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**Inter-Regional Integration of the
Philippine Rice Market**

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Abstract

This study examines the existence of the spatial market integration of the different pairs of regional rice markets in the Philippines. Using modern time series econometric techniques uncovered compelling pieces of evidence of strong steady state linkages of the various pair-wise combinations of regional markets, with only an insignificant few segregated routes. The main conclusion of the study is that despite the geographic segregation of the regional rice markets and the presence of fragmented and often inefficient distribution system, price signals and other market information are transmitted efficiently across the markets, thus negating the potential occurrences of unexploited arbitrage opportunities.

Inter-Regional Integration of the Philippine Rice Market

Being the major staple food of Filipinos, rice has been at the center stage of every administration's agricultural modernization, poverty alleviation and food self-sufficiency programs. Many government instrumentalities, spearheaded by the Department of Agriculture (DA) and the National Food Authority (NFA) are tasked to ensure continuous supply of this strategic commodity at stabilized prices all over the country. These agencies are also mandated to make farmers get the best possible price for their produce. However, rice production and consumption in the country are characterized by a great deal of seasonal and regional variability, resulting in the occurrences of periodic surpluses and deficits in the different regions. This makes the task of stabilizing prices, both at the farm level or palay, and at the retail level for rice, truly difficult (Martinez et al., 1998). The problem is often exacerbated by the generally fragmented and inefficient distribution and transportation systems (Intal & Ranit, 2001).

The need to move the surpluses from production areas to deficit consumption areas in the most economical manner possible has been a challenge to the stakeholders of the rice economy since the beginning of rice trading in the country. Over the years, trading patterns for rice linking the different supply-demand areas have evolved, and distribution volumes consistent with market directed prices and transfer costs have traditionally been followed by rice traders. The question of how integrated the country's regional rice market is, to effectively reflect price margins and other market information that would signal rice movements along traditional and non-traditional trading routes, has not been adequately addressed by analysts. Examining the extent of inter-regional market integration, at both spatial and across marketing stages, will provide insights on the speed of traders' responses in moving this vital commodity from surplus to deficit areas especially during emergencies. This is not to mention the identification of routes where bottlenecks and market imperfections are expected to appear. Furthermore, authorities will have basis of gauging the effectiveness of market-based policies for poverty alleviation and food security in light of perceived integration of such geographically separated rice markets.

This study is an attempt to investigate the existence and the extent of spatial market integration among the different regional rice markets across the whole archipelago. In this study, various time series econometric techniques are employed to empirically test the integration of all possible pair-wise combinations of the existing regional subdivisions of the country. It consists of four main parts. Following the introductory portion, a brief review of the existing literature on spatial rice market integration and other relevant issues is presented. An exposition of the theoretical framework of the study together with the description of the empirical tools, models and the database employed constitute the next part. The last major portion deals with the presentation of the results of implementing the different models. This part also covers the analysis and discussion of the various implications of the results.

Research Problem and Objectives

The study attempts to empirically answer the following research problem: "To what extent is the inter-regional rice market of the Philippines spatially integrated?" In addressing such problem, the proponent intends to achieve the following objectives:

1. To assess the time series properties of the available regional price series for rice and examine their suitability for use in extensive econometric model building.
2. To implement various state-of-the-art co-integration based empirical testing of the spatial market integration of the different pair-wise combinations of regional rice markets.
3. To extract meaningful insights from the results of the analysis and translate these into useful decision-making information.

Scope and Limitations of the Study

The original scope of the study includes the determination of the optimal regional trading patterns as well as the establishment of forecasts of appropriate monthly dispersal volumes along the different regional routes. However, because of serious data constraints stemming from both the unavailability of most of the needed data (transfer costs, traders' margins, distance matrix, historical production/consumption and milling data, etc.) and the unsuitability of available data particularly the asymmetrical regional classifications being used by different data producers (NFA and Bureau of Agricultural Statistics), the proponent decided to limit the scope of the study to the empirical assessment of regional market integration.

Also due to the above data limitations, some of the econometric models supposed to be implemented as per proposal are deemed inapplicable. These include the Parity Bound Model (PBM) and the Band Threshold Auto Regressive Model (Band-Tar Model) which requires extensive use of transfer cost data. However, despite its much-restricted scope, the study still can be considered a substantial research undertaking not only because of its nationwide scope but also of its use of sophisticated cointegration-based econometric techniques.

Significance of the Study

As a strategic economic commodity, it is imperative for rice research to be given sufficient importance. True enough, the government, the private sector and even the international community are giving their share to uplift the level of research and development on this staple. However, most of the research efforts are focused on the production side—producing high yielding variety to improve productivity per hectare planted, improving post harvest technology to minimize losses, increasing researches in irrigation and extension services, among others. Despite the huge strides in production technology and extension services on rice, it is rather unfortunate that our rice farmers and other participants in the rice economy still are among the poorest in the agricultural sector.

Over the years, very few studies have been devoted to examine the competitiveness and efficiency of the local rice market. Sadly, little importance has been given to research and development of the country's rice marketing and distribution system than what these areas truly deserve. Thus, at times it is cheaper to bring rice shipments to the primary deficit region of Metro Manila from abroad than from a number of rice producing regions of the country. Making the market and the distribution systems work better for the farmers, processors and consumers is

a continuing challenge (Intal & Ranit, 2001) that should be adequately met through an expanded research program. Priority should be given to rice distribution and marketing since these are two of the most neglected areas of rice research, but with so much at stake – the welfare of our rice farmers and processors – which comprise the largest sectors of the agricultural economy.

Review of Literature

In order for a market to function efficiently, supply/demand shocks strong enough to create impact on prices must be readily transmitted across the various market outreaches, allowing spatial traders to take advantage of the arbitrage created that sooner or later prices return to equilibrium. This concept has been generally known in economic literature as *spatial market integration*. Integration of markets may have important implications for price formation and discovery, and can give a lot of insights to analysts on the operation of commodity markets since sustained deviations from integration may imply the presence of risk-less profit opportunities for traders (Goodwin & Piggott, 1999). Over the last two decades, market integration has increased its importance, particularly in developing countries where it has potential applications to policy questions regarding government intervention in markets (Alexander & Wyeth, 1994), analysis of trade flows and transaction costs (Barrett, 1996) and presence of market imperfections (Familiow & Benson, 1990).

In theory, in an economy consisting of a number of regions, trade for a homogeneous commodity takes place between any two regions if the price in the importing region equals the price in the exporting region plus the per unit transfer cost between the two. This can happen only when there is free flow of goods and information and thus prices across regions and the economy are said to be well integrated (Sexton et al. 1991). Cournot and Marshall initially proposed this idea when they suggested that two regions are in the same economic market for a homogeneous good if the prices for that good differ by exactly the interregional transportation cost. The failure of two or more of these regions to adhere to this one price prescription may either be due to them being autarkic markets, or there are impediments to efficient arbitrage such as trade barriers, imperfect information or risk aversion. Or it may also be explained by the presence of imperfect competition in one or more of the markets like oligopolistic pricing, or presence of monopolistic element(s). Information therefore on market integration may provide specific evidence as to the extent of the competitiveness of the market.

Approaches in Testing for Market Integration

Market linkages across spatially segregated markets have long been central to the study of agricultural markets in low-income economies. Lele (1967) first recognized the importance of the price linkages of markets in his analysis of food markets in India. Until the early 1980s, analyses of spatial market integration were basically centered on the cursory evaluation of bivariate correlation coefficients between prices of market pairs (Barrett 1996). Countless studies of market integration during the period are mostly anchored on the analysis of co-movement of prices via the Pearson product moment correlation coefficient and relative deviations of prices over time.

The use of correlation coefficient technique was recognized later on by economists to be subject to inferential inadequacy, and may be open to misuse when applied to poor data sets and to those that have trends, seasonality and cycles. The main danger was the possibility of spurious relationship and misleading inferences brought about by lack of stationarity of the price series. Results must be interpreted carefully and are at best be used only to augment an already thorough

knowledge about the workings of the market being studied (Alexander & Wyeth, 1994). Despite widespread recognition of the inferential dangers in using correlation analysis in testing for market integration, more recent techniques like Granger Causality (Gupta & Mueller, 1982), error-correction (Ravallion, 1986), and econometric cointegration (Alexander & Wyeth, 1994) are still based on assessing the co-movement of interregional prices.

Aside from these techniques, a more modern approach introduced by Gonzales-Rivera and Helfand in 2001 – hence the GRH approach – is also a test for detecting linkages as found in the literature. The pioneers argued that it is not sufficient for market integration to hold that $I(1)$ prices in an n -market system be cointegrated. It was proposed that whenever there is a single common factor linking these markets, it would mean that there should be $n-1$ cointegration vectors, which is insufficient to validate the bivariate approach. A cointegrated system can be written as a vector error correction model (VEC). In a system with n locations, each equation of the VEC is likely to contain error correction terms and lags from numerous other locations in the market system. The standard approach necessarily restricts each equation of the VEC to have at most one error correction term and implied lag structures. In most cases this would be a gross misspecification of the model. The GRH overcomes this problem.

Relevant Empirical Studies

Most of the market analysis methods enumerated above have been applied to real-world interregional market settings, generally in developing economies. Interestingly, among the studies in the literature that are important to the development of the present study are those that employed Philippine rice data. In particular, the studies of Baulch (1997) and that of Dercon and Van Campenhout (1999) offer a lot of valuable insights. The same thing can be said of the analysis of rice market integration in countries having more or less similar marketing and distribution systems as in the Philippines. Among these studies are those of Alexander and Wyeth (1994) for the interregional rice market of Indonesia, Goleti et al. (1996) in the rice market of Vietnam, Rozele et al. (1997) on the rice and corn market of China and that of Laping (2001) on the rice, corn and pork market of China as well. A much recent analysis by Jha et al. (2005) delved into the wholesale rice markets in India.

Baulch (1997) implemented the Parity Band Model (PBM) to wholesale rice markets in the Philippines. Instead of using all potential supply-demand regional market pairs, he only considered 8 traditional market routes involving only 7 regions – Metro Manila and Region VII (Central Visayas) representing deficit regions; Regions II (Northern Luzon), III (Central Luzon) and VI (Western Visayas) as surplus regions, and Region IX (Western Mindanao) as a relatively self sufficient region. Using monthly price series from January 1983 to June 1993, and transfer costs data which the author constructed using a special survey, the study revealed that Philippine rice markets are integrated 100 percent of the time (except between market pair Region VI-Region VII where estimation problem was encountered which the author attributed to a monopoly element in shipping). Price transmission was seen to be complete within a single period (one month) and the model was able to detect efficient spatial arbitrage and all market pairs considered.

Using the same data set employed by Baulch, Dercon and Campenhout (1999) applied a testing procedure called the Band-Threshold Autoregression (Band-TAR) and found somewhat differing short run results than that of Baulch PBM. The study showed that the markets are not integrated in the short run, with the exception of the high volume trade routes between Region II to Metro Manila and Metro Manila to Region IV. However, long run integration of all market pairs was established and found quick adjustment (within one month—consistent with short run integration) in two—Region II to Manila and Region VI to Manila. Contrary to Baulch, only four of the eight market pairs considered adhered to the efficient arbitrage conditions. Unexploited profits are common, especially in the market pair Region VI-Region VII. The results of this study however, appear to be downgraded by the lack of inference made on the estimated thresholds.

The study made by Alexander and Wyeth (1994) on the integration of the Indonesian rice market incorporated improvements on the Ravallion model by introducing the concept of econometric cointegration to the standard Ravallion procedure. The resulting model is an error correction representation of the standard model, which is to be implemented after establishing cointegration. The model, as applied to the Indonesian rice market revealed that supply factors carry more importance than demand factors in influencing rice prices in Indonesia. Using the Augmented Dickey Fuller (ADF) procedure in establishing cointegration, a weaker form of long run market integration was established in practically all of the pair wise combinations of seven rice producing provinces. The only route that failed to pass the cointegration test was the Surabaya to Ujung Pandang. The study evidently suffers from lack of empirical strength since only weak form test was employed and the price adjustment mechanism, which the model can adequately handle, was not pursued.

The study of Goleti et al. (1996) on the rice market of Vietnam looked into the extent of its spatial integration using the traditional market analysis tools. Correlation based analysis revealed a higher level of integration during the period 1986-1990 but significantly dropped the period 1991-1995. More sophisticated cointegration and error-correction models supported such a result. The study also found that one out of every five regional market pairs in Vietnam are segregated, basically because of poor infrastructure.

Like the study on the Vietnamese market, the work of Rozelle et al. (1997) of the rice and corn market of China employed a good number of traditional statistical tools to trace their evolution towards integration. The only analytical improvement the China study has over Vietnam case is the use of Parity bounds analysis pioneered by Saxton, Kling and Carman (1997). All of the tools used in the analysis confirmed the presence of increasing level of market intervention in both rice and corn markets. Laping (2001), on the other hand, assessed the price differentials and market integration of China's three main agricultural products which are rice, corn and pork. Laping (2001) was able to test integration of the markets in both the short- and long-run. The proponent pursued the Bessler and Brandt (1982) model using the F-test and the Engle-Granger 2-step residual based test in evaluating short and long-run integration, respectively. It was found that market integration existed only in the long-run for China's markets.

Lastly, Jha et al. (2005), after considering other correlation-based tests, chose to employ the GRH approach in 55 wholesale rice markets in India using monthly data over the period January 1970 – December 1999. It was found that market integration is far from complete in India. Correspondingly with the result of Rozelle et al. (1997) China study, the conclusion by Jha et al. (2005) of a segregated market was also attributed to excessive interference in rice markets; hence it became hard for scarcity conditions in isolated markets to be picked up by markets with abundance in supply.

Intal and Ranit (2001) compiled a fairly extensive literature review on the Philippines agricultural distribution system, and cited a good number of local market integration studies for different agricultural commodities. Among the research gaps they uncovered is the need for an intensive evaluation of the efficiency and competitiveness of the agricultural sector. In line with this research agenda is the conduct of market integration studies for the key agricultural products of the country for as many supply-demand routes as possible.

Inter-market price analysis with transport cost have to be undertaken to examine the possible existence of monopoly/monopsony element along the distribution market chain and transportation bottlenecks brought about by poor infrastructure facilities. Market integration studies to be conducted must be comprehensive employing the most suitable analytical techniques in order to have robust conclusions.

Related Empirical Studies

While there are numerous accounts on rice, corn and other grain produce, the presence of analysis on livestock market integration cannot be discounted. Works by Goodwin and Schroeder (1990) on U.S. cattle markets, and Fafchamps and Gavian (1995) on the Niger livestock markets shall be discussed briefly.

Not all countries depend on rice as their staple food. Goodwin and Schroeder (1990) built their study based on the Law of One Price. To prove price co-movement in almost all state cattle markets, they incorporated the Generalized Method of Moments (GMM) procedure that overcame the problems of simultaneity and serial correlation inherent in the standard approaches to testing spatial market integration.

On the other hand, Fafchamps and Gavian (1995) tested for cointegration and Granger Causality, estimated a version of Ravallion's model, computed average price differentials, and estimated a Parity Bounds Model (PBM). The evidence all points in the same direction—that livestock markets in Niger are related but not closely integrated. This result is due to the lack of market integration and can thus be blamed in part on the long distances involved and on the rudimentary way in which animals are transported from one market to another. Long distance trade, as opposed to local arbitrage, appears to be what guarantees a modicum of market efficiency.

Theoretical Framework

Geographically separated markets for a homogeneous commodity are integrated if goods and information flow freely among them. As a result, prices are linked and arbitrage activities will not allow prices to differ by an amount greater than the transfer costs. Whenever the spread of prices between a pair of markets are larger than unit transfer cost, profitable opportunities are not being exploited, in which case these markets are not efficiently connected. In integrated markets however, price changes in one region are reflected in the other region's price.

In an interregional setup for the market of a homogeneous agricultural commodity such as rice, two regional markets belonging to this setup are said to be spatially integrated whenever the following conditions are satisfied: *when trade takes place between them, the nominal price at the receiving market is equal to the nominal price at the exporting market plus the transportation and other incidental costs required in moving unit amount of commodity between them.* Notationally, if P^{ij}_t denotes the unit price of the commodity in the exporting market during time period t and P^{jl}_t the contemporaneous unit price in the importing market, and T^{ijl}_t denotes unit transfer cost incurred in i to j route during the same period, then if:

$$P^{ij}_t + T^{ijl}_t = P^{jl}_t$$

Then there is no incentive to trade. Arbitrage occurs when

$$P^{ij}_t + T^{ijl}_t < P^{jl}_t$$

In the literature, the above conditions are referred to as the spatial arbitrage conditions, which are the pre-conditions to the presence of market integration between the two linked markets for the same standardized commodity. On the other hand, whenever:

$$P^{ij}_t + T^{ijl}_t > P^{jl}_t$$

the spatial arbitrage conditions are violated, whether or not trade occurs. This violation constitutes an evidence of lack of market integration.

Empirical evaluation of the presence or absence of market integration must take into account available price time series on the various markets. Conventional tests are basically level I procedures anchored on econometric assessment of long-run co-movement of the price series of the market pairs. Baulch (1997) identified four econometric approaches that can be employed in measuring spatial market integration: the Law of One Price (LOP), the Ravallion Model, the Granger Causality technique and Econometric Cointegration analysis.

Richardson (1978) postulated that the LOP is a test of market integration in period t and involves the regression:

$$\Delta P^{jl}_t = \beta_1 + \beta_2 \Delta P^{ij}_t + u_t$$

If the joint test $\beta_1 = 0$ and $\beta_2 = 1$ is not rejected, the two prices are not statistically different, hence the LOP holds. The model is estimated using the original price series or series in natural logarithms. The former implies an absolute price difference as the maintained hypothesis, while the latter implies a proportional price difference. Ravallion (1986) extended the LOP model of Richardson by assuming that price adjustment between markets takes time, and through an error correction model (ECM) showed that a nested test for short-run market integration is equivalent to a test of the LOP. The Granger-Causality Approach Gupta and Mueller (1982), Alexander and Wyeth (1994) on the other hand, improved on the Ravallion Model and employed a single equation ECM to test for causality between prices.

The econometric cointegration technique (Palaskas & Harris-Whit, 1993; Alexander & Wyeth, 1994; Prakash & Taylor, 1997) of establishing spatial market integration is based on the first step of the Engle and Granger (1987) two-step procedure that is estimating the regression:

$$P^{lij}_t = \beta_1 + \beta_2 P^{lij}_t + u_t$$

A test of long-run spatial integration is equivalent to testing the presence of unit root(s) in the stochastic disturbance term, that is, the stationarity of the residual series (u_t). The theoretical basis of such procedure is the fact that if the linear combination of two non-stationary, that is I(1) variables, is stationary then the two variables are said to be cointegrated (Engle & Granger, 1987) and a long-run equilibrium relationship exist between the two series.

Empirical Methodology

In order to supply the empirical content to the theoretical framework of the study, the following approach is adopted in the study: an initial assessment of the presence of seasonality of the different price series will be implemented to make required transformation if warranted, in order to remove seasonal disturbances. The X11 and X12 Census Bureau routines will be employed in testing as well as in the deseasonalization process. After addressing the problem of seasonality, a cursory analysis of the line graph of all the series will be carried out to check the graphical pattern of prices.

Pearson Product-Moment correlation coefficients of the various pair-wise combinations of regional market prices will then be undertaken. Such a procedure is necessary to check whether the different regional market pairs exhibit significant linear relationships in their price time series. This step will provide an intuitively appealing evidence of the price linkages among the markets. Although the results of this step should be viewed with caution because of the possibility of spurious correlation, their strong intuitive appeal should never be overlooked.

Unit Root Tests

The main technique involved in the empirical methodology used in the study is Ordinary Least Squares (OLS) regression. An implicit requirement of any regression-based model is that all time series variables to be used should exhibit the property of stationarity. A variable is said

to be stationary if it has time invariant mean and variance, and the covariance between two time periods depends only on the lag between the periods and not on the length of the estimation period (Gujarati, 2003). Implementing OLS regressions on non-stationary series may result in spurious or nonsensical outcomes. Hence, as a matter of course, all time series-based analyses must include prior testing for the stationarity of the variables involved.

Unfortunately, most available economic time series are not stationary in nature and must undergo appropriate transformation before they can achieve stationarity. The most frequent transformation used in practice is the process called integration (or differencing). A stationary series is said to be integrated of order zero or $I(0)$ since it does not require undergoing differencing before attaining stationarity. Most economic time series are $I(1)$, that is, they generally become stationary only after taking their first differences. In general, if a non-stationary series has to be first differenced d times to make it stationary is said to be integrated of order (d), or $I(d)$.

A formal test of stationarity that has become very popular over the past two decades is the so-called Unit Root test. An $I(d)$ series is said to contain d unit roots, hence the null hypothesis is $H_0: I(1)$ is synonymous to the non-stationarity of the level value of the underlying series versus the alternative of $H_1: I(0)$. Such test is an empirical verification of the presence or absence of a single unit root of the underlying time series. In this study two powerful unit root diagnostics are employed—the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests.

Cointegration Analysis

The term cointegration is a property of two or more variables which have already been shown to be integrated (that is, $I(d)$) and which, though trending, cannot drift too far apart. Since they are “tied together” in some sense, long run equilibrium will exist in a model based on such variables (Alexander & Wyeth, 1994). When two price series are cointegrated it follows that the markets are integrated in the long run, in economic sense.

Engle and Granger (1987) pointed out that if a series must be differenced d times before it becomes stationary, then it contains d unit roots and is said to be integrated of order d , denoted $I(d)$. Then if two time series y_t and x_t were both $I(1)$, and $\varepsilon_t \sim I(0)$, the two series would be cointegrated of order $CI(1,1)$.

Until recently, much of the empirical work involving the estimation of cointegrating vectors utilized the single-equation error-correction technique proposed primarily by Engle and Granger (1987). While quite useful, this technique suffers from a number of problems. For instance, it allowed for the estimation and testing of only one cointegrating vector, even though there could be as many as the number of variables involved less one. In the past few years, Johansen (1988) outlined a method, which was later expanded by Johansen and Juselius (1990), which allowed for the testing of more than one cointegrating vector in the data.

The Johansen-Juselius methodology begins with a statistical model of the following form:

$$\mathbf{X}_t = \Pi_1 \mathbf{X}_{t-1} + \dots + \Pi_k \mathbf{X}_{t-k} + \boldsymbol{\mu} + \boldsymbol{\varepsilon}_t$$

Where \mathbf{X}_t is a vector of p variables, $\boldsymbol{\varepsilon}_t$ is a vector of disturbances such that $\boldsymbol{\varepsilon}_1, \dots, \boldsymbol{\varepsilon}_t$ are iid $N(\mathbf{0}, \Lambda)$, $\boldsymbol{\mu}$ is a constant.

The Johansen-Juselius technique decomposed the matrix Π ($p \times p$) to discover information about the long-run relationships between the variables in \mathbf{X} . In particular, if Π has a rank of $0 < r < p$, then it can be written as $\Pi = \boldsymbol{\alpha} \boldsymbol{\beta}'$ where $\boldsymbol{\beta}'$ is an $r \times p$ matrix of r cointegrating vectors, and $\boldsymbol{\alpha}$ is a $p \times r$ matrix of loading or speed of adjustment. Johansen and Juselius designed a maximum likelihood estimator to obtain estimates of $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}'$. This procedure also yields two test statistics of the number of statistically significant cointegrating vectors. One test is called the λ -max statistic and compares the null of $\mathbf{H}_0(r)$ with an alternative of $\mathbf{H}_1(r+1)$. The second is the trace test, which examines the same null of $\mathbf{H}_0(r)$ versus an alternative of $\mathbf{H}_1(p)$. Both the Maximum Eigenvalue and the Trace tests for cointegration utilize the MacKinnon critical values. The Johansen cointegration procedure examines cointegration based on the technique of reduced rank regression in the Vector Autoregression (VAR) framework.

Data Used in the Study

The choice of the database to be used in the study is not a particularly easy one. There are several rice price time series that are obtainable from the Bureau of Agricultural Statistics, the primary agricultural data producer. These are: Farm gate, Retail and Wholesale prices. All price series are available for nationwide, provincial and regional domains, and also for the different reporting frequencies – monthly, quarterly and annually. Furthermore, the price series are also classified as to the various rice variety – ordinary, premium grade, etc.

This study deemed appropriate to use regional monthly wholesale price series for the ordinary variety of rice. Monthly series were preferred over annual and quarterly frequency because of the large observation volume required to be used by most models. Wholesale prices were chosen since rice dispersal is based on wholesale prices; and Ordinary variety, because of the large transaction volume of this variety in rice trading.

The period of analysis covers a 13-year monthly era from January 1989 to December 2001—long enough time period to capture the inherent tendencies of regional price series to exhibit their long run linkages. The total of 156 monthly observations expectedly contained all information needed in performing all of the statistical tests of cointegration in the methodology section.

Discussion of the Results

The logical starting point in analyzing the regional co-movement of the regional price series over time is to make a cursory glimpse at the line graph of the different variables. Figure 1 shows the movement of the sixteen regional monthly time series of rice prices over the whole period of analysis. Prices appear to move together as an ensemble, with almost all series making the same turning point except for one or two regions which make reversed turns at some points in time. Identifiable seasonality was ruled out by the X11 and X12 routines of Eviews 4.1.

Such concerted movement of the regional price series provides an early indication that common shocks and other universal market forces are influencing regional rice prices. The presence of some regions making some atypical turning point behavior shows the likelihood of existence of some market imperfections and some regions during certain points in time.

During the middle part of 1995, a very prominent spike in all regional price series was noted, followed by a precipitous drop immediately to some extent, and followed by a somewhat sideways movement for the rest of the period under review. A distinctive feature of the movement of the prices is that they give the impression that an invisible hand is guiding them in a smooth manner along the time path of the study.

Correlation Matrix of Prices

An intuitively appealing procedure to use in the light of the ostensible co-movement of the price variables of the different regions is to look at their statistical correlation. One may rationalize that if the prices exhibit highly significant pair wise correlations, they also show an unmistakably strong sign of integration. Table 1 presents the correlation matrix of all possible regional market pairs. All entries in the table register Pearson-Product moment correlation coefficients of not lower than 98%, indicating a compelling evidence of market linkages.

Although the strong price relationships of the different regional markets for rice may give the impression of being excellent evidence of their spatial integration, one should view such findings with caution. The method of using bivariate correlations as a measure of market integration suffers from a number of defects. For one, similar pattern of events such as droughts, excessive rainfalls and other weather related phenomena might cause the prices at different locations to move in line with each other. More importantly, general economic trends and other forces of growth and decay pull the different regional prices in common direction, such as inflation, population growth, technology and other demographic changes.

Thus the information given by the correlation matrix of inter-regional rice markets may not be strong evidence in support of market integration. The existence of high inter-correlations should be supported by more in-depth analysis of the various price statistics.

Time Series Properties of the Regional Rice Prices

The feature graphically exhibited by the different regional price series may lead one to believe that practically all of these variables follow the same secular trend. This trending behavior is a feature of non-stationary time series. To formally test for the seeming non-stationary movement of the different series, a battery of unit root tests will have to be implemented.

Unit Root Test Results

One common characteristic of most economic time series is that they appear to be moving together in unison, as certain common overriding forces of growth and decline impact their behavior. Such feature of economic variables makes them non-stationary and a regression involving these time series may produce spurious results. In order to empirically verify the extent of deviation from stationary movement of the regional rice price series, two of the most powerful and highly popular unit root tests are implemented in the study – the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) tests.

Results of the ADF Unit Root Tests.

The standard procedure for determining the order of integration of a time series is the Augmented Dickey-Fuller Test. The test requires regressing the first difference of the tested series on a constant, its first period lag series and several lags of the first differenced series. The number of lagged first difference must be chosen so as to remove all traces of higher order residual autocorrelation.

Shown in Table 2 are the computerized results of the implementation of the ADF test. The optimal lag length for each regional price series is automatically determined for the level values of the prices by the Eviews 4.1 using Akaike Information Criterion (AIC). Intercept and trend are assumed for the level values while random walk is assumed for the first-differenced D(1) series.

The Augmented Dickey-Fuller (ADF) tests undertaken for the 16 regional monthly price series covering the period January 1989 to December 2001 formalize our initial cursory assessment on the non-stationarity of all of the level series. With all of the Tau (τ) statistics registering extremely high p-values, the null hypothesis of non-stationarity cannot be rejected at any conventional levels of significance. However, when the first difference transformed series were tested, all of the τ -values of ADF statistics show highly significant results indicating the stationarity of the D(1) series. Hence without the shadow of doubt, the regional price series are I(1) and their first difference are I(0).

To bolster our findings concerning the I(1) and I(0) nature of the level regional series and their first difference respectively, the Phillips-Perron (PP) Unit root test is implemented using the same data.

Generally, the Phillips-Perron tests confirm the findings of the Augmented Dickey-Fuller tests on the presence of unit roots in the price series in all regions. The only instance when the two tests diverge in their results is in the case of Region 1, when the PP test recognized Region 1's level series to be $I(0)$ with p-value of 0.0251 (significant at 5 percent) while ADF τ -statistic has a p-value of 0.6105 (not significant) for Region 1. Both test agree that the $D(1)$ series for Region 1 is $I(0)$. In this instance, the ADF test result is deemed to prevail because of the counter-intuitive nature of Phillip-Perron's result that the level series for Region 1 and its first difference are both $I(0)$.

Econometric Cointegration of Prices

Having mentioned that the regional price series are integrated of order one, or $I(1)$ and their respective first difference series are stationary at order zero, or $I(0)$, the stage is now clear to test for the bivariate cointegration of the 120 distinct pair wise combinations of regional rice markets.

As mentioned in the discussion on the methodology to use, three tests to establish the cointegration of the various regional routes will be employed in the empirical portion of the study. Each of these cointegration-based testing techniques has its own shortcomings and merits. In this study, in contrast with other spatial integration studies made on regional market setup, all three tests will be applied to check whether each one supports the findings of the other two. The three tests are the Engle-Granger 2-step test, the Maximum Eigenvalue and Trace Statistics tests.

Results of the Engle-Granger Cointegration Test.

Shown in Table 4 are the results of the ADF unit root tests of the residuals of the test regressions involving the different regional market pairs. The table reveals that out of the 120 possible pairs, only 4 routes produced non-stationary residuals, signifying that these routes are not statistically cointegrated. In non-technical terms, these market pairs do not show evidence of spatial integration. The rest of the regional market routes are all tied-up in some sense, thus are spatially integrated. The segregated market pairs are: Region 8 with Region 1 and Region 5, and CARAGA region with Region 9 and 11. Before any final conclusions can be drawn from the results of the Engle-Granger procedure, the results of the two other cointegration tests must be considered.

The figures reflected in Table 4 are the ADF Tau statistics of the residuals of the ADF regressions relating the different market pairs. Being $I(1)$, the regional price series are all non-stationary. Hence, regressions involving them may produce spurious results unless they are truly linked in a long run fashion. According to Engle and Granger (1987), if bivariate regressions featuring $I(1)$ variables can generate $I(0)$ residuals, the variables show evidence of long run equilibrium relationship.

Results of the Maximum Eigenvalue Tests.

The first of the two Vector Autoregression (VAR) based Johansen tests for econometric cointegration is put into application, and the outcomes are shown in Table 5.

The figures shown in the table are the computed values of the Johansen Maximum Eigenvalue test statistic for the various market pairs. The higher the value for this statistic, the more likely the regional market pairs are linked in a steady-state fashion. The critical values for the test at various conventional levels of significance are those by Osterwald and Lenum (1992). Looking at the figures in the table, one may notice that only five out of the 120 routes showed absence of cointegration. These include the four identified by the Engle-Granger (EG) procedure, while the market pair Region 1-Caraga, identified by this method but was not detected by the EG technique. Thus, in general, the battery of Maximum Eigenvalue tests confirms the results of the EG procedure. It also intensified the empirical evidence gathered by the EG tests concerning the likelihood of persistent risk-free arbitrage opportunities in some routes involving Region 8 and CARAGA region. What are in these regions that lack of cointegration is manifested may not be answered by the study in the absence of transfer costs and other trader-specific information.

Results of the Johansen Trace Statistics Tests

The final econometric cointegration test to be put to work in this study is the Trace Statistics test, also developed by Johansen and operationalized through maximum likelihood estimation. The test, like the Maximum Eigenvalue criterion, is based on Vector Autoregression (VAR) framework. These two tests are considered as state-of-the-art in testing for cointegration and are powerful enough to detect cointegration of a given set of I(1) variables in a multivariate setup.

The results of the Trace tests are presented in **Table 6**. It is interesting to note that the outcome of the test to the same set of market pairs exactly duplicated that of the Maximum Eigenvalue tests. These regional market pairs are deemed to be significantly separated.

Inference drawn from the Cointegration Test Results.

A consensus was reached by the empirical evaluation of econometric cointegration. The three tests used are almost unanimous in their results that the Philippines inter-regional market for rice is highly integrated notwithstanding the presence of a few market pairs that are not spatially integrated. These market pairs which curiously involve two regions—Region 8 and CARAGA exhibit aberrant behavior, the explanation of which is beyond the scope of this study. Just the same, out of the 120 possible regional market pairs, 115 are found to be spatially integrated, for a better than 95% success rate.

The results of the study might be a surprise to some analysts who expect lesser level of cointegration of regional markets because of the generally fragmented distribution system and oftentimes-inefficient transportation system. Also, being an archipelago of widely dispersed

island groups and regions, dispersal bottlenecks and the presence of oligopolistic elements in certain areas of the rice marketing chain contributed to the perception that the law of one price may not hold in many inter-regional routes.

The graphical evidence provided by the line graph of regional price series for rice in Figure 1 and Appendix B, and the extremely high inter-correlation of the prices across regions are some of the initial indications of the high level of spatial integration of the markets.

Granger Causality of Regional Prices

After undertaking cointegration analysis of the long run linkages of the various market pairs, and having identified the market pair that are linked, an analysis of statistical causation can now be made. This type of analysis is known in the literature as Granger Causality test. This test is anchored on the rationale that if a pair of series is cointegrated, then there must be Granger-Causality (or statistical causation) in at least one direction – from one market to another, or from the other market to the other, or a two-way causation (feedback) between the two markets.

Granger causality tests focus on the presence of at least unidirectional causality linkages as an indication of some extent of integration (Gupta & Mueller, 1982). Feedback implies that each market uses information from the others when forming its own price expectations, while unidirectional causality indicated something of leader-follower relationships in terms of price adjustment (Gordon et al., 1993; Bellego, 1992). The empirical results of the Granger causality tests performed in all regional market pairs are presented in Table 7.

It should be made clear that whenever market pairs are cointegrated, there exist at least a unidirectional causality exerted by one variable over the other. The symbols exhibited in the table are the causality directions of the row/column market. For instance, a symbol \Rightarrow means that the information provided by the row market contribute in the price formation in the column market. A symbol \Leftarrow on the other hand, suggests that the column market is the one providing the information for the formation of prices in the row market. When the symbol \Leftrightarrow is noted for the market pair, the conjecture is that there is some sort of “feedback” statistical causality between the paired market. Finally, the symbol \equiv implies market pair to be non-integrated.

The information provided by Table 7 indicates the high level of integration among regional rice markets. Except for some non-linked markets, the various market pairs exhibit Granger causality in either directions, or are linked in a feedback relationship. Only about 6 regional pairs show evidence of segregation, five of which coincide with the ones identified by the Engle-Granger and the Johansen cointegration test approaches. The only non-linked pairs identified by the Granger causality approach not identified by the other tests is the ARMM-Region 1 route.

It is interesting to note that the all unidirectional causality registered in routes emanating from Metro Manila Region suggest that information from the capital region are used to form price expectations in the regions 4, 5, 6, 7 and CAR. Only ARMM signified reversed causality. The rest of other regions exhibit feedback causality. On the other hand, in most of the rice

producing regions (Region 2, Region 3), causality directions mainly point toward them, which means that price formation information in these regions came mostly from their regional trade partners.

Conclusions and Implications of the Results

The present study is an attempt to examine the extent of the spatial integration of the regional markets for milled rice in the country. The research covers all of the 120 different pair wise combinations of regional markets using monthly price per kilo data for Wholesale Ordinary variety the period 1989 to 2001. Other studies made concerning Philippine interregional rice integration are not as comprehensive in their analyses, although some of these studies employ sophisticated Level II analysis (prices with transfer cost data).

One other distinguishing feature of this study aside from its comprehensive scope is the use of four cointegration based econometric analyses (Engle-Granger technique, Maximum Eigenvalue and Trace Statistics of Johansen; and the Granger Causality approach). This is in addition to the usual descriptive assessment of the graphical flow of prices over time and evaluation of the bivariate correlations of the pairs of regional price series. It was initially intended to undertake Level II analysis but because of serious data availability constraint, an upgraded Level I type of market analysis was implemented.

Conclusions Drawn from the Analysis

The primary result of the study is the empirically determined high level of spatial market integration of the inter-regional rice markets. Out of the 120 possible regional market pairs, 115 showed statistically significant level of spatial integration, with results of the four empirical procedures confirming each other's results. Only the market pairs of **CARAGA-Region 1, CARAGA-Region 9, CARAGA-Region 12, Region 8-Region 1 and Region 8-Region 5** are found to be non-spatially integrated. This does not mean that no trading is possible along these routes and there exists market failures along these routes.

In the non-integrated pairs, what the study uncovered is simply the lack of statistical alignment of prices in these regional pairs. In other words, there exist no long-run equilibrium relationship of the prices in the identified market pairs, and that the price transmission mechanism is flawed. The reasons for such market segregation were not pursued in the study since the available data are not sufficient to do such analysis. It might be an interesting research question as to why such market pairs involving CARAGA and Region 8 exhibited such tendency.

The Granger causality tests conducted on all regional market pairs identified what the theory predicts—that at least a unidirectional causality exists in the integrated market pairs. Interestingly, market information in deficit regions are apparently being used in the price formation at the rice producing regions. In some deficit-surplus regional pairs, significant feedback causality is noted.

All of the inference procedures used in the study generated almost identical results, thus giving us sufficient confidence on the empirical validity of our results—**the interregional rice price transmission system is highly efficient.**

Implications of the Results and Recommendations

It has been propounded in theory that the existence of market integration is a prerequisite to an efficient system of price formation and price discovery in widely dispersed spatial markets of homogeneous commodities. Generally, the Law of One Price (LOP) is expected to prevail when spatial markets are integrated. This means that contemporaneous prices in two location-separated markets are expected to differ only by an amount equivalent to the cost needed in transferring the commodity from the exporting to the importing region. When the price transmission system is flawed, persistent risk-free arbitrage opportunities may never be discovered and availed of by spatial traders, resulting in market failures.

In the case of the interregional market for rice in the Philippines, the study uncovered the existence of a high level of spatial integration. Higher than 95% of all regional market pairs have long-run equilibrium price linkages, and that short-run deviations from equilibrium will readily be corrected through the efficient transmission of price setting information. The following are the possible implications of the findings made:

- The Law of One Price is in operation in the inter-regional rice market of the Philippines.
- For the rice traders to take advantage of the high level of spatial market integration, the problem of the highly inefficient and fragmented distribution and transportation systems must be addressed.
- Because of the high level of spatial integration of regional rice markets, government price support and other market-oriented policies are expected to achieve their intended goals.
- The greater the extent of domestic market integration, the more modest are the informational and technical demands necessary for policy formulation.
- More importance should now be placed on alternative non-price government policies such as investment in roads, electricity, irrigation, research and development, etc., for stimulating agricultural output.
- Further research on market integration for rice using advance Level II (with transfer costs data) and Level III (with transfer costs and trade flows data) analysis should be supported.
- Market integration studies across marketing stages (farm gate-wholesale-retail) must also be encouraged.
- Efforts should also be expended to empirically determine the extent of spatial market integration for other major agricultural commodities.

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Table 1
Correlation Matrix of the Regional Rice Price Series

	ARMM	CAR	CARAGA	MM	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
ARMM	1.0000	0.9676	0.9665	0.9795	0.9767	0.9676	0.9782	0.9837	0.9706	0.9691	0.9769	0.9772	0.9734	0.9754	0.9528	0.9607
CAR		1.0000	0.9779	0.9890	0.9843	0.9883	0.9885	0.9834	0.9886	0.9643	0.9855	0.9893	0.9814	0.9837	0.9655	0.9585
CARAGA			1.0000	0.9852	0.9747	0.9762	0.9764	0.9695	0.9773	0.9628	0.9873	0.9871	0.9947	0.9905	0.9867	0.9731
MM				1.0000	0.9860	0.9904	0.9909	0.9890	0.9882	0.9797	0.9927	0.9929	0.9887	0.9927	0.9784	0.9736
R1					1.0000	0.9819	0.9860	0.9878	0.9825	0.9778	0.9859	0.9867	0.9788	0.9812	0.9598	0.9578
R2						1.0000	0.9854	0.9811	0.9881	0.9721	0.9854	0.9875	0.9817	0.9873	0.9720	0.9611
R3							1.0000	0.9916	0.9855	0.9736	0.9861	0.9893	0.9801	0.9865	0.9644	0.9670
R4								1.0000	0.9874	0.9789	0.9858	0.9859	0.9747	0.9813	0.9568	0.9652
R5									1.0000	0.9704	0.9886	0.9892	0.9819	0.9838	0.9667	0.9624
R6										1.0000	0.9808	0.9719	0.9703	0.9768	0.9665	0.9752
R7											1.0000	0.9903	0.9921	0.9921	0.9826	0.9794
R8												1.0000	0.9897	0.9899	0.9745	0.9685
R9													1.0000	0.9930	0.9900	0.9793
R10														1.0000	0.9882	0.9804
R11															1.0000	0.9872
R12																1.0000

Table 2
Augmented Dickey-Fuller Unit Root Tests for Regional Rice Prices

Region	T-value @ level	p-value @ level	Lag Length	T-value @ D(1)	p-value @ D(1)
ARMM	-2.1579	0.5102	1	-9.6462	0.0000
CAR	-2.2163	0.4777	3	-7.9591	0.0000
CARAGA	-1.8650	0.6689	12	-2.8715	0.0042
METRO MANILA	-1.6775	0.7579	6	-6.8987	0.0008
REGION 1	-3.6237	0.0305	1	-8.9018	0.0000
REGION 2	-2.2839	0.4405	3	-8.4307	0.0000
REGION 3	-2.0093	0.5925	5	-10.1414	0.0000
REGION 4	-2.4463	0.3547	1	-8.8213	0.0000
REGION 5	-2.3152	0.4235	1	-9.3748	0.0000
REGION 6	-1.7715	0.7151	13	-3.1083	0.0020
REGION 7	-1.3491	0.8723	14	-3.3420	0.0009
REGION 8	-1.5564	0.8067	5	-5.7546	0.0000
REGION 9	-1.9608	0.6186	14	-2.4638	0.0137
REGION 10	-1.9609	0.6186	12	-2.9668	0.0031
REGION 11	-2.1108	0.5363	13	-3.0172	0.0027
REGION 12	-1.6576	0.7664	12	-3.2547	0.0012

Table 3
Phillips-Perron Unit Root Tests for Regional Rice Series

Region	T-value @ level	p-value @ level	Bandwidth	T-value @ D(1)	p-value @ D(1)
ARMM	-2.0335	0.5793	4	-13.1666	0.0000
CAR	-2.3791	0.3894	8	-11.3252	0.0000
CARAGA	-2.4097	0.3734	20	-9.9212	0.0000
METRO MANILA	-2.1219	0.5303	8	-10.9067	0.0000
REGION 1	-3.2444	0.0791	4	-10.0397	0.0000
REGION 2	-2.1477	0.5158	11	-10.6876	0.0000
REGION 3	-2.2313	0.4694	28	-11.9989	0.0000
REGION 4	-2.1260	0.5280	3	-9.7964	0.0000
REGION 5	-2.1696	0.5036	2	-11.3621	0.0000
REGION 6	-2.5362	0.3105	5	-13.6715	0.0000
REGION 7	-2.2952	0.4343	7	-10.6921	0.0000
REGION 8	-2.2112	0.4805	18	-12.4484	0.0000
REGION 9	-2.0749	0.5564	8	-9.3162	0.0000
REGION 10	-2.2548	0.4564	6	-10.6858	0.0000
REGION 11	-2.6020	0.2799	9	-10.5745	0.0000
REGION 12	-2.5919	0.2845	8	-10.0003	0.0000

Table 4
Engle-Granger 2-Step Cointegration Test for Regional Market Pairs

	CAR	CARAGA	MM	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
ARMM	-4.5746	-3.1049	-5.3995	-4.9620	-4.4816	-3.9774	-5.7161	-4.2506	-6.2901	-2.4424	-5.0327	-1.7383	-4.4449	-1.7999	-2.4228
CAR		-4.6218	-5.3995	-5.0390	-5.0179	-5.2726	-3.3296	-6.0709	-5.2524	-5.9426	-5.7267	-5.3806	-5.7450	-4.3904	-4.5568
CARAGA			-2.9198	-5.8941	-3.0872	-2.8417	-2.9060	-4.0613	-4.4603	-5.4491	-5.9464	-6.6440	-3.0352	-3.5156	-2.4213
MM				-5.0840	-4.1781	-5.7549	-5.4568	-5.1423	-5.9627	-6.8366	-6.7843	-5.2427	-7.2079	-2.3250	-3.4919
R1					-3.7811	-3.3477	-4.7805	-3.7140	-2.9711	-5.9980	-4.7978	-4.9427	-2.8623	-2.7453	-3.0065
R2						-4.0506	-2.7255	-6.1491	-5.8522	-2.5362	-5.2604	-3.7631	-6.2654	-2.5832	-2.7056
R3							-3.7593	-3.8539	-3.3240	-5.3158	-3.5976	-2.5859	-4.5783	-2.8362	-3.1632
R4								-3.5332	-3.3321	-4.0255	-2.7094	-2.3386	-3.6014	-2.5870	-3.0831
R5									-2.0005	-5.4790	-3.9749	-5.3173	-4.6567	-4.1558	-4.1376
R6										-1.5637	-2.2023	-3.0735	-4.4289	-3.5130	-2.9352
R7											-6.8134	-6.5298	-4.8567	-3.4317	-3.1155
R8												-2.9975	-3.2716	-3.3269	-4.3428
R9													-1.8656	-2.5206	-1.6657
R10														-2.5999	-3.2253
R11															-5.5681

Note:

Shaded values indicate lack of cointegration with $p > 0.10$ based on McKinnon Critical values. 35 out of the 120 (29%) market pairs lacked evidence for cointegration. Figures are Tau-values of the ADF Unit Root tests of residuals.

Table 5
Maximum Eigenvalue Statistics of Johansen Cointegration Test of Rice Prices of Regional Market Pairs

	CAR	CARAGA	MM	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
ARMM	11.5608	4.7037	9.7330	15.0250	8.4902	12.2614	30.6595	10.9416	29.8281	4.3996	9.1068	5.5741	5.4848	4.5645	9.2530
CAR		13.8700	14.3163	7.6309	6.9923	10.6266	7.5046	11.0121	5.1781	11.4718	17.1535	18.0992	14.0892	15.2962	13.6888
CARAGA			5.7464	15.5249	6.1342	7.6247	6.0962	8.0318	6.2309	6.8197	6.2306	7.8937	5.0707	10.0922	5.3654
MM				14.1206	7.7953	17.1047	8.2737	13.2138	7.9820	8.0336	21.0711	7.5117	9.1069	5.3638	8.9990
R1					6.1485	14.5394	18.9917	5.0193	10.4543	11.6957	10.5143	25.0019	15.3325	22.4782	23.5499
R2						11.4688	6.6957	6.3190	5.7984	2.6102	6.8038	8.2807	11.0880	7.5194	8.2910
R3							12.7414	10.7696	12.6124	10.0700	13.8599	8.3416	11.4554	9.6060	11.5253
R4								6.3964	8.1367	9.9289	7.5221	6.8866	7.2715	8.2310	13.5435
R5									4.6006	9.0815	11.2823	13.0710	10.3514	11.3381	10.1690
R6										4.2870	8.0041	9.7815	8.8938	9.6926	17.1197
R7											9.7658	15.5697	5.1273	15.9929	11.0331
R8												10.5488	12.4673	12.0572	13.6210
R9													5.4564	7.7274	6.2940
R10														9.4822	7.4381
R11															4.4330

Note:

Shaded values indicate lack of cointegration with $p > 0.10$.
 82 out of the 120 (68%) market pairs were found to be fragmented.

Table 6
Trace Statistics of Johansen Cointegration Test of Rice Prices of Regional Market Pairs

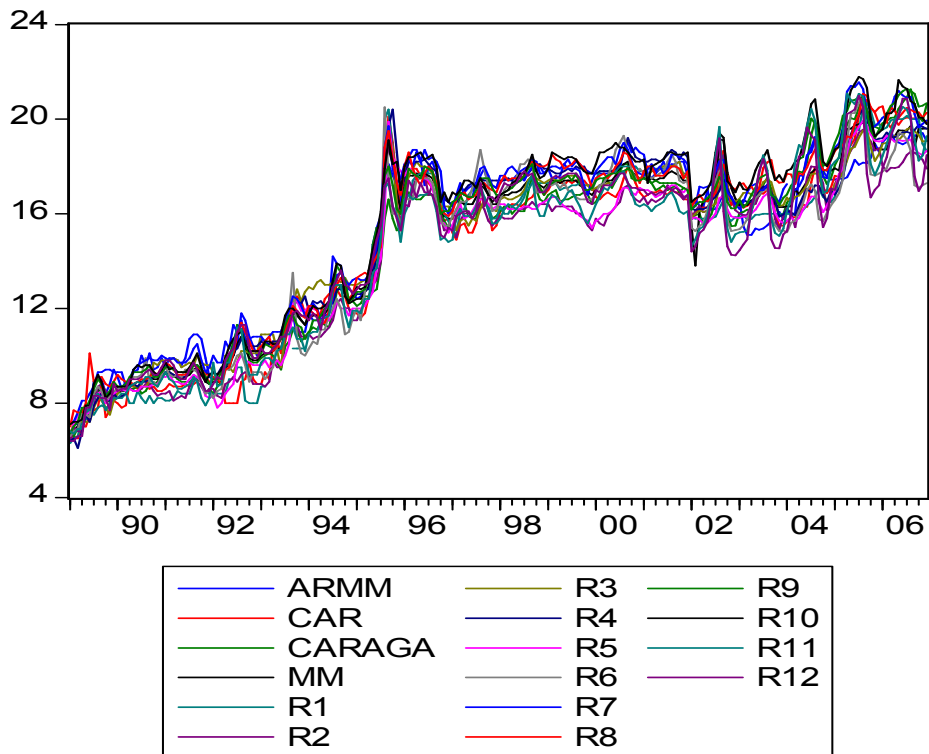
	CAR	CARAGA	MM	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
ARMM	13.8747	4.7897	11.7341	15.8518	10.6721	15.0840	33.1955	13.4051	32.2038	7.1656	11.3683	5.5795	7.1978	5.0602	11.2966
CAR		14.4162	16.3089	7.9555	8.7333	14.7149	9.5030	12.9369	6.5715	13.7887	19.0214	19.0030	16.2557	16.6590	15.8015
CARAGA			5.8677	15.8462	6.2827	7.8854	6.1451	8.2798	6.3367	7.5468	6.6520	8.6752	5.0773	10.8818	5.4501
MM				14.6298	9.8923	19.7716	9.4220	15.1214	8.7983	10.6774	22.6200	7.5127	10.9515	6.1708	11.1917
R1					6.2521	16.0447	23.2225	5.4329	10.7482	14.0594	11.0750	25.1086	17.8278	23.2856	25.4272
R2						14.7203	8.6283	7.8746	7.1418	4.6177	8.7104	8.6817	13.1971	8.6601	10.4552
R3							15.9541	14.4727	15.8659	13.2368	16.3082	9.2489	13.7103	11.1217	13.4786
R4								7.8179	11.0612	12.1953	7.9115	6.8969	8.3619	9.0127	15.2221
R5									5.9942	11.4375	12.7018	13.6162	12.5969	12.6740	12.4124
R6										5.9685	8.3497	9.8119	10.2122	10.2216	18.7708
R7											11.0157	17.4329	8.3762	19.7946	15.4905
R8												11.5499	14.7858	13.5818	15.8529
R9													5.4682	8.8110	6.3330
R10														10.5371	9.6068
R11															4.8127

Note:
Shaded values indicate lack of cointegration with $p > 0.10$.
74 out of the 120 (62%) market pairs are not cointegrated.

Table 7
Causality Directions of Linked Markets Based on Results of Granger Causality Tests

	CAR	CARAGA	MM	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
ARMM	↔	⇐	↔	↔	⇐	↔	⇐	↔	↔	⇐	↔	⇐	⇐	↔	⇐
CAR		⇐	⇐	↔	⇐	↔	↔	↔	↔	⇐	⇐	↔	⇐	↔	⇐
CARAGA			↔	⇒	⇒	↔	⇒	⇒	⇐	↔	↔	⇐	↔	↔	↔
MM				↔	↔	⇒	↔	↔	↔	↔	↔	⇐	↔	↔	↔
R1					⇒	⇒	↔	⇐	↔	⇐	⇐	⇐	⇐	↔	↔
R2						⇒	↔	↔	⇐	↔	↔	⇐	⇐	↔	↔
R3							⇐	↔	↔	⇐	⇐	↔	⇐	↔	↔
R4								↔	↔	⇐	↔	↔	⇐	↔	↔
R5									↔	↔	↔	⇐	⇐	↔	⇐
R6										⇒	↔	↔	↔	⇐	↔
R7											↔	⇐	↔	↔	↔
R8												⇐	↔	↔	↔
R9													⇒	↔	↔
R10														↔	↔
R11															↔

Figure 1. Line graph of regional rice price series.



Appendix A

Dated Data Table of Regional Monthly Rice Prices, January 1989 to December 2006

1989												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	6.7	6.9	7.0	7.3	7.8	7.8	8.2	8.6	8.5	8.2	8.2	8.5
CAR	6.5	6.6	6.5	7.0	7.0	7.5	7.7	7.8	8.9	7.4	7.7	8.1
R1	6.3	6.5	6.6	7.3	7.3	7.9	7.5	7.8	7.9	7.8	7.9	8.1
R2	6.4	7.0	6.8	6.8	7.7	7.7	8.0	8.7	8.8	8.5	8.4	8.2
R3	6.7	7.1	7.2	7.2	7.2	7.2	7.8	8.2	8.1	7.8	7.5	8.1
R4	6.4	6.5	6.1	6.8	7.5	7.2	7.9	8.2	8.4	8.1	8.1	8.4
R5	6.6	7.1	7.5	7.5	7.5	7.6	8.2	8.4	8.5	8.0	8.3	8.4
R6	6.6	6.8	6.9	7.5	7.5	7.4	8.4	8.7	8.5	8.1	8.3	8.5
R7	7.2	7.2	7.6	8.1	8.1	8.4	8.7	9.3	9.3	9.4	9.4	9.3
R8	7.0	7.7	7.6	7.6	8.0	10.1	8.9	9.1	9.1	8.8	8.7	8.9
R9	6.7	7.0	7.2	7.8	7.8	8.1	8.6	9.0	8.8	8.3	8.5	8.9
R10	7.1	7.2	7.2	7.3	7.9	7.9	8.8	9.2	8.9	8.2	8.4	8.7
R11	6.8	6.7	6.9	6.9	7.7	7.7	8.2	8.4	8.2	7.7	8.0	8.2
R12	6.4	6.4	6.6	6.6	7.8	7.8	8.3	8.3	8.2	8.2	7.7	8.8
ARMM	7.2	7.1	7.1	7.1	7.7	7.7	8.9	9.1	9.0	8.4	8.8	9.4
CARAGA	6.8	6.6	7.0	7.5	7.5	7.5	8.5	8.5	8.5	8.2	8.1	8.2

1990												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	8.5	8.5	8.6	8.7	8.8	8.9	8.9	9.0	9.1	9.0	9.0	9.2
CAR	8.0	7.8	7.9	8.9	8.7	8.6	8.8	9.0	8.6	8.7	8.5	8.5
R1	8.2	8.2	8.4	8.0	8.0	8.5	8.2	8.0	8.3	8.0	8.2	8.2
R2	8.7	8.5	8.8	8.6	8.5	8.5	8.6	8.8	8.8	8.5	8.3	8.4
R3	8.4	8.7	8.6	8.7	8.7	8.7	8.7	8.7	8.9	9.7	9.6	9.8
R4	8.2	8.3	8.4	8.7	8.8	8.7	8.9	8.9	9.0	9.1	9.2	9.1
R5	8.5	8.6	8.5	8.6	8.5	8.5	8.7	8.7	8.7	8.8	8.8	9.1
R6	8.6	8.6	8.8	8.9	9.1	9.1	9.2	9.9	8.9	8.9	8.7	9.2
R7	9.3	9.3	8.7	9.0	9.4	9.6	9.7	9.8	9.9	9.8	9.8	10.0
R8	9.2	9.0	8.9	8.9	8.8	8.9	9.0	9.0	9.1	9.3	9.2	9.5
R9	8.7	8.7	8.8	9.1	9.3	9.3	9.3	9.4	9.6	9.1	9.1	9.3
R10	8.7	8.7	8.7	8.8	9.4	9.6	9.5	9.6	9.6	9.3	9.2	9.4
R11	8.2	8.4	8.4	8.7	8.8	8.9	8.8	9.1	9.1	8.8	8.7	9.0
R12	8.5	8.6	8.6	9.0	9.0	9.0	9.1	9.3	9.4	9.2	9.2	9.5
ARMM	9.1	8.6	8.9	8.9	9.3	9.4	10.0	9.6	10.1	9.4	9.5	9.9
CARAGA	8.4	8.5	8.5	8.6	8.6	8.7	8.4	8.5	8.8	8.8	8.9	9.2

1991												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	9.3	9.2	9.1	9.1	9.0	9.1	9.2	9.4	9.5	9.2	8.9	8.8
CAR	8.6	8.8	8.7	8.7	8.7	8.8	8.7	8.8	8.9	9.3	9.1	8.9
R1	8.1	8.1	8.2	8.5	8.4	8.4	8.4	8.9	9.1	8.9	8.5	8.4
R2	8.4	8.5	8.1	8.2	8.3	8.2	8.7	9.1	8.9	8.7	8.4	8.6
R3	9.8	9.8	9.9	9.8	9.5	9.6	9.7	9.6	10.0	9.7	9.6	9.6
R4	9.3	9.3	9.2	9.1	9.1	9.1	9.4	9.6	9.6	9.4	9.3	9.2
R5	9.1	9.2	8.9	8.9	8.8	8.8	9.0	9.2	9.1	8.9	8.3	8.2
R6	9.5	9.2	9.1	9.2	9.1	9.4	9.4	9.4	9.3	8.8	8.4	8.5
R7	9.9	9.8	9.9	9.7	9.7	9.7	9.9	10.3	10.5	9.8	9.3	9.5
R8	9.7	9.6	9.4	9.2	9.2	9.2	9.4	9.6	9.5	9.4	9.2	9.2
R9	9.5	9.5	9.4	9.3	9.3	9.3	9.3	9.6	9.6	9.4	9.1	8.8
R10	9.7	9.4	9.5	9.3	9.3	9.3	9.5	9.8	10.1	9.5	8.9	9.2
R11	9.3	9.0	8.9	8.6	8.6	8.7	8.8	9.1	8.9	8.2	7.9	8.2
R12	9.8	9.8	9.6	9.1	9.0	9.0	9.4	9.7	9.4	8.9	8.5	8.5
ARMM	9.5	9.9	9.9	9.8	9.6	9.9	10.7	10.9	10.9	10.7	9.9	9.1
CARAGA	9.2	9.3	9.2	9.0	8.9	8.9	8.9	9.0	9.0	8.9	8.4	8.6

1992												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	8.9	8.9	8.9	9.5	9.6	10.0	10.5	10.8	10.3	9.9	9.8	9.8
CAR	8.9	8.9	8.9	8.0	8.0	8.0	8.0	8.9	9.0	9.7	9.0	8.8
R1	8.4	8.4	8.4	8.4	9.0	9.0	9.5	9.5	8.1	8.0	8.0	8.0
R2	8.6	8.3	8.2	8.8	8.9	9.1	8.9	9.2	9.3	9.2	8.8	8.8
R3	9.3	9.0	9.0	10.0	9.5	9.3	9.7	10.2	10.2	10.1	10.1	10.1
R4	9.3	9.2	9.5	9.5	9.8	10.2	10.3	10.7	10.7	10.4	10.4	10.4
R5	8.3	7.8	8.0	8.4	8.6	8.8	9.7	10.0	9.8	9.7	9.6	9.6
R6	8.2	8.5	8.6	9.4	9.4	9.6	10.0	10.1	9.6	8.9	9.3	9.3
R7	10.0	9.7	9.7	10.6	10.3	11.3	11.0	11.5	10.7	10.7	10.8	10.8
R8	9.1	9.0	8.8	9.4	9.5	10.1	10.9	11.4	11.0	10.6	10.2	10.2
R9	9.0	9.0	9.3	9.6	9.9	10.6	11.1	11.1	10.5	10.1	9.9	9.9
R10	9.3	9.2	9.4	9.9	10.4	10.7	10.9	11.0	10.5	10.2	10.2	10.2
R11	9.7	8.7	8.8	9.7	9.7	10.3	11.2	11.1	9.9	9.2	9.2	9.2
R12	8.8	9.1	9.0	9.8	10.1	10.3	11.0	11.3	11.3	10.3	9.9	9.9
ARMM	9.0	9.0	9.0	9.8	10.0	10.0	10.5	11.8	11.5	10.8	10.4	10.0
CARAGA	8.4	8.7	8.9	9.5	9.4	10.2	11.3	11.1	10.7	9.8	9.7	9.7

1993												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	10.0	10.1	10.1	10.2	10.3	10.3	11.0	11.3	11.8	11.7	11.5	11.3
CAR	8.8	9.3	9.0	10.5	10.6	10.1	10.6	11.3	11.9	12.5	12.3	11.8
R1	8.7	8.7	-	-	-	-	-	-	10.3	10.3	10.3	10.3
R2	8.8	8.7	8.9	9.8	9.5	9.5	10.8	11.2	11.6	11.3	10.8	10.8
R3	10.9	10.9	10.9	10.9	10.2	9.5	11.0	11.3	12.2	12.8	12.3	12.7
R4	10.6	10.5	10.5	10.6	10.6	10.8	11.4	11.5	12.1	12.3	12.2	12.5
R5	9.6	9.8	9.5	9.6	9.8	9.6	10.0	10.5	12.2	12.3	11.9	11.9
R6	9.3	9.0	9.3	9.5	10.5	11.0	11.5	11.8	13.5	10.7	10.1	10.0
R7	10.8	10.6	10.8	11.0	11.0	11.0	11.5	11.9	12.5	12.4	12.1	11.7
R8	10.4	10.6	10.8	10.2	10.4	10.7	11.1	11.5	12.1	11.9	11.7	11.6
R9	10.1	10.5	10.4	10.3	10.5	10.7	11.3	11.7	11.7	11.3	11.2	10.7
R10	10.2	10.6	10.6	10.5	10.5	10.9	11.7	12.0	12.0	11.8	11.5	11.3
R11	9.7	9.9	9.9	9.7	10.2	10.3	10.9	10.9	11.2	10.7	10.7	10.2
R12	10.3	10.1	10.1	10.3	10.5	10.8	10.8	11.3	11.8	11.9	11.7	11.7
ARMM	10.7	10.6	10.5	10.6	10.5	10.7	10.8	11.8	11.8	10.8	11.0	11.0
CARAGA	9.9	10.0	10.1	10.0	9.7	9.4	10.4	10.6	11.1	11.2	10.6	10.8

1994												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	11.6	11.7	11.7	11.7	11.8	12.0	12.5	13.0	13.0	12.6	12.2	12.3
CAR	12.0	11.8	11.7	11.8	12.4	12.6	12.2	12.8	12.5	12.5	12.0	11.8
R1	-	-	-	-	-	-	-	-	-	-	-	-
R2	10.9	10.7	10.8	10.8	11.0	11.2	11.5	12.2	12.4	12.0	12.0	11.5
R3	12.9	12.8	13.1	13.2	13.0	13.0	13.1	13.2	13.1	13.3	13.0	13.0
R4	11.9	12.3	12.2	12.3	12.1	12.2	12.2	12.8	12.8	12.6	12.4	12.4
R5	12.1	12.0	11.9	11.6	11.4	11.5	11.8	12.3	12.0	12.0	11.7	12.0
R6	10.3	10.6	10.5	11.1	11.1	11.8	12.0	12.4	12.0	10.9	11.0	11.6
R7	11.7	12.2	12.0	11.5	11.7	11.8	12.4	13.4	13.5	13.2	13.0	13.2
R8	12.1	12.1	11.9	11.3	11.4	11.9	12.6	13.0	13.3	12.9	12.4	12.6
R9	10.9	11.5	11.5	11.7	12.0	12.0	12.8	13.8	13.5	13.2	12.3	12.4
R10	11.8	12.1	12.0	12.0	12.1	12.3	13.2	13.9	13.8	12.5	12.3	12.5
R11	10.9	11.0	11.0	11.5	11.6	11.7	12.9	13.0	13.0	11.8	11.2	11.9
R12	11.5	11.8	11.6	11.1	11.9	12.3	12.9	13.2	13.6	13.0	12.9	12.6
ARMM	11.8	11.5	11.5	11.5	12.0	12.1	14.2	13.9	13.8	13.0	12.8	12.7
CARAGA	11.0	11.2	11.1	11.4	11.3	11.2	11.9	12.7	13.0	12.7	12.2	12.3

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1995												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	12.4	12.4	12.7	12.9	13.6	14.2	14.9	18.0	18.8	18.1	16.9	16.2
CAR	11.8	11.6	11.8	12.5	13.0	13.8	14.2	18.5	20.1	19.0	17.3	16.0
R1	-	-	-	-	-	-	-	20.0	20.4	18.8	15.9	14.8
R2	11.5	11.9	12.2	12.4	13.0	13.2	14.0	18.5	19.8	18.7	16.4	15.7
R3	13.0	13.1	13.2	13.2	13.4	13.8	14.1	19.0	19.4	18.8	16.3	15.3
R4	12.6	12.6	12.8	12.8	13.4	14.3	15.5	18.5	19.7	20.4	18.6	16.9
R5	12.0	12.0	12.1	12.4	12.7	13.7	14.1	16.2	19.9	18.4	18.0	17.8
R6	12.0	11.5	12.7	13.6	14.5	15.0	15.3	20.5	17.5	16.0	16.0	15.5
R7	13.3	13.2	13.2	13.4	13.8	14.7	15.6	18.8	19.7	17.9	17.3	17.5
R8	13.3	13.4	13.5	13.4	13.9	14.2	14.6	18.8	19.5	18.3	17.3	16.8
R9	12.7	12.7	12.8	13.2	14.7	15.4	15.5	17.6	18.0	17.2	16.2	16.0
R10	12.9	12.8	12.9	13.6	14.5	15.1	16.1	17.9	19.1	18.1	18.2	17.0
R11	11.9	11.8	12.4	12.4	13.5	13.7	15.0	17.1	17.3	16.3	15.9	15.4
R12	12.8	13.0	13.0	13.1	14.1	14.9	15.5	17.2	17.5	16.3	15.8	15.3
ARMM	12.4	12.5	12.7	12.9	14.7	15.4	15.9	17.2	18.1	17.6	17.3	16.5
CARAGA	12.1	12.2	12.5	12.5	12.7	12.8	14.0	15.8	16.6	15.8	15.3	15.5

1996												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	17.1	17.6	17.6	17.7	17.6	17.7	17.6	17.5	17.1	16.2	15.9	15.8
CAR	17.3	17.9	17.9	17.9	17.6	17.7	17.3	17.1	16.6	15.8	15.7	15.8
R1	16.0	16.4	17.4	17.6	17.7	17.8	17.7	17.7	17.5	16.8	16.0	15.7
R2	16.4	16.3	17.1	17.5	17.5	17.6	16.8	17.2	16.6	15.9	15.3	15.4
R3	16.8	17.6	17.9	18.2	18.0	18.0	17.9	17.7	17.0	16.3	16.3	16.3
R4	17.5	18.2	18.1	18.2	18.2	18.3	18.1	17.9	17.8	16.8	16.6	16.5
R5	17.6	17.9	17.9	17.5	17.5	17.5	17.4	17.1	16.4	15.6	15.6	15.2
R6	16.6	16.6	16.6	17.4	17.5	17.5	17.5	17.3	16.5	15.7	15.5	15.5
R7	18.1	18.3	18.0	18.6	18.2	18.7	18.3	18.4	18.2	17.8	16.3	16.0
R8	18.0	18.6	17.9	17.5	17.2	17.7	18.0	17.8	17.3	16.2	16.0	15.9
R9	17.0	17.9	17.7	17.6	17.5	18.0	17.9	17.8	17.1	16.0	16.1	16.1
R10	18.0	18.4	18.4	18.5	18.6	18.3	18.4	18.5	18.0	16.5	16.9	16.5
R11	16.6	16.8	16.6	16.7	16.8	16.8	16.9	16.8	16.1	14.9	15.0	14.8
R12	16.2	17.4	17.1	16.7	17.3	16.9	16.9	16.8	16.3	15.1	15.0	15.4
ARMM	17.6	18.4	18.7	18.7	18.3	17.2	18.0	18.2	17.7	16.6	16.7	16.5
CARAGA	16.4	16.9	16.7	16.6	16.6	16.8	16.8	16.8	16.5	16.1	15.7	15.4

1997												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	15.8	16.0	16.5	16.4	16.4	16.4	16.7	17.2	17.1	16.8	16.4	16.4
CAR	15.2	14.9	15.5	15.6	15.2	15.2	15.6	16.6	16.7	16.3	15.3	15.5
R1	15.3	15.1	16.1	16.2	16.8	17.0	17.3	17.0	16.7	16.3	15.8	15.8
R2	15.3	15.0	15.7	16.0	16.0	15.8	16.1	16.4	16.2	15.7	15.5	15.7
R3	16.0	15.3	15.7	15.8	15.5	15.8	15.7	16.2	16.6	16.4	16.2	16.1
R4	16.3	16.5	16.8	17.0	17.2	17.3	17.3	17.5	17.4	17.4	17.4	17.4
R5	15.5	16.0	16.4	15.8	15.9	16.1	16.4	16.6	16.6	16.4	16.2	16.3
R6	15.9	16.2	16.5	16.5	16.6	17.1	17.8	18.7	17.9	17.2	16.1	16.2
R7	16.2	16.8	17.3	16.8	16.7	16.7	17.3	17.9	18.0	17.6	17.2	17.1
R8	16.1	16.6	16.8	16.9	16.6	16.7	16.8	17.2	17.3	17.1	17.0	16.9
R9	16.5	16.6	16.9	16.8	16.7	16.7	17.0	17.5	17.5	17.5	17.1	16.8
R10	16.9	16.8	17.0	17.4	17.4	17.3	17.1	17.5	17.2	16.8	16.5	16.7
R11	14.9	15.9	16.2	15.9	15.9	16.0	16.3	17.2	16.7	16.1	15.6	15.6
R12	15.3	15.9	16.0	16.1	16.1	15.8	16.1	17.3	16.3	16.7	16.7	16.5
ARMM	16.4	16.5	17.2	16.9	17.1	17.2	17.1	17.6	17.9	17.2	17.2	17.1
CARAGA	15.3	15.8	16.8	16.4	15.9	15.8	15.8	17.0	16.6	16.2	15.8	15.9

	1998											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	16.7	16.8	16.8	16.9	16.9	17.0	17.2	17.4	17.6	17.3	17.2	17.1
CAR	16.1	16.2	16.3	16.4	16.4	16.3	16.4	16.6	16.7	17.0	17.1	16.8
R1	16.3	16.0	16.0	16.3	16.4	16.6	16.9	17.0	17.3	17.3	17.3	17.3
R2	15.9	15.8	15.8	15.8	16.0	16.2	16.2	16.3	16.5	16.3	16.4	16.4
R3	16.6	16.7	16.6	16.6	16.7	16.8	17.0	17.4	17.6	17.5	17.4	17.3
R4	17.4	17.4	17.5	17.4	17.3	17.4	17.5	17.7	17.9	18.1	18.1	17.9
R5	16.4	16.4	16.2	16.2	16.2	16.2	16.3	16.3	16.2	16.2	16.4	16.5
R6	16.6	17.0	17.2	17.2	17.5	18.1	18.1	18.3	18.1	16.9	16.9	17.0
R7	17.6	17.6	17.9	18.0	17.8	17.6	17.4	17.7	18.0	17.8	18.0	17.7
R8	17.3	17.6	17.4	17.5	17.5	17.5	17.6	18.0	18.2	18.1	18.0	18.0
R9	16.8	16.9	17.0	17.1	17.3	17.4	17.6	17.9	18.1	17.4	17.1	16.8
R10	16.8	16.9	17.0	17.3	17.4	17.7	17.7	18.0	18.5	17.8	17.5	17.6
R11	15.8	16.2	16.4	16.3	16.2	16.4	16.7	17.3	17.6	16.3	15.9	15.9
R12	16.9	17.3	17.2	17.2	17.3	17.6	17.8	17.6	17.7	17.2	16.9	16.9
ARMM	17.3	17.5	17.4	17.4	17.6	17.8	17.9	18.0	18.3	18.2	17.7	17.7
CARAGA	16.1	16.3	16.3	16.0	16.2	16.1	16.1	16.9	17.6	17.0	16.6	16.5

	1999											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	17.3	17.4	17.4	17.3	17.4	17.4	17.4	17.4	17.2	17.1	16.9	16.8
CAR	17.0	17.3	17.3	17.4	17.2	17.4	17.3	17.4	17.4	17.4	17.2	17.2
R1	17.3	17.3	17.3	17.0	17.1	17.1	17.2	17.2	17.3	17.2	17.2	17.0
R2	16.4	16.1	16.3	16.3	16.3	16.3	16.3	16.0	16.0	15.8	15.5	15.3
R3	17.4	17.5	17.4	17.4	17.6	17.6	17.6	17.6	17.4	17.2	17.2	17.0
R4	17.9	17.8	17.7	17.7	17.8	17.9	17.8	18.0	17.9	18.0	17.7	17.7
R5	16.6	16.7	16.7	16.5	16.3	16.2	16.1	16.1	15.9	15.8	15.7	15.4
R6	17.2	17.2	17.3	17.1	17.3	17.0	16.9	16.7	16.6	16.6	16.6	16.6
R7	17.9	18.0	18.0	17.9	18.1	17.9	17.9	17.9	17.8	17.2	16.8	17.4
R8	18.1	18.5	18.3	18.2	17.9	18.0	18.1	18.3	18.1	17.9	17.6	17.1
R9	17.2	17.3	17.4	17.4	17.5	17.6	17.4	17.7	17.3	17.0	17.0	17.1
R10	17.9	18.6	18.5	18.4	18.3	18.4	18.4	18.3	18.0	17.8	17.7	17.7
R11	16.5	16.8	16.7	16.4	16.6	16.9	17.0	16.6	16.3	15.8	15.6	16.0
R12	17.1	17.5	17.6	17.5	17.6	17.7	17.7	17.7	17.5	16.9	16.5	16.4
ARMM	17.9	17.5	17.5	17.6	18.1	18.3	18.0	18.2	18.1	17.9	17.8	17.7
CARAGA	16.8	16.9	17.0	16.5	16.6	16.6	16.7	16.8	16.8	16.9	16.8	16.4

	2000											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	17.0	17.2	17.3	17.4	17.4	17.6	17.9	18.1	18.2	17.8	17.6	17.5
CAR	16.7	16.6	16.8	16.9	16.8	16.7	17.0	17.5	18.0	17.7	17.3	16.9
R1	17.4	17.8	17.8	17.8	17.8	17.8	18.0	18.0	18.0	18.0	18.0	17.8
R2	15.8	15.6	15.5	15.9	16.1	16.3	16.5	17.1	17.2	16.8	16.6	16.5
R3	17.1	17.2	17.2	17.3	17.3	17.4	17.7	17.8	17.9	17.7	17.4	17.5
R4	17.7	17.8	17.8	17.8	17.8	17.9	18.1	18.6	19.2	18.8	18.4	18.3
R5	15.7	15.8	16.0	16.0	16.1	16.3	16.9	17.1	17.1	16.9	16.8	17.1
R6	16.9	17.2	17.3	17.6	18.0	18.7	19.0	19.3	18.6	17.8	17.5	17.9
R7	17.8	18.0	18.2	18.4	18.4	18.1	18.7	19.0	18.7	18.2	17.8	17.7
R8	17.5	17.6	17.7	17.5	17.7	18.0	18.2	18.6	18.5	18.1	17.8	17.3
R9	17.4	17.5	17.5	17.6	17.7	17.7	17.8	17.8	17.9	17.8	17.4	17.4
R10	18.1	18.6	18.6	18.7	18.8	19.0	18.8	18.8	18.6	18.4	18.2	18.2
R11	16.4	16.7	17.1	17.0	17.3	17.4	17.7	17.8	17.3	16.9	16.4	16.3
R12	17.0	16.9	17.2	17.2	17.2	17.5	17.7	17.7	17.3	17.1	17.1	17.0
ARMM	17.7	17.7	17.7	17.7	17.7	17.8	17.9	18.7	19.0	18.6	18.8	18.6
CARAGA	16.5	16.8	17.5	17.4	17.1	17.4	17.8	18.1	18.1	17.5	17.4	17.5

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	2001											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	17.5	17.4	17.5	17.4	17.5	17.5	17.7	17.8	17.7	17.6	17.4	17.4
CAR	16.7	16.8	16.9	16.9	17.0	16.9	16.8	17.0	16.9	16.9	16.6	16.6
R1	17.8	17.9	17.9	17.9	17.9	17.9	18.0	18.0	18.0	17.9	17.7	17.7
R2	16.7	16.4	16.6	16.5	16.6	16.7	17.2	17.0	16.9	16.8	16.6	16.8
R3	17.6	17.6	17.8	17.8	17.9	18.0	18.1	18.0	18.1	18.2	17.6	17.5
R4	18.2	18.2	18.3	18.3	18.2	18.3	18.5	18.7	18.6	18.3	18.6	18.4
R5	17.0	17.0	16.9	16.7	16.8	16.9	17.1	17.2	17.2	17.0	16.9	17.1
R6	17.7	17.6	17.5	17.6	17.7	17.8	18.2	18.5	18.2	17.4	17.3	17.4
R7	17.6	17.9	18.1	17.8	18.0	17.7	17.9	18.5	18.5	18.4	18.3	18.1
R8	17.8	18.0	18.0	17.6	17.6	17.6	17.8	18.0	18.0	17.9	17.5	17.8
R9	17.5	17.4	17.3	17.4	17.3	17.3	17.3	17.3	17.3	17.2	17.1	17.0
R10	18.3	17.3	18.0	18.1	18.2	18.3	18.6	18.6	18.5	18.5	18.5	18.6
R11	16.4	16.3	16.1	16.3	16.4	16.5	16.8	16.9	16.6	16.1	16.0	16.1
R12	17.0	16.8	16.9	16.8	16.9	16.9	17.1	17.0	17.1	17.0	16.7	16.8
ARMM	18.5	17.7	17.5	17.7	17.9	18.2	17.8	18.1	18.1	18.2	18.2	17.6
CARAGA	17.5	17.5	17.3	17.0	17.1	17.2	17.0	17.1	17.2	16.9	17.1	17.0

	2002											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	15.4	13.8	16.2	16.5	16.5	16.9	17.3	19.1	19.1	17.8	17.1	16.6
CAR	16.0	16.0	16.3	16.3	16.3	16.5	17.6	18.1	18.7	17.2	16.4	16.5
R1	15.8	15.8	15.8	15.8	15.8	15.8	15.9	16.2	16.6	15.8	15.7	15.9
R2	15.8	16.1	16.3	16.1	16.1	16.5	17.2	18.1	18.5	16.8	16.7	16.2
R3	15.8	16.0	16.1	16.1	16.1	16.3	16.4	17.2	18.0	17.2	16.6	16.5
R4	16.2	16.2	16.2	16.2	16.3	16.6	16.7	17.0	17.4	17.0	16.7	16.4
R5	15.8	15.9	15.8	15.6	15.6	15.8	16.0	16.7	16.8	16.2	15.9	15.8
R6	15.4	15.3	15.5	15.6	16.2	16.8	17.4	17.8	17.2	15.7	15.3	15.3
R7	16.2	16.3	17.2	17.1	17.2	17.2	17.8	18.2	18.3	16.9	16.7	16.4
R8	16.3	16.6	16.8	16.6	16.5	16.7	16.9	17.6	18.1	17.6	17.2	17.0
R9	16.2	16.4	16.5	16.5	16.7	16.8	17.2	17.6	17.3	16.5	16.2	16.2
R10	16.5	16.7	16.7	16.8	17.0	17.4	18.6	19.4	19.2	17.4	17.2	16.9
R11	14.6	14.9	15.4	15.5	15.9	16.7	18.4	19.7	16.8	15.4	14.8	15.1
R12	14.4	14.6	15.2	15.3	15.7	16.5	18.2	19.2	16.1	14.6	14.3	14.2
ARMM	16.3	16.6	16.3	16.3	17.0	16.2	16.2	16.5	16.9	16.7	16.4	16.5
CARAGA	15.8	15.9	16.0	15.5	15.7	16.0	16.6	18.3	17.6	16.0	15.5	15.5

	2003											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	16.4	16.4	16.4	16.6	16.6	16.8	17.1	17.0	16.8	16.4	16.3	16.3
CAR	16.3	16.3	16.3	16.4	16.5	16.8	16.9	17.0	17.1	16.0	15.5	15.5
R1	15.8	16.0	15.8	15.8	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
R2	16.0	15.9	16.0	16.4	16.4	16.8	17.1	17.2	17.0	15.8	15.3	15.9
R3	16.6	16.9	16.9	16.8	16.7	16.9	17.3	17.5	17.3	16.8	16.3	16.4
R4	16.5	16.6	16.5	16.5	16.8	17.0	17.2	17.1	16.9	16.6	15.9	16.0
R5	15.8	15.9	15.9	16.0	16.2	16.4	16.7	16.9	16.6	16.0	15.7	15.6
R6	15.4	15.5	15.8	16.2	16.7	16.8	17.0	17.0	15.9	15.5	15.3	15.3
R7	16.2	16.5	16.9	17.2	17.3	17.0	17.0	17.2	16.8	16.7	16.5	17.0
R8	17.3	17.3	17.1	17.1	16.9	17.1	17.9	18.2	18.3	17.5	17.3	17.3
R9	16.6	16.3	16.5	16.8	17.1	17.5	17.6	17.7	16.8	16.7	16.4	16.7
R10	17.3	17.0	17.0	17.3	17.8	18.2	18.4	18.7	18.0	17.4	17.6	17.4
R11	15.2	15.3	15.3	16.1	17.0	17.7	18.5	17.8	15.8	15.2	15.1	15.4
R12	14.5	14.7	14.9	16.3	16.9	17.8	18.3	17.6	14.9	14.6	14.5	15.1
ARMM	16.6	15.5	15.1	15.1	15.4	15.3	15.4	15.5	15.7	15.6	16.1	15.8
CARAGA	16.0	16.1	16.2	16.1	16.6	16.9	17.2	17.5	17.0	16.5	15.9	16.0

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	2004											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	16.3	16.3	17.0	16.8	17.1	17.4	17.7	17.9	18.0	17.8	17.8	17.8
CAR	15.7	15.9	15.9	16.0	16.4	16.3	17.3	18.0	17.5	17.1	16.9	17.1
R1	16.0	16.0	16.0	16.0	16.2	16.4	16.5	16.7	17.1	16.7	16.6	16.5
R2	16.2	16.0	15.4	16.3	16.5	17.5	18.0	18.0	17.8	17.3	16.1	16.7
R3	16.7	16.5	16.7	16.8	17.0	17.2	17.7	17.7	17.7	16.9	16.5	16.8
R4	16.2	16.1	15.9	16.4	16.7	17.0	16.9	17.2	17.2	16.8	16.5	17.0
R5	15.7	15.9	15.7	15.8	16.2	16.4	16.7	16.7	16.5	16.1	16.3	16.7
R6	15.2	15.6	15.7	16.1	16.4	17.0	17.2	17.0	15.8	15.7	16.0	16.4
R7	17.3		17.0	17.2	17.5	18.5	18.8	19.3	18.4	17.6	17.5	18.4
R8	17.7	17.7	17.3	17.7	17.7	18.0	18.4	18.7	18.4	17.9	17.9	18.3
R9	16.8	17.2	17.4	18.3	18.4	19.2	20.0	19.8	18.8	18.0	18.1	18.5
R10	17.8	17.9	18.2	18.3	18.9	19.7	20.6	20.8	19.6	18.2	18.0	18.3
R11	16.1	16.6	18.3	18.9	18.8	19.7	20.4	19.9	18.0	16.9	17.0	18.0
R12	15.3	16.0	17.7	18.4	18.5	19.6	19.3	19.1	16.6	15.4	15.8	17.1
ARMM	16.1	15.9	16.1	17.6	17.6	18.5	18.6	19.1	18.7	17.8	17.6	17.4
CARAGA	16.5	16.7	17.5	17.8	17.8	18.2	19.3	19.9	19.4	17.6	17.3	17.5

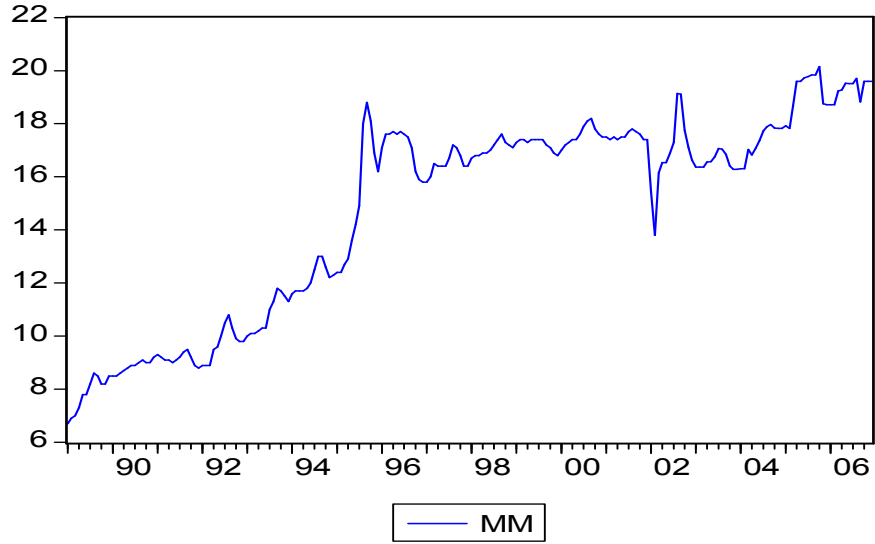
	2005											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	17.9	17.8	18.7	19.6	19.6	19.7	19.8	19.8	19.8	20.2	18.8	18.7
CAR	17.6	17.6	18.0	18.8	18.9	19.2	20.2	20.5	20.8	20.5	20.3	19.8
R1	16.7	17.5	17.6	18.3	19.0	19.6	19.5	20.5	20.7	20.4	19.7	19.8
R2	17.3	17.6	18.0	18.4	18.7	19.0	19.4	19.6	19.3	19.1	18.7	18.8
R3	17.2	17.5	17.8	18.3	18.7	18.8	19.2	19.5	19.6	18.8	18.2	18.5
R4	16.8	17.1	17.5	18.7	19.4	19.8	20.2	20.4	20.1	19.5	19.1	19.2
R5	17.0	17.7	17.9	18.6	19.2	19.4	19.7	19.9	19.7	19.4	19.1	19.1
R6	16.6	16.9	17.5	19.1	20.2	20.3	20.7	21.0	18.8	17.7	17.6	17.7
R7	18.8	19.0	19.7	21.2	21.4	21.4	21.6	21.3	20.3	19.6	19.7	19.9
R8	18.7	18.9	18.9	19.3	19.2	19.8	20.2	21.1	21.0	20.5	20.3	20.5
R9	19.0	19.4	20.1	20.4	20.8	20.8	20.9	20.9	20.3	19.5	19.2	19.6
R10	18.7	18.8	19.5	20.6	21.2	21.5	21.8	21.7	21.3	20.0	19.3	19.4
R11	18.2	18.4	19.5	21.1	20.8	20.6	21.1	21.0	19.4	18.1	17.6	18.0
R12	17.0	17.5	18.4	20.2	20.3	20.4	21.0	20.5	17.7	16.7	17.0	17.2
ARMM	17.4	17.5	17.5	17.5	17.9	18.3	18.1	18.2	18.1	18.4	19.0	18.6
CARAGA	18.1	18.4	19.2	19.8	20.0	20.0	20.5	21.0	20.4	20.0	19.7	19.6

	2006											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MM	18.7	18.7	19.2	19.3	19.5	19.5	19.5	19.7	18.8	19.6	19.6	19.6
CAR	19.7	19.9	19.6	20.0	19.8	20.0	20.1	20.0	20.0	20.0	20.0	19.9
R1	19.6	19.6	20.0	20.0	20.0	20.0	20.1	20.0	20.0	20.0	19.0	18.6
R2	18.0	17.8	18.0	17.9	18.0	18.2	18.5	18.6	18.6	18.4	18.3	17.9
R3	19.0	19.0	19.2	19.3	19.1	19.3	19.6	19.6	19.5	19.3	19.1	19.1
R4	19.2	19.4	19.2	19.2	19.3	19.4	19.5	19.4	19.5	19.8	19.7	19.6
R5	19.1	19.3	19.2	19.0	19.1	19.1	19.1	19.1	18.8	18.6	18.5	18.7
R6	17.8	17.9	18.4	18.7	19.4	19.4	19.1	18.7	17.2	17.1	17.2	17.3
R7	20.1	20.2	20.4	20.9	21.2	21.0	20.9	21.0	20.2	19.6	19.8	19.9
R8	20.6	19.9	20.5	20.4	20.1	20.3	20.5	20.4	20.3	20.3	20.1	20.3
R9	19.6	20.2	20.6	20.7	21.0	21.2	21.3	21.2	21.1	20.5	20.6	20.7
R10	19.6	20.2	20.2	20.4	21.7	21.4	21.3	20.8	20.7	20.1	20.1	19.8
R11	18.5	19.0	19.5	20.0	20.2	20.5	20.4	20.0	19.1	18.2	18.5	19.3
R12	17.9	18.4	19.3	19.7	20.1	20.9	20.9	20.1	17.6	17.0	17.3	18.5
ARMM	19.0	19.2	19.5	19.1	19.0	18.9	19.0	19.4	19.3	19.4	19.4	19.1
CARAGA	19.8	19.9	20.1	20.1	20.4	20.7	20.9	21.3	20.6	20.1	19.9	20.6

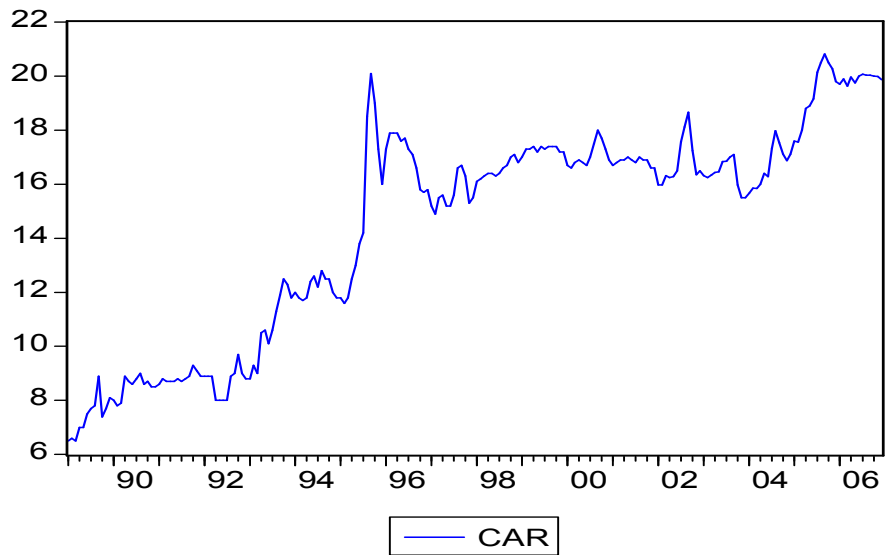
Appendix B

Line Graphs of Regional Rice Prices from January 1989 to December 2001

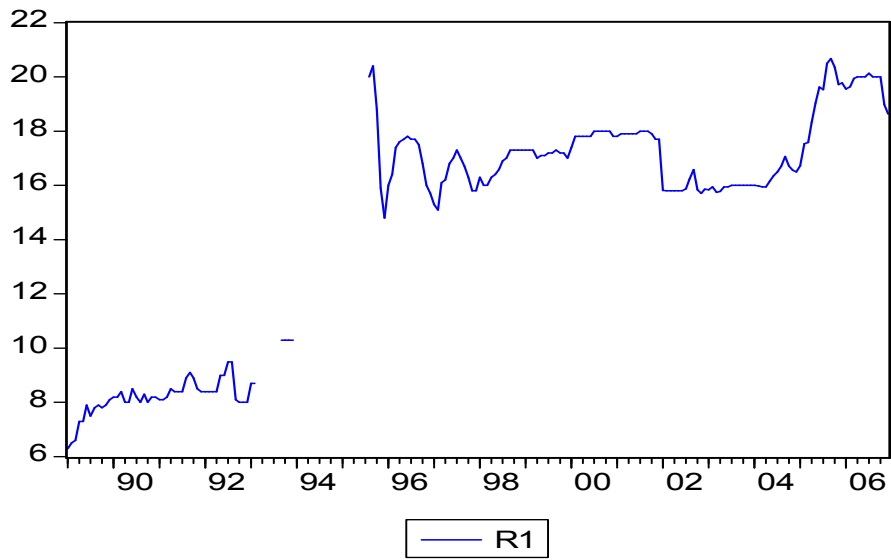
Line graph of rice prices for Metro Manila



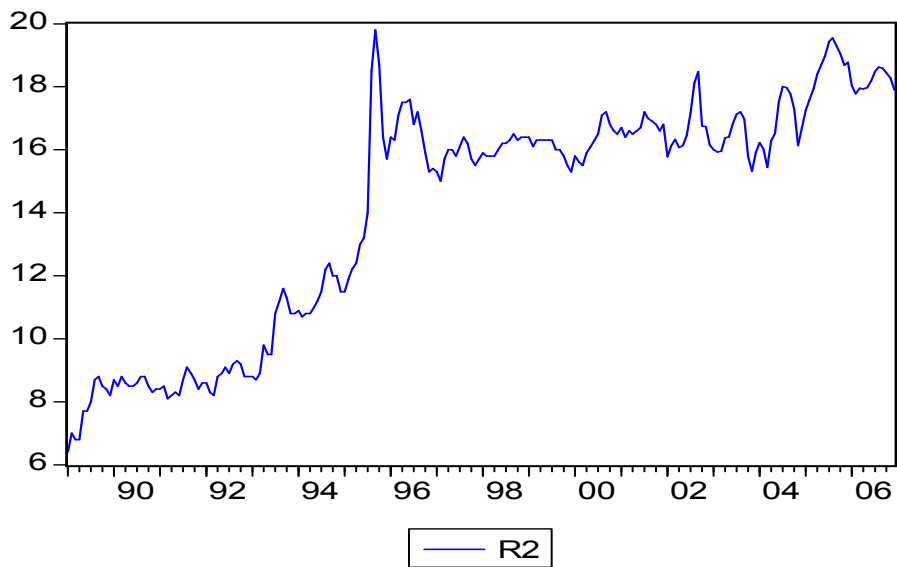
Line graph of rice prices for CAR



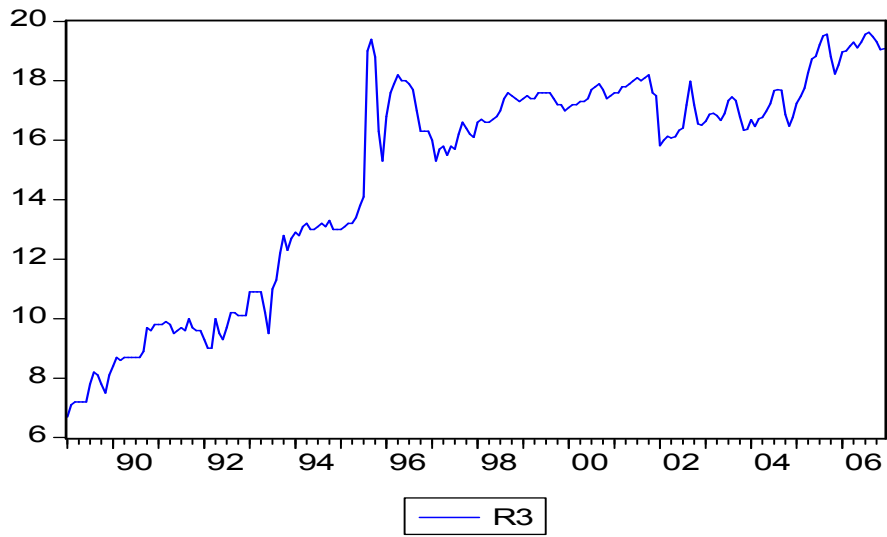
Line graph of Region 1 rice prices



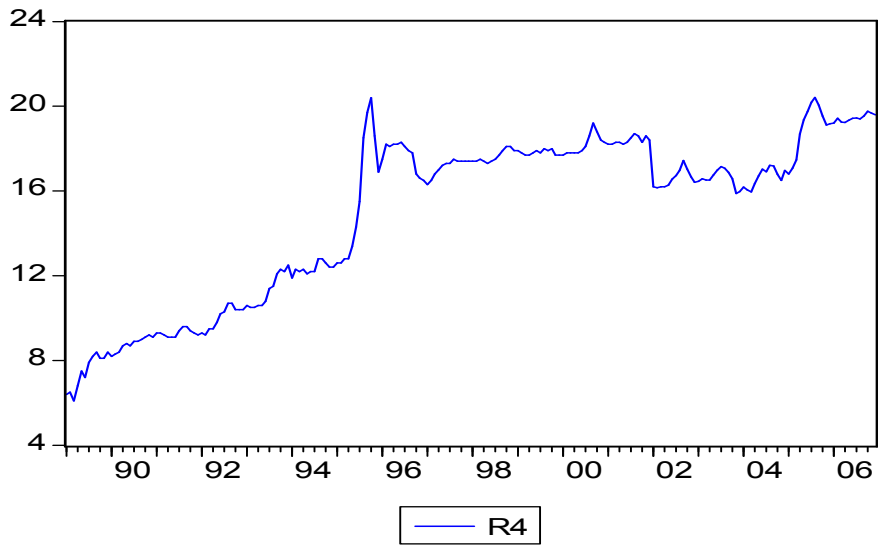
Line graph of Region 2 rice prices



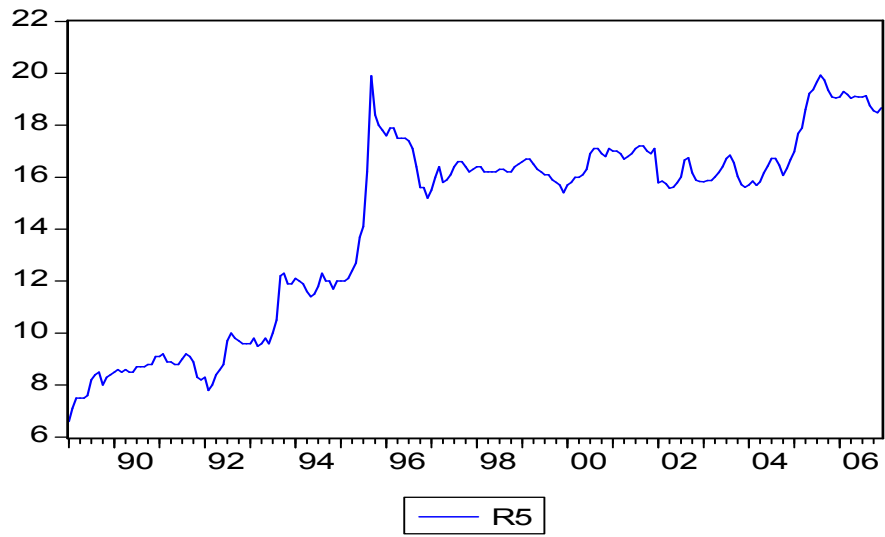
Line graph of Region 3 rice prices



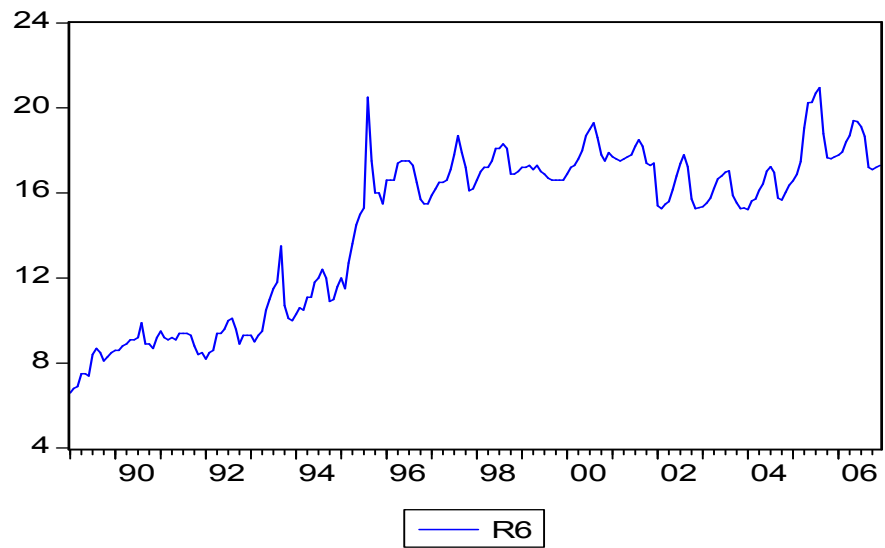
Line graph of Region 4 rice prices



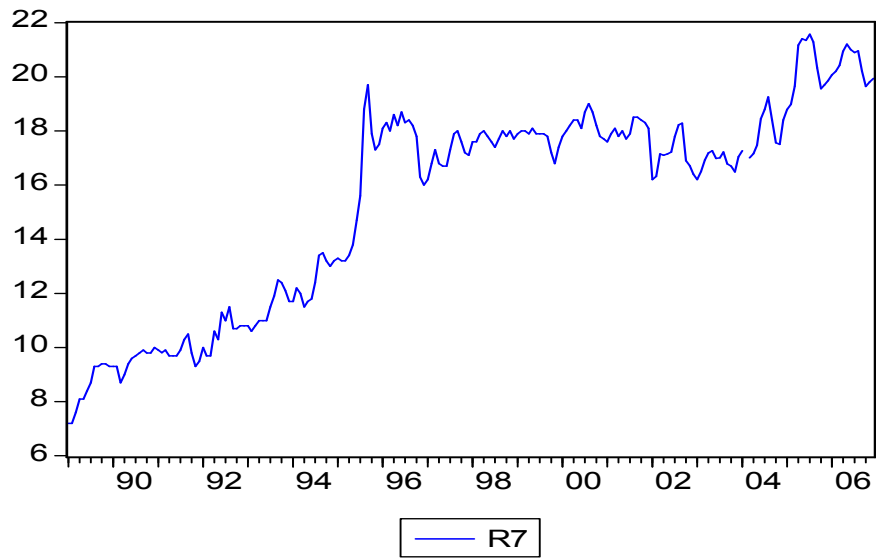
Line graph of Region 5 rice prices



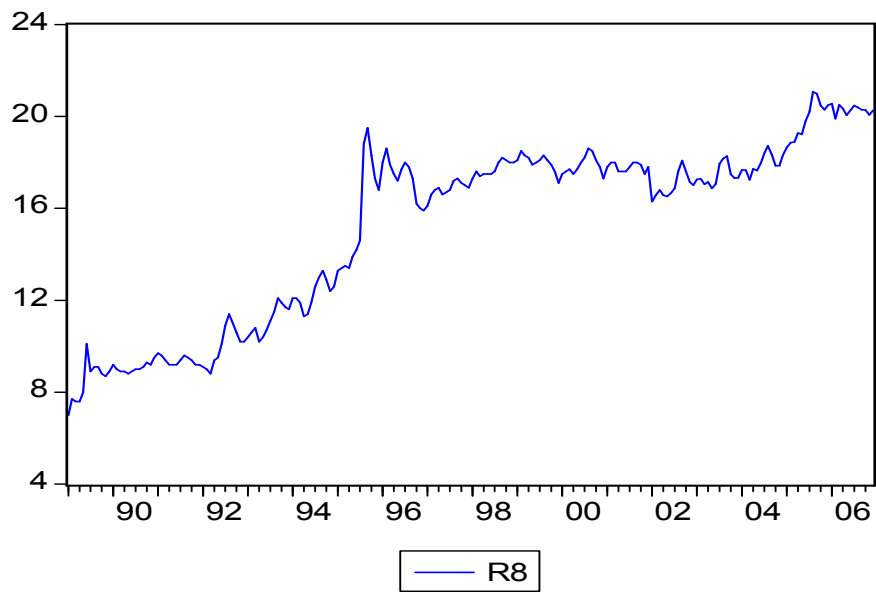
Line graph of Region 6 rice prices



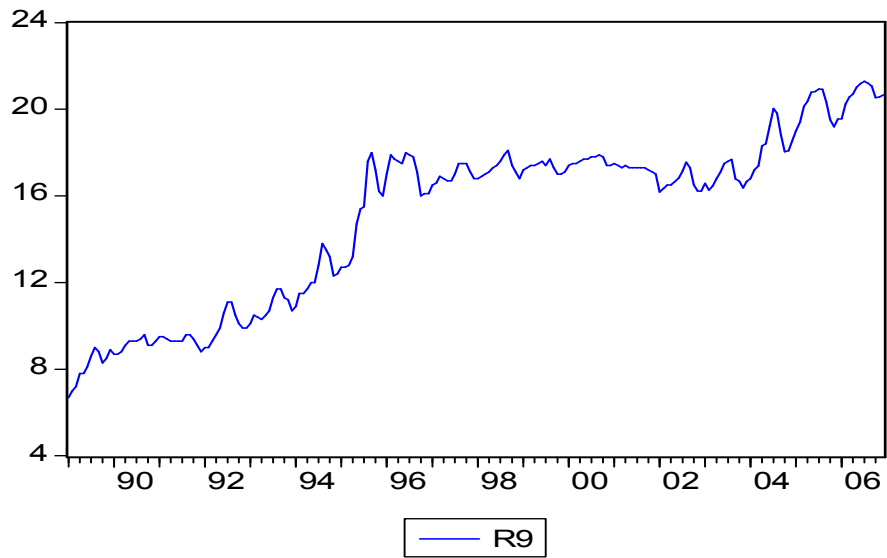
Line graph of Region 7 rice prices



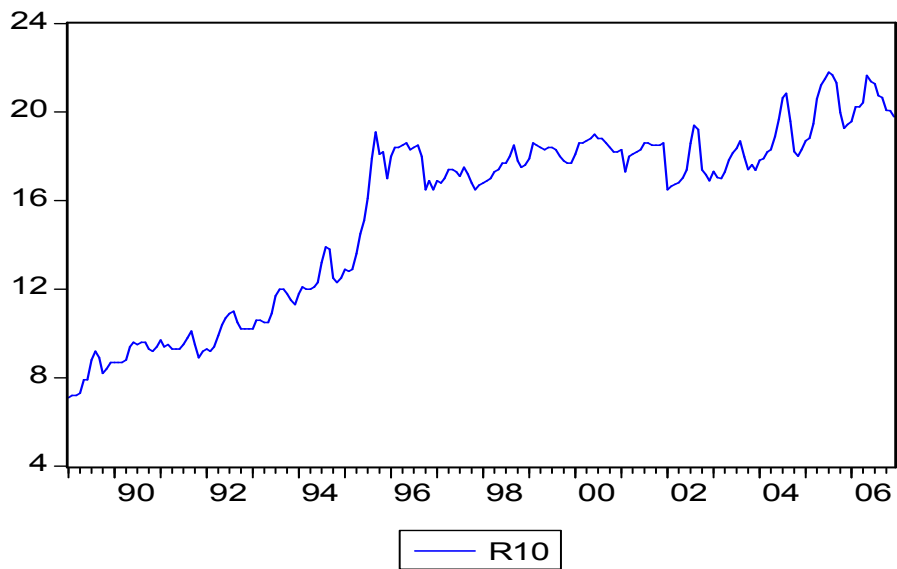
Line graph of Region 8 rice prices



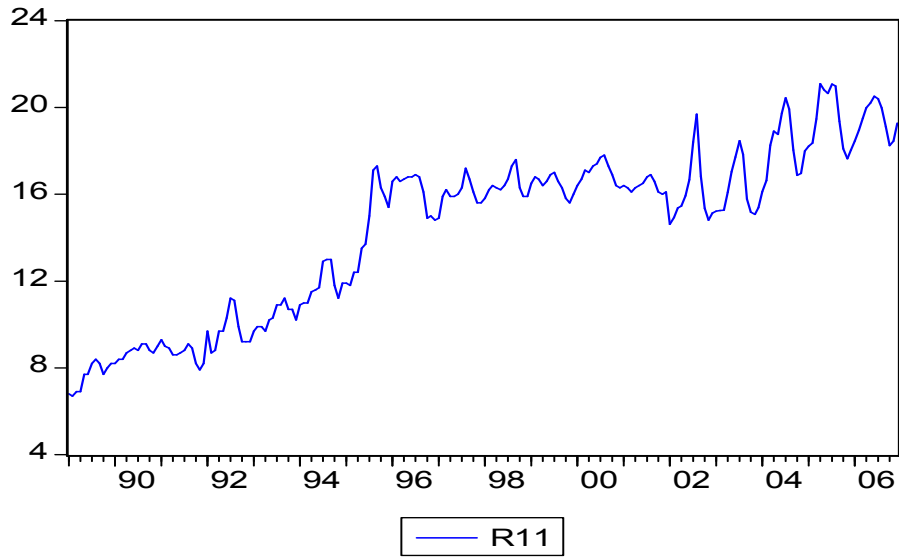
Line graph of Region 9 rice prices



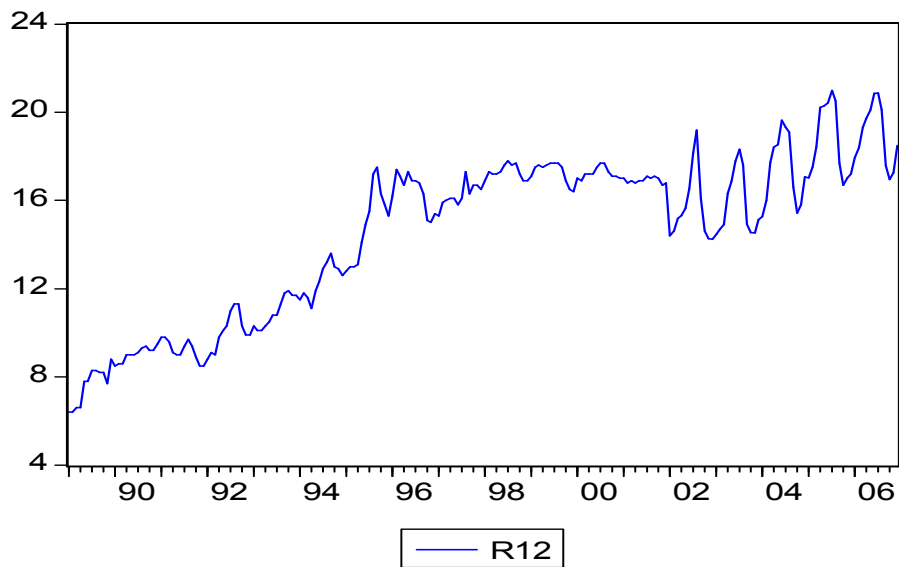
Line graph of Region 10 rice prices



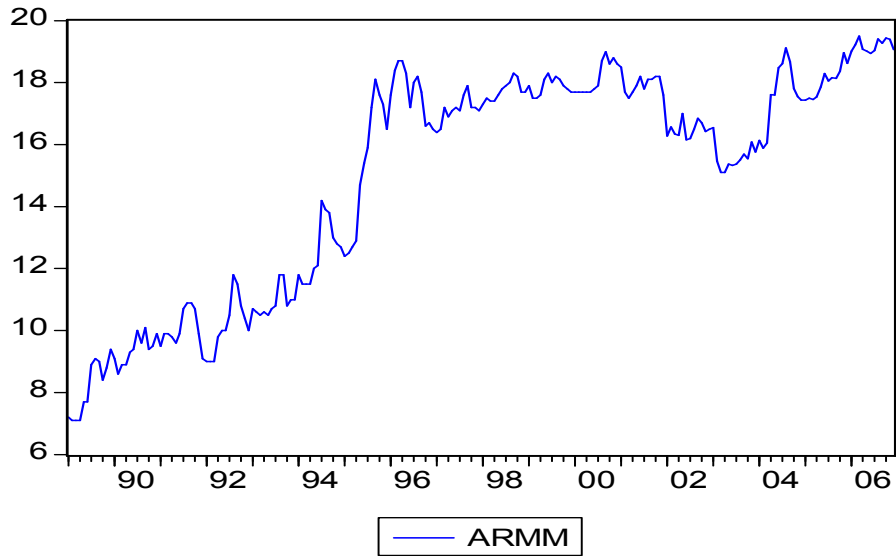
Line graph of Region 11 rice prices



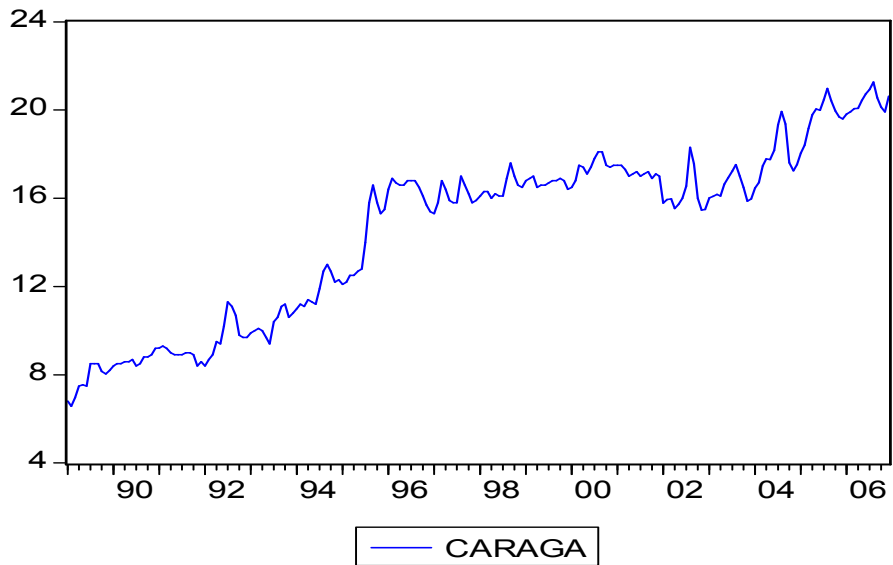
Line graph of Region 12 rice prices



Line graph of rice prices for ARMM



Line graph of rice prices for CARAGA



Appendix C

Regional Subdivisions of the Philippines with their Provincial Composition

National Capital Region - Metro Manila

City of Manila
Quezon City
Caloocan City
City of San Juan
City of Makati
City of Paranaque
Pasay City
City of Marikina
City of Pasig
City of Mandaluyong
City of Muntinlupa
Malabon
Navotas
City of Las Pinas
City of Valenzuela
Taguig
Pateros

Cordillera Administrative Region (CAR)

Abra
Benguet
Ifugao
Kalinga
Apayao
Mountain Province

Region I – Ilocos Region

Ilocos Norte
Ilocos Sur
La Union
Pangasinan

Region II – Cagayan Valley

Batanes
Cagayan
Isabela
Nueva Vizcaya
Quirino

Region III – Central Luzon

Bataan
Bulacan
Nueva Ecija
Pampanga
Tarlac
Zambales

Region IV – Southern Luzon

Aurora
Batangas
Cavite
Laguna
Marinduque
Occidental Mindoro
Oriental Mindoro
Palawan
Quezon
Rizal

Region V – Bicol Region

Albay
Camarines Norte
Camarines Sur
Masbate
Sorsogon

Region VI – Western Visayas

Aklan
Antique
Capiz
Iloilo
Guimaras
Negros Occidental

Region VII – Central Visayas

Bohol
Cebu
Negros Oriental
Siquijor

Region VIII – Eastern Visayas

Eastern Samar
Leyte
Biliran
Northern Samar
Western Samar
Southern Leyte

Region IX – Western Mindanao

Basilan
Zamboanga Del Norte
Zamboanga Del Sur

Region X – Northern Mindanao

Bukidnon
Camiguin
Misamis Occidental
Misamis Oriental

Region XI – Southern Mindanao

Davao Del Norte
Davao Del Sur
Davao Oriental
South Cotabato
Sarangani

Region XII – Central Mindanao

Lanao Del Norte
North Cotabato
Sultan Kudarat

Autonomous Region of Muslim Mindanao (ARMM)

Sulu
Tawi-Tawi
Lanao Del Sur
Maguindano

CARAGA Region

Agusan Del Norte
Agusan Del Sur
Surigao Del Norte
Surigao Del Sur