potatoes this cannot be found. The degree of market integration of potatoes in the reference market of Jakarta is higher than that for cabbages. This phenomenon is quite different from the reference market of Bandung.

From the discussion above, it can be concluded that hypothesis 1, that the price integration among market places for selected vegetables is maximal, is only accepted for the reference market of Jakarta. Moreover, it can be concluded that hypothesis 2, that the price integration among market places for non-perishable vegetables is identical to that for market places for perishable vegetables, is only rejected for the reference market of Jakarta. The next section will discuss the results.

5.6 Summary

The model firstly was estimated by using the OLS method, however the Durbin h statistic indicated that autocorrelation was present in most of the models. Therefore, the model was re-estimated by using the MA (1) error method.

The model will be employed only if it indicates that the market is integrated. Therefore, several IMCs were ignored as discussed in sections 5.4 and 5.5. The model was discussed for the whole study period (for potatoes 1986-1988 and for cabbages 1987-1988) and on the year by year basis.

For the whole study period, the degree of market integration in the reference market of Jakarta is higher than for that of Bandung. In relation to the local markets, the lowest degree of market integration is in Pangalengan. Based on the analysis of commodities, the degree of market integration of potatoes is higher than that for cabbages.

For the year by year basis, the results are not very different. There are several differences which were found in the discussion based on the year by year analysis. The range of IMCs are higher for the year by year basis than for the whole study period. Moreover, the range of the IMCs for potatoes is higher than that for cabbages.

The degree of market integration for the reference market of Jakarta is higher than for that of Bandung. In relation to the local market, the lowest degree of market integration is in Pangalengan, and in relation to commodities, the degree of market integration of potatoes is higher than for that of cabbages only for the reference market of Jakarta.

From the results above, it can be concluded that hypothesis 1 is accepted only for the reference market of Jakarta (both for the whole study period and on the year by year basis). Moreover, hypothesis 2 is rejected for both reference markets only for the whole period study. On the year by year basis, the hypothesis is rejected only for the reference market of Jakarta.

Based on the research findings as discussed above, the next chapter will discuss conclusions and recommendations together with a discussion of the study's limitations and suggestions for further research.

Chapter 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter will firstly discuss the conclusions and recommendations. Secondly, the limitations of the present study and suggestions for further research will be detailed.

6.2 Conclusions

The measurement of price integration was undertaken in this study using the concept of market integration which was adopted by Ravallion (1986) and Heytens (1986). The market integration model was constructed in 1985 by Ravallion and developed by Timmer (in Heytens 1986). Heytens (1986) provided a broader interpretation for examining questions relating to market integration.

The degree of market integration was measured using the index of market connection (IMC). In general, the closer the index to zero, the greater the degree of market integration. Timmer (in Heytens 1986) states that an IMC of less than one reflects a relatively high degree of short-run market integration. This degree of market integration is defined in this study as 'maximal'.

Based on the discussion in sections 5.4 and 5.5, the conclusion of the study will be divided into two parts, i.e., the analysis of the degree of market integration for the whole study period (for potatoes 1986-1988 and for cabbages 1987-1988) and on a year by year basis in relation to the reference markets, local markets and commodities. For the whole study period, the degree of market integration between the local markets and the reference market of Jakarta is higher than that between the local markets and Bandung. Moreover, the degree of market integration with the reference market of Jakarta is maximal.

In relation to the local markets, for the reference markets of both Jakarta and Bandung the lowest degree of market integration is with the local market of Pangalengan (for both potatoes and cabbages) and the highest is with the local market of Ciwidey (for potatoes) and Cipanas (for cabbages). In general, the degree of market integration between the local markets and the reference markets is quite similar.

Based on the conclusions above, hypothesis 1 is accepted for the reference market of Jakarta (for both potatoes and cabbages) and the local markets of Ciwidey (for potatoes) and Cipanas (for cabbages).

In relation to commodities, the degree of market integration for potatoes is higher than that for cabbages. Moreover, the degree of market integration for potatoes is maximal. Therefore, hypothesis 2 is rejected.

On a year by year basis, the degree of market integration in relation to the reference markets, local markets and commodities is broadly similar to the analysis for the whole study period. Hypothesis 1 is accepted for the reference market of Jakarta (for both potatoes and cabbages) and the local markets of Ciwidey (for potatoes) and Cipanas (for cabbages).

Several differences, however, were found between the result estimated on a year by year basis and those estimated from the whole study period data.

The degree of market integration for the year by year basis fluctuates more widely than for the whole study period. On the year by year basis, the degree of market integration for potatoes is more variable than that for cabbages. This indicates that the markets are segmented rather than integrated.

The performance of the model for the analysis of the whole study period market integration indicated that the markets were highly integrated. However, the phenomenon tends to be converse on the year by year basis. It seems probable that the response to the current period's change in the reference market price and the local market is more likely to occur in the current time period, the longer the period of observation (Heytens 1986, p. 39).

Integration in the whole study period appears to be substantially due to the single year 1987 when the markets were strongly integrated. In fact, the degree of market integration is relatively highly variable on the year by year basis. This suggests that marketing information services, provided consistently, do not guarantee high market integration. A possible reason for poor integration in 1986 and 1988 for potatoes is high supply in those years which led to farmers receiving excessively low prices, relative to prices in the reference markets, which would be expected to reflect the price effects of the high supply. Therefore, further work is needed.

In relation to commodities, the degree of market integration for potatoes is higher than that for cabbages only for the reference market of Jakarta. Therefore, hypothesis 2 is rejected only for the reference market of Jakarta.

6.3 Recommendations

Although Bandung municipality is situated nearer to Bandung, Garut and Cipanas Regencies than to Jakarta, the degree of market integration between those regencies and Bandung is lower than that for Jakarta.

The prices of potatoes and cabbages in Bandung are generally higher than or equal to those prices in Jakarta. Because the prices are broadcast nationally every weekday, the farmers and the wholesalers are encouraged to deliver their commodities to Bandung municipality.

On the basis of these facts, instead of just broadcasting the daily prices of commodities, the radio station should also consider broadcasting the last period prices and the predicted prices at certain fixed times, such as every month or when the prices are extreme.

6.4 Limitations of the Present Study and Suggestions for Further Research

The research was geographically limited in that it only covered five subregencies (from three regencies) in West Java, despite the fact that there are other subregencies or regencies in West Java which produce commodities.

The study used (in equation 8) the prices between local and reference markets in terms of the prices which were reported at particular times. However, Heytens (1986) used the price in terms of the differences between local and reference markets at the particular times (see equation 5 in Section 4.2 above). It may be that if Heytens' method was applied the results would have been different.

The model used only the daily price data from the local and reference markets. If the other data, such as the daily quantity of commodities exchanged in local markets were available, the model may have performed better, particularly in regard to the relationship between the IMC and β_2 values in between the reference markets of Jakarta and Bandung and the differences of the IMC values over time.

As mentioned by Heytens (1986), the model is an improvement on the use of only the correlation coefficient. However, the result of the study still only explains the degree of integration between the two markets; it does not indicate the competitiveness in price formation. The result of this study shows only whether the degree of integration is relatively high or not and which markets or commodities have a higher degree of integration than others. This information would be very useful for understanding the behaviour of a market, such as the price fluctuation and price equilibrium for a commodity in the marketing system, and commodity flows between rural and urban areas.