Market integration of Red chilli commodity markets in Indonesia

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List of acronyms

MoA : Ministry of Agriculture
DGH : Directorate General of Horticulture
FAO : Food and Agriculture Organization
FDI : Foreign Direct Investment
PIKJ : Pasar Induk Kramat Jati
LOP : Law of One Price
ECM : Error Correction Model
PBM : Parity Bound Model
MIS : Marketing Information System
ADF : Augmented Dickey Fuller
BIC : Bayesian Information Criteria
AIC : Akaike Information Criteria
LR : Long-run relationship
SR : Short-run relationship
ACH : Aceh
NSM : North Sumatera
WSM : West Sumatera
JBI : Jambi
BKL : Bengkulu
LPG : Lampung
SSM : South Sumatera
WJV : West Java
CJV : Central Java
EJV : East Java
YOG : Yogyakarta
WNT : West Nusa Tenggara
ENT : East Nusa Tenggara
WKL : West Kalimantan
CKL : East Kalimantan
SKL : South Kalimantan
EKL : Central Kalimantan
SSW : South Sulawesi
CSW : Central Sulawesi
NSW : North Sulawesi
SESW : South East Sulawesi

Abstract

Many researches have been examined price transmission and market integration of staple food in Indonesia, while relatively few studies are there on market integration of vegetable commodities markets. Mostly previous study assessed the information to what extents and to which markets prices are transmitted across spatially different markets. However, there is scarce literature that determines the factors influence market integration or lack of integration in Indonesia. Thus, the analysis of market integration remains weak without further analysis on factors that explain such of market integration or segmentation. Hence, it becomes a gap to be occupied by this research. The author believes that the study on commodity markets integration might be more useful if it is complemented with further discussion on factor that could explain the process of market integration or lack of integration in Indonesia. Therefore, by using prices dataset from 23 producer markets and wholesale market in Jakarta that covering the years from January 2000 to December 2011 and from January 2005 to December 2011 this paper aims to investigate two types of spatial market integration with focus on red chilli commodity markets.

A series of techniques, such as the Engle-Granger cointegration test and ECM were used to test red chilli market integration. With this approaches, then it is possible to analyze price transmission, identify market integration or segmentation that occurs in red chilli commodity markets in Indonesia, and specify the long-run and short-run dynamic. Moreover, some variables such as the number of production, population, distance between markets, the quality of infrastructure, and the numbers of markets have been obtained to discuss on factor that might drives interconnectedness between red chilli markets.

The result of model 1 indicates that generally producer markets are not cointegrate with PIKJ as central market. However, these markets tend to have short-run relationship. On the other hand, the results of spatial market integration model 2, which test cointegration across 23 producer markets, imply that red chilli markets across producer provinces tend to integrate in the long-run. In addition, in the short-run changes in the red chilli's price in one producer market also seem to have immediate impact on red chilli's price in other producer markets.

Finally, the research has shown evidences that red chilli commodity markets integration in Indonesia are influenced by the good quality of infrastructure, location or distance between market, and trade opportunity that can be indicated by the large consumer area such as the number of populations and the number of markets.

Relevance to development studies

The study of regional price transmission and market integration try to seek the price relationship between markets that are located in different regions within country or the relationship between markets in different stages on marketing chain. Thus, the analysis of market integration will provide information of the overall performance of commodity market system. Furthermore, by identifying factors that could encourage or impede market integration in Indonesia. Then, obstacles in the achieving of well-functioning red chilli markets will be determined; hence, some recommendations will be offered to react with this condition. Therefore, it will give valuable information for policy maker to speed up red chilli market integration, encourage the development of economic process and enhance the economic growth.

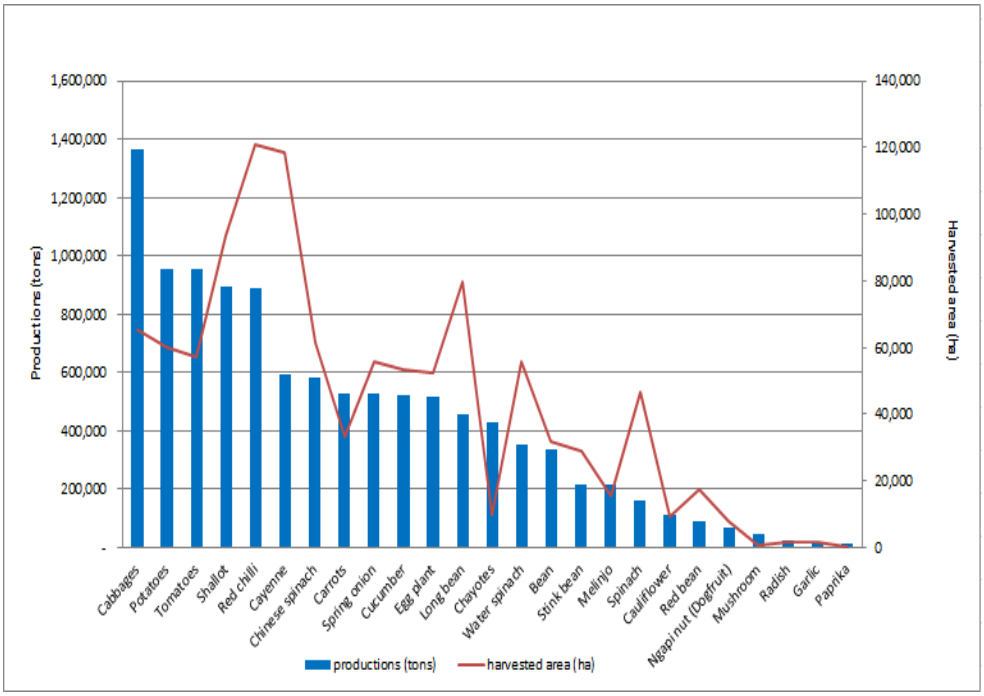
Keywords: Indonesia, red chilli, vegetable markets, price transmission, market integration, factors affect integration, determinant of market integration, cointegration, ECM

Chapter 1 Introduction

1.1 Background

In Indonesian vegetables group, five major vegetables have the highest production compare to other vegetables, which are cabbages, potatoes, tomatoes, shallot and red chilli. However, red chilli has the highest harvested area, followed by cayenne, shallot, long bean and cabbages. The production and harvested area of these vegetable are presented in figure 1.

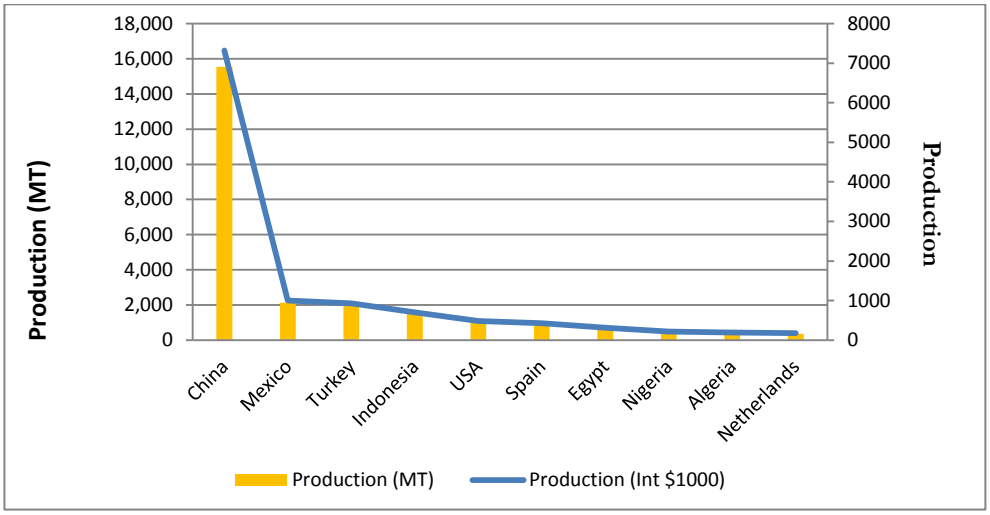
Figure 1 Production and harvested area of Indonesian vegetable commodities



Source: Directorate General of Horticulture (DGH), Ministry of Agriculture 2011

According to Food and Agriculture Organization (FAO 2010), Indonesian chilli includes as the top ten chilli producing countries in the world. The top ten chilli producing countries are China, Mexico, Turkey, Indonesia, United States, Spain, Egypt, Nigeria and the Netherland. In the fourth position, Indonesian chilli shares about 5% to global production. Meanwhile, China accounted for more than 57%, Mexico 8% and Turkey 7% to global production. Figure 2 reveals the top ten chilli producing countries in the worldwide.

Figure 2 the top ten chilli producing countries in the world



Source: FAO 2010

Chilli is the most important spices, and most common cultivated in Indonesia. According to Ministry of Agriculture (MoA), chili has contributed to Indonesian economy, since the value of export in 2011 achieves 11 million US$ and creates job opportunities for large number of farmers. The export value of chilli increases in 2012 become 26 million US$, and stays in second position as the vegetable commodity which has the highest export value.

This paper presents the case study of red chilli commodity markets, since chilli has played an important role in the Indonesian economy. Further, this commodity remains important in the food basket; because of the weighted inflation of chilli is around 0.35% (Farid and Subekti 2012). In addition, the price of chilli is unstable, in 2011 "the price of chillies have soared as much as 10-fold in recent month… driving up inflation .. making it more expensive than beef.." (Jakarta Post 2011 as quoted in Webb et al. 2012: 1). This condition happens due to government did not play an important role in price determination for vegetable commodities. Therefore, this price swings will have an impact to farmers as producers, as well as to consumers in gaining reasonable profit and affordable price.

The phenomena that rise in the vegetable markets especially in red chilli commodity markets need a further study to investigate the price and market mechanism. Therefore, first we have to know the structure of commodity chain, and its characteristics. According to Ferrari (1994: 14), the common feature of vegetables market system is a collection market, which has seasonal nature. It means, vegetables are collected from producer areas and they are sold in one location. Generally, the marketing channel of vegetables in Indonesia passes through from farmer to collector and local retailer. Then, distribution channel usually continue flows to wholesale markets and inter

islands traders, and traditional retailers. Then, finally it is received by the consumer.[1] However, the implementation of trade liberalization in 1990s, and the removal of restriction of the Foreign Direct Investment (FDI) in 1998 have stimulated the rapid growth of the supermarket sector in Indonesia. In short period, the sales of fresh vegetables in the supermarket increase rapidly. Then, it has led to a change of vegetables market chain where new channels are not only the supermarkets and food processing industries, but also farmer associations, hotels and restaurants have emerged in the marketing chain in Indonesia (Natawidjaja et al. 2007).

In addition, the distribution systems of vegetable commodities in Indonesia have constraint such as reported by Shepherd and Schalke (1995: 4). Particularly in some parts of Indonesia, the vegetable markets are characterized by vast distance and poor infrastructure. Even though, there has been an improvement in transportation and communication facilities to integrate the geographical separated market within the country, the uneven distributions of development of infrastructure appear among regions. As reported by Ariwanto (2012), the development of infrastructures is higher in the western part of Indonesia rather than in the eastern part of Indonesia. Hence, vast distance between market and poor infrastructures will lead to high transportation cost, thereby making arbitrage unprofitable and lead to isolated markets (Abdulai 2006). This condition, however, will discourage economic development.

According to the conditions mentioned above, an analysis of the red chilli markets structure in Indonesia, about how red chilli commodity markets function to encourage or hinder the economic development process, could form the basis information for a consideration of policy options. Moreover, as pointed by Maizels (1984: 31) it is possible to identify a dominant pattern of trading channel and market structure. Therefore, a study on price transmission and integration between chilli markets in Indonesia is a way to understand the structure, behaviour and effectiveness of red chilli markets. Price transmission elucidates the relationship of prices in the market. It describes a condition when change in one price causes another price to change (Götz 2008: 4).

There are three types of price transmission: spatially, vertical and cross commodity price transmission.[2] Precisely, the focus of this paper will lay on the spatial price transmission. The research will seek the relationship of red chilli markets within country and the linkage between market integration with

[1] The details of red chilli marketing channel are illustrated in chapter 3

[2] Spatial price transmission refers to the price signal that is transmitted between geographically separated markets. Vertical price transmission describes the price signal that is fully transmitted along marketing channel from one stage to the next stage. Cross commodity price transmission refers to the transmission of price signals between different commodity in the supply chain (Götz 2008)

geographical condition and other factors that might generate market integration. Thus, the price and mechanism of red chilli markets can be clearly examined, and we can assess the strength of markets as well as the transmission mechanism of the price of one market to another, and it will help the government to determine the proper price (Aryani and Yulius 2012: 1).

Based on some previous studies, price transmissions not only have practical usefulness for policymaker, but also theoretical usefulness. As mentioned by Meyer and Cramen-Taubadel (2004) and Amikuzuno and Ogundari (2012) , prices drive resource allocation and output mix decisions by economic actors and,, and price transmission integrates markets vertically and horizontally. Further, "The degree of price transmission is an indicator for market integration and efficiency" (Götz 2008). It means that efficiency on price transmissions is an evidence for market integration. Regarding the term of efficiency, in the efficient operating marketing system the price of commodity will only differ by transportation cost between separated geographical markets. As mentioned by Cournot, "two regional markets are integrated if the prices of homogenous good differ exactly by the interregional transportation costs" (as quoted on Munir et al. 1997: 40). Further, as stated by Fackler and Goodwin (2001), all markets in a perfectly efficient market would immediately respond to relevant news and their prices should commonly determine by aggregate supply and demand. In addition, "the issue of efficiency is important because it will speed up specialization according to comparative advantage and by then raises economic welfare" (Federico 2004 as cited on Tamru 2006).

Some researchers have studied price transmission within the context of the market integration (Ravallion 1986; Sexton et al. 1991; Palaskas and Harriss 1993; Zanias 1993, 1999; Gardner and Brooks 1994; Blauch 1997; Abdulai 2000, 2006). Following these previous studies, this paper will try to identify price transmission relate to the context of spatial market integration of red chilli commodity markets in the free market system in Indonesia. Spatial market integration is defined as the co-movement of prices, that reflecting through smooth transmission of price signals and information across spatially separated markets (Goletti et al. 1995: 185). Negassa et al. (2003) noted that market integration can be said as a measure of the extent to which demand and supply shocks in one market are transmitted to other markets. Then, "measurement of market integration can be viewed as basic data for an understanding of how specific markets work" (Ravallion 1986: 103). Therefore, the results are expected could inform the functioning of red chilli commodity market in Indonesia.

1.3 Research objectives and research questions

1.3.1 Research objectives

This research aims to determine the price transmission and spatial market integration of red chilli markets in Indonesia. This research will focuses on the linkages between red chilli markets in farm gate (producer area) and Pasar Induk Kramat Jati (PIKJ) a wholesale market in Jakarta, and also assesses the relationship across red chilli producer markets that are located in different provinces in Indonesia. The results are expected to be able to elucidate the pattern that occurs in the market system and asses information of the overall performance of commodity markets domestically (Faminow and Benson 1990: 49). Through this study, we can determine the extent to which vegetables producers are integrated in the market process, and show the dynamic of the short run and long run relationship between heterogeneous markets overtime. The research will covers the years from 2000 to 2010. It will covers time after economy crisis that hit Indonesia in 1998 and 2008 when the crisis hit again. This period also covers inflation, increasing in oil price and the changes in trade policies.

In addition, factors associated in the market integration will be defined clearly by using descriptive analysis, and then we can see whether geographical condition and development in infrastructure, production, population, and institutions have an impact to integrate red chilli markets in Indonesia overtime in order to encourage economic development. This study attempts to suggest relevant recommendations that might be needed to boost price transmission and market integration in Indonesia. Consequently, it may lead the government to formulate appropriate policies that contribute to efficient outcome. Lohano et al. (2005:717) pointed that information resulted from the area of market integration could be used by the government to formulate policies in term of market infrastructure and information regulatory, and avoid market exploitation.

Previous studies on the market integration by Munir et al. (1997), Adiyoga et al. (2006), and Firdaus and Gunawan (2012), have tended to analyze the five major vegetables (red chilli, potato, tomato, cabbage and shallot) in particular markets in Indonesia. However, mostly previous study assessed the information to what extents and to which markets prices are transmitted across spatially different markets. The information about price and market mechanism of vegetables commodities in Indonesia have not yet been cleared enough. Because the variables, which influence the degree of integration in vegetable commodity especially red chili commodity market have not yet been clarified. Thus, the analysis of market integration remains weak without further analysis on factors that explain such of market integration or segmentation.

1.3.2 Research questions

The basic question of this study is: Is the price of red chilli in one market transmitted to other markets that are located in different provinces in Indonesia?

Then the sub questions are:

1. What is the long-run and short-run dynamic between those spatially distinct markets?
2. What are the factors that explain spatial market integration or the lack of integration of red chilli commodity markets in Indonesia?
3. What are the appropriate recommendations to encourage red chilli commodity markets development?

1.4 Scope and limitations

Data availability was one of the main obstacles that faced by the author. Thus, due to limitations and availability of prices dataset, this study will employ a different period for two types of analyses. This is because the monthly producer price are available from January 2000 to December 2011. On the other hand, the monthly wholesale price in PIKJ is available only from January 2005 to December 2010. Another limitation that the author faced is that the study has difficulty to assess the data of red chilli's demand and consumption per provinces. However, including those variables in the analysis of factors that determine market integration or the lack of such integration would have improved the precision of the results. Therefore, the research did not include red chilli's demand and consumption in the analysis. Moreover, the study could not use the econometric model in identifying factor that affect market integration because the limitations and availability of dataset. The variables that include in the analysis are annual data and have different period with the former study on spatial market integration. Therefore, we choose to conduct descriptive analysis on factors that encourage market integration despite of econometric model.

1.5 Organizations of the paper

This paper is organized as follow: Chapter 2 present the literature review and empirical findings. This chapter includes the review of the concept of market integrations, empirical studies on market integration in Indonesia and factors affecting market integration, and approaches of testing market integration. Overview of red chilli commodity will be presented in Chapter 3. Chapter 4 describes the data characteristic and estimation methods for market integration analysis. The results are given in Chapter 5. Finally, Chapter 6 concludes and draws policy recommendations.

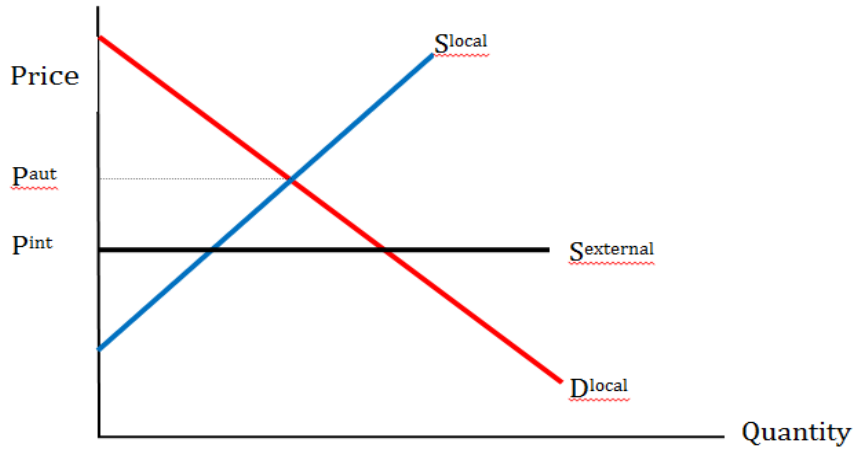
Chapter 2 Concept of market integration and empirical evidence

As noted in Chapter one, the analysis of price transmission and spatially market integration has attracted much attention in the agricultural commodity markets. This section will undertake a review of the concept of market integration; then, continue to summarize empirical studies in market integration issues, the factors generate spatial market integration, and the models used for price transmission and market integration analysis over the years.

2.1 The concept of market integration

Many studies about price transmission and market integration in agricultural commodity market have been conducted around the world. Spatial market integration is an analysis that help us to understand the response of market to demand and supply shock. Figure 3 illustrates the responsiveness of supply in the markets integration.

Figure 3 Supply and demand curves in the market integration



Based on the graph, if there is an increasing in local demand, then the price will goes up because of the limits to local supply response, especially in the short-run. However, if market is integrated with external markets, the local market will have more supply that is elastic because there are additional commodity supplies that can meet increased local demand. Similarly, "if food is distributed locally, thereby shifting both market demand and supply curves, prices will change far less in a market that is integrated with external markets than in an autarkic/segmented local market" (Barrett, et al. 2009).

According the explanation above, as can be seen that market integration have played an important role in dealing with risk relate to supply and demand response. It would indicates "the movement of the respective commodity from the excess supply to the lower supply, in a Walrashian sense, the transmission of price shocks between the markets, or both" (Barret and Li 2000 as cited in Tamru 2006)

Moreover, as said by Dercon (1995) we can assess the speed of price transmission in the main market to the peripheral markets through market integration analysis. A decline in the time lag of price transmission suggests better arbitrage and consequently an enhancement in the functioning of markets. "If arbitrage is possible, then one good in one region should have the same price in other regions. If the price among region is being converged or the price tends to converge, then the price differential will be smaller and smaller" (Wimanda 2006: 5). This condition is explained in the law of one price (LOP) that usually related as the basic concept of market integration analysis.

We concern on the short-run and long-run integration of red chili markets within country. Market integration analysis provides a clear framework to examine these issues (Goodwin and Schroeder 1991; Dercon 1995). As claimed by Viju et al., "Market integration means that a measurable long-run relationship exists between spatially separated prices for the same good. Thus, even when prices might temporarily deviate from each other in the short-run, overall, prices should still be consistent with other integrated markets" (Viju et al. 2006: 35). However, this analysis also can be used as the test for price arbitrage: "as price increases in one region, this product will eventually be imported into that region from a region with lower prices. This, in turn, leads to a shortage in the exporting region, and, as a result, the good's price increases in the exporting region as well. The possibility of spatial arbitrage explains why prices of homogenous goods can track together in spatially separated markets so long as those markets are integrated in some manner" (Ibid: 35). Therefore, we can conclude that if spatial price arbitrage exist then it suggest well-functioning market. Meanwhile, if profitable trade did not take place, it suggests poorly functioning market.

Tahir and Riaz reported several impediments in agricultural commodity markets that could affect the efficient functioning of markets. These impediments include "inadequate transportation infrastructure, difficulties in access to market information, government-imposed restrictions on movement of goods between regions, government monopoly over the marketing and distribution system, and poor enforcement of anti-trust regulation that results in price fixing and oligopolistic market structures. If markets are not well-integrated, price signals are distorted, which leads to inefficient allocation of resources" (1997: 241).

2.2 Empirical studies on market integration, and factors influence the integration

There are extensive literature on the spatial market integration in agricultural commodity markets especially staple food have been done with various result[3]. On the other hand, relatively few studies have been done for integration in vegetables markets, with the exception of Sexton et al. (1991), Zanias (1993), Munir et al. (1997), Sarker and Sasaki (2000), Myae et al. (2005), Adiyoga et al. (2006), van Sickle (2006), Amikuzuno (2010), Firdaus and Gunawan (2012), and Adeoye et al. (2013).

First of all, the brief review of spatial market integration of staple food will be elucidated before presenting the study of vegetable market integration. Ravallion (1986) investigated spatial price differential in Bangladesh for rice commodity by using monthly data during price turbulence from July 1972 to June 1975. He employed bivariate dynamic models to test relationship among each local price of rice and price level in the reference market. The study decided to conduct research on Dhaka and its trade linkage, which are the five main grain surplus districts. The analysis discovered that market segmentation shown poor performance. However, the long run integration shows better performances. Short run integration remains to be weak when long run integration is imposed. This research can be implemented with the condition that relate to Indonesia, where Jakarta similar with Dhaka as the capital and largest city. Therefore, this paper tries to examine whether wholesale market in Jakarta would have influence to the price at local markets.

Rice is a commodity that has attracted many researchers to investigate in the context of market integration. Previous studies have been done also in Indonesia for this commodity, such as the research by Timmer (1974; 1985; 1996), Heytens and Pearson 1990), Alexander and Wyeth (1994; 1995), Ismet et al. (1998). In their research, Alexander and Wyeth (1995) investigate the relationship between price of rice in Jakarta, Bandung, Surabaya, Medan, Banjarmasin, Ujung Pandang and Jayapura. They used regression and cointegration approach to test integration between those markets. The results showed that the link between Medan and Jakarta, Medan and Ujung Pandang, and Bandung and Ujung Pandang had the higher degree of integration. Further, Jayapura and Surabaya tend to segmented rather than integrated with other markets. The weaknesses of this research are they did not complement the analysis of what the main drivers of commodity market integration. Thus, the result just reports the cointegration analysis.

[3] List of previous empirical studies of market integration of staple food and vegetables is provided in appendix

Beside foodstuffs commodity, a number of empirical studies of vegetables market integration have been conducted around the globe. A study by Zanias (1993) identified the degree of spatial market integration in European Community of agricultural commodity markets. His study applied co-integration analysis to test the law of one price (LOP) for potatoes, and other agricultural products such as soft wheat, milk, and pig carcasses in Belgium, Denmark, France, Germany, Italy and UK. In the case of potatoes, the study used monthly series data from April 1983 to December 1990. The study pointed out that integration was found in three locations out of six locations. For overall results, "the integration of the agricultural product markets does not live up to the ideal of a truly common market in which efficient arbitrage ensures the existence of a single price throughout the European Community". Then, "non-integrated markets seem to be in the minority" (Ibid: 425). This study suggest future research of market integration to examine more thoroughly the cases where market integration has failed and identify the specific factors responsible, and investigate the possibility of spatial markets being linked by efficient arbitrage (Ibid: 425). In order to contribute to the literature, then we seem to follow Zanias's recommendations in order to seek the factors that responsible to affect market integration. Despite examines the link between markets in a group of countries, this paper will focus on the regional market integration.

Regarding the issue of vegetables market integration in Indonesia, little has been done in evaluating vegetable commodity markets performance in Indonesia, here are presented the result of those studies. Munir et al. (1997) selected five major vegetable commodities (chilli, shallot, cabbages, potatoes and tomatoes) in Indonesia to be observed in the context of spatial market integration between producer markets and consumer markets. They conclude that 'markets within the same islands are more likely to be integrated' (Ibid: 50). The possible reason behind this is that the distance within the same island is relative close compare to inter island. However, the study did not provide further information about the determination of which factor that directly affects the process of market integration.

A research by Firdaus and Gunawan (2012) on integration among regional vegetable markets in Indonesia used co-integration approach and Ravallion model to identify whether market integration exist between four producing area in Sumatera and Java island and central market in Jakarta (PIKJ). The analysis was conducted into five kinds of vegetables (shallot, red chilli, potatoes, cabbage and tomatoes). The results reported that cointegration model found that markets are integrated, while other does not. According to this research, we will try to identify whether our research find different result or not with this previous study by Firdaus and Gunawan. We do add the population of research by expanded the markets become 23 producers markets.

However, the studies on market integration around the world often use different analytical models and datasets to estimate the extent of market integration and the aspects behind spatially integrated markets. Their findings highlight several possible underlying factors driving or hindering price signal under different contexts.

In depth examination of the factors influencing market integration, Goodwin and Schroeder (1991) explained that the increase the distances then the spatial linkage between cattle markets in the United States will worsen. They emphasized, "Regional market pricing performance also is influenced by distances between markets and slaughter volumes" (Ibid: 463). However, this condition might be the same in Indonesia. Distance might affect the integration between markets, which also have poor infrastructure.

Regarding to geographical condition, another condition except distance also attract to be examined. As reported by Hernández-Villafuerte (2011: 10), who studied the relation between spatial price transmission and geographical distance in Brazil, poorly integrated markets have been triggered by the location of the markets that is nearby the port or neighboring country as an export point.

In addition, the quality of infrastructure also plays an important role in the determination of market integration. As reported by Goletti et al. (1995), the quality of infrastructure that shows by road density positively influenced market integration in rice markets in Bangladesh. Moreover, dissimilarity in production also have identified as factors that positively generated integration. While, distance between market, telephone density and labour strikes negatively affected integration. Okoh and Egbon (2005) have also found similar result. Using data from the Federal Office of Statistics and Central Bank of Nigeria publications, they found that market segmentation between rural and urban area in Nigeria is encouraged by the presence of poor roads, inefficient transport facilities and hence high transportation costs. Munir et al. (1997) also found that poor infrastructure as the aspect that lead to lower percentage of degree of integration in selected vegetable markets in Indonesia. However, Ismet et al. (1998) found that the length of road was negatively affecting market integration in Indonesia.

Furthermore, Varela et al. (2012) said that remoteness would lead to less integrated market than provincial capital in Indonesian commodity markets. The results in line with what Golleti et al. (1995), and Goodwin and Schroeder (1991) have found in their research. They explained that beside remoteness, other factors such as infrastructures, output per capita and productivity were the factors that also affected market integration in Indonesia.

Finally, among those studies that determine factors drive market integration there are some, which pay more attention to geographical condition and the quality of infrastructure, whilst others to aspects related to production.

2.4 The methods of testing price transmission and market integration

Part of this paper elucidates a review of the main econometric models used for price transmission and market integration analysis over the years. The following reviews chronologically the methods that begin from the analytical tolls to identify market integration from first generation to the latest generation, which are the simple static price correlation, dynamic models, causality approach, cointegration and error correction model (ECM), threshold model and lastly parity bound models (PBM). Details on the various models based on previous studies in the price transmission and market integration literature are presented below.

The issue of price transmission and market integration have been discussed for almost six decades. Different approaches are used to analyse the spatial market integration in agricultural commodity. Those available tool analyses include a package of different model methodologies, and assumptions that will influence, enhance or limit the result. Therefore, it creates some debate to pursue the most appropriate methodology for testing price transmission and market integration.

Earlier studies on first generation of market integration analysis used static price correlation between the prices in pairs of regions (Jones 1968; Farruk 1972; Richardson 1978; Harris 1979). However, other researchers argue that static bivariate price correlation cannot capture the dynamic nature of marketing mechanism (Heytens 1986; Ravallion 1986). Hence, the findings of the static price are suspicious, because the static regression might reflect of spurious market integration and inferential error; thus, cannot be tested to overall marketing system (Delgado 1986, Palaskas and Harris 1993). In addition, Barret (1996) and Baulch (1997) had strengthened the argument. They argued that the results of static model was not reliable, due to assumption of stationary in price behaviour and fixed transaction cost. These lead to the result in which underestimate the extent of market integration.

To cope with the problems that arise on the previous measurements of market integration, a new method was modelled. Ravallion offers new approach, which is an Autoregressive Distributed Lag model that can extract more information on the nature of price differentials and permits a clear distinction between short run and long run market integration, which do not provide by static price correlation analysis (1986: 108). This model has been employed by Faminov and Benson (1990) to investigate price relationship in

hog markets in Canada. However, this empirical test of Ravallion model "allow certain predictions of various spatial pricing systems that may underlie oligopoly (oligopsony) market price formation to be examined" (Ibid: 61). On the contrary, the basic flaws of the Ravallion model are, "the problems of simultaneity, failure to measure the level of integration where the flow between rural and urban areas reverses with the season, and colinearity among explanatory variables, as well as the problems associated with non-stationary time series data" (Dittoh 1994 as quoted in Okoh and Egbon 2005: 150-151)

According to the explanations above, the dynamic models have limitation and inappropriate techniques to deal with non-stationary of the price series. Then to address this inferential problem, a variety of analysis techniques offers appropriate procedures that were unavailable in the former approaches. Cointegration test, and ECM provide analytical tools that can enrich the result of the market integration in testing some notions such as completeness, speed and asymmetry of the relationship between prices (Rapsomanikis et al. 2003; Meyer and Cramon-Taubadel 2004, and Hossain and Verbeke 2010). Many researchers used these tools rather than other approaches (Goletti and Babu 1994; Lutz et al 1994; Alexander and Wyeth 1994; Badiane and Shiveli 1998; Hossain and Verbeke 2010; Myae et al 2005; Adiyoga et al. 2006; van Sickle 2006; Zahid et al. 2007; Firdaus and Gunawan 2012; Adeoye et al. 2013). Then, cointegration analysis has become the prominent approaches used in research of market integration.

Although, cointegration analysis has used extensively to test market integration, there is a debate for the validity of its result. Because of the cointegration test neglected transportation cost. Thus, the ignorance of transaction cost may inhibit price transmission across spatially separated market (Abdulai 2000; Fackler and Goodwin 2001; Goodwin and Piggot 2001; Barrett and Li 2002). The difficulties to measure or observe transportation cost especially in developing countries are the facts that lead to neglect transfer cost.

While the previous approaches mentioned above ignore transport cost, which means only rely on data price. Knowing the important of transaction costs has led to the application of new empirical approaches which response to the influence of transaction costs in spatial market integration (Goodwin and Piggott 2001: 302). Analytical tools that compress transport cost in their model to investigate market integration are Threshold Model and PBM.

According to Abdulai, "Threshold model is the approach that recognize threshold, caused by transactions costs that deviations must exceed before provoking equilibrating price adjustments which lead to market integration" (2006: 169). Threshold model of dynamic economic equilibrium is more

appropriate to examine dynamic price relationship between geographical separated markets. Therefore, some studies employed threshold autoregression model and combined it with cointegration model (Abdulai 2000, 2006; van Campenhout 2007). However, the limitation of this model is the assumption of constant threshold, implying a fixed neutral band over the period that being studied. The assumption of constant threshold may only reasonable in the short run periods in the single estimation, while in the two periods estimation direct observation on transaction cost is needed (Abdulai 2006: 184).

Further, Baulch (1997) established the PBM by improving the earlier approach by taking into account the non-linear price relationship that caused by transfer cost. The reliability of this new model has tested on the case of food market integration in Philippines. PBM examines the market integration by distinguishing among three different trade regimes that cover all arbitrage conditions. Therefore, PBM tends to be able to detect violations of the spatial arbitrage conditions with a high degree of accuracy (Baulch 1997: 478-479). In addition, this method provides continuous measure of the frequency of profitable opportunities (Fafchamps and Gavian 1996; Baulch 1997).

To give better understanding of all approaches of market integration analyses, then the equation of each method is depicted in appendix 2.

Chapter 3 Overview of red chilli commodity

In this Chapter, the characteristic of red chilli commodity will be presented clearly. Some information that relate to trade activity is reported in this chapter. In the end, it will describe the structure of marketing channel and marketing information system in Indonesia.

3.1 Supply characteristics of red chilli commodity

Red Chilli (Capsicum annum L. var annum) is vegetable commodity origins from South America, and included in the family of Solanaceae. Red chilli in Indonesia cultivate in lowlands area, which has altitude around 0 to 200 meters above sea level. In Indonesia, chilli is considered as one of the most important commercial vegetable crops and is widely used as a condiment. In addition, beside consumes as fresh products, chilli also allow to further processing for various products such as chilli powder, chilli sauce, dried chilli and for seeds. The self-life of chilli is between 5 to 7 days in room temperature.

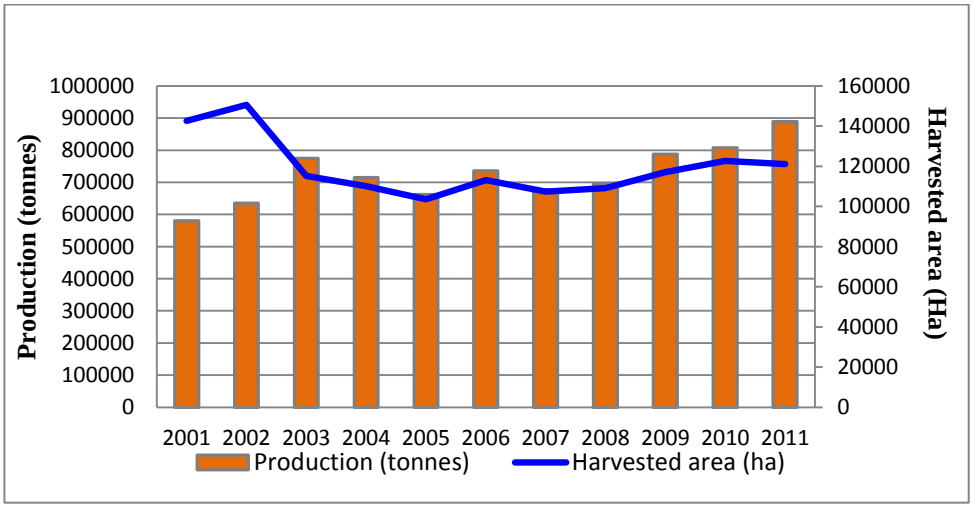
According to Webb et al. (2012: 3), there are two major production seasons of red chili, but red chili's production takes place all year round in Indonesia. The first one starting to plant from mid-February; then, after 3 months in the late April to early June is the harvest time. The second season is starting in late of July, thus the harvest time is running from September to early November. Therefore, the supply of chilli does not reveal a strong seasonal pattern. However, a shock in supply could be derived through some variations in weather, pest and disease, planting and other factors (ibid).

In Indonesia, red chillies are grown in almost all provinces. However, Java Island is the major production area of chilli. West Java dominates the cultivation area of chilli, which contributes nearly 24.69% to the total production during 2001 to 2011. Central Java is the second largest producer contributing 14.78% to the total production, followed by North Sumatera (15.86%). In addition, there is variation in chilli's productivity within country. For instance, chili's yield in West Java was 12.33 ton/ha in 2011, compare to only 5.31 ton/ha in Central Java. Meanwhile, North Sumatera's yield were 2.88 ton/ha. The differences are nearly a three-fold and a four-fold (MoA, 2012).

In the last decade, red chillies's production has increasing trend during 2001 to 2011. The production of chillies increased slightly from 580,464 ton in 2001 to 774,408 ton in 2003; Then, it decreased until 2005 to 661,730 ton. Further, the trend of chillies' production went up and stood at 888,852 ton in

2011. On the other hand, the trend of chillies' harvested area is slightly different. Because, after increased in 2002 (150,598 ha) the harvested area of chillies never hit the same point or above. Yet, the harvested area of chillies remained stable since 2005 around 103.531 ha to 121,035 ha in 2011. The harvested area and productions of red chilli in Indonesia is depicted in figure 4.

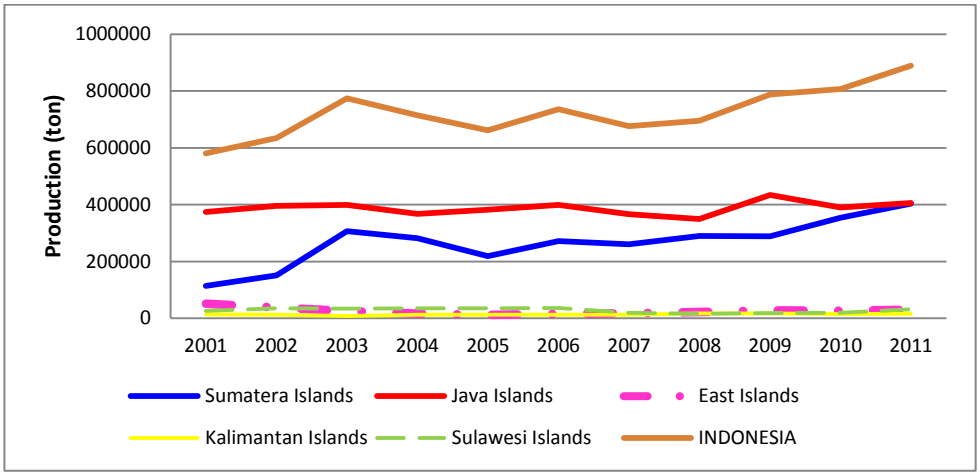
Figure 4 Hectares harvested area and productions of red chilli in Indonesia



Source: Elaborated based on MoA (2001 – 2011)

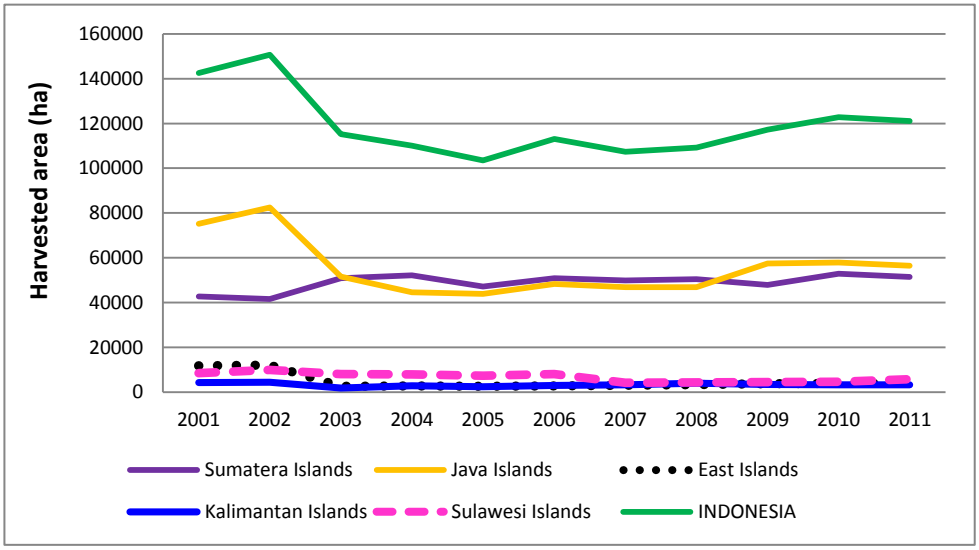
The performance of production and harvested area by islands classification is presented in Figure 5 and 6. According to the graph, the production of chilli in Java Island was slightly fluctuate, but remained around 400,000 ton. Yet, the harvested area in Java Island decreased moderately from 82,500 ton in 2002 to 56,479 ton in 2011. Sumatera Island has increasing trends, both in production and harvested area. However, their growths in harvested area were less encouraged. The same pattern for East Islands are shown both in their trend of production and harvested area.

Figure 5 Red chilli productions during 2001 to 2011



Source: Elaborated based on MoA (2001 – 2011)

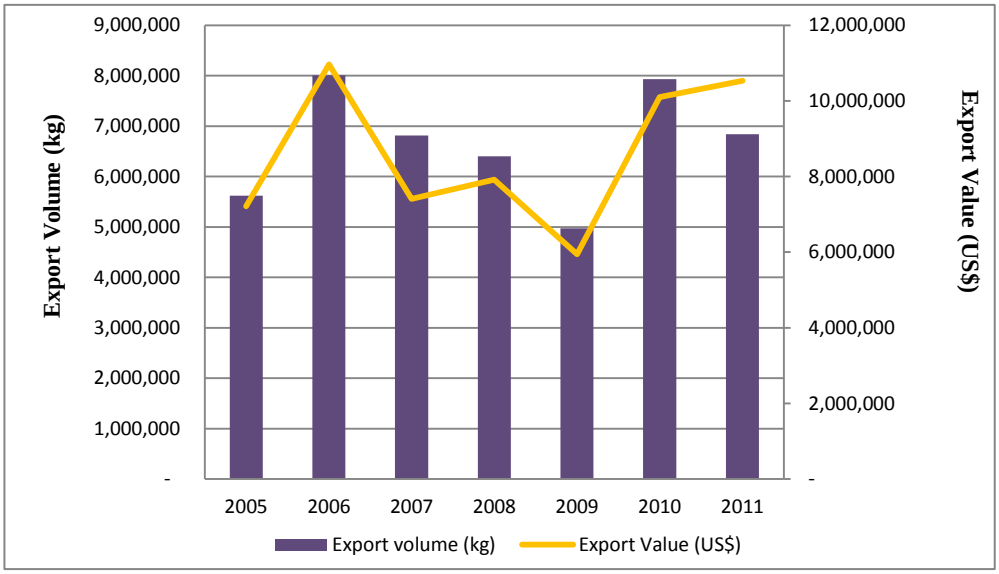
Figure 6 Red chilli harvested area during 2001 to 2011



Source: Elaborated based on MoA (2001 – 2011)

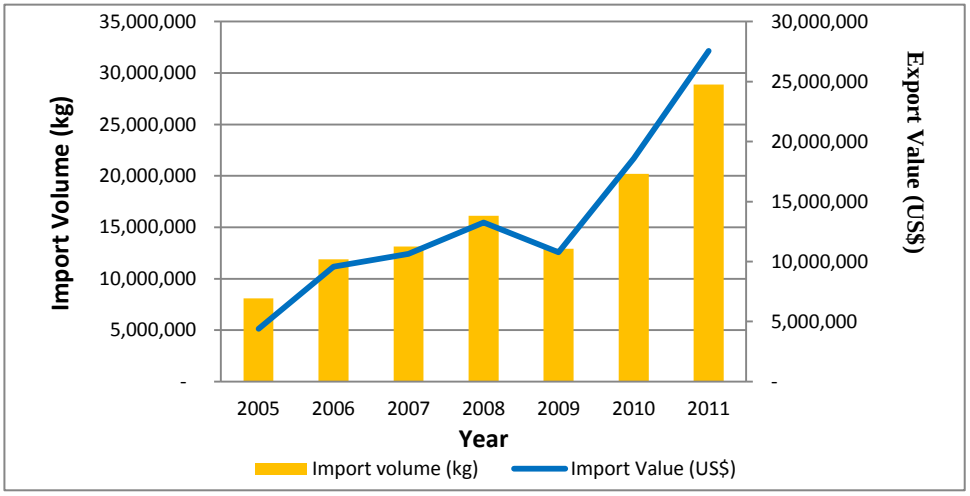
Regarding trade characteristic, Indonesian red chilli has potential to export. Although, the export volume decreased in a couple years, it increased in 2010. It might due to the rise in production of chilli during last few year that has boosted Indonesia's chillies export opportunities. According to DGH (2012), red chillies are mainly export to Singapore, Malaysia, Saudi Arabia, Japan, Czech Republic, the Netherlands, and Australia. However, the import volume of chilli tends to goes up overtime. Mainly, import chillies come from India, China, Thailand and Malaysia. Figure 7 and 8 present the export and import of red chilli during 2005 to 2011.

Figure 7 Export of red chillies from Indonesia (2005-2011)



Source: Elaborated based on MoA (2005– 2011)

Figure 8 Import of red chillies to Indonesia (2005-2011)

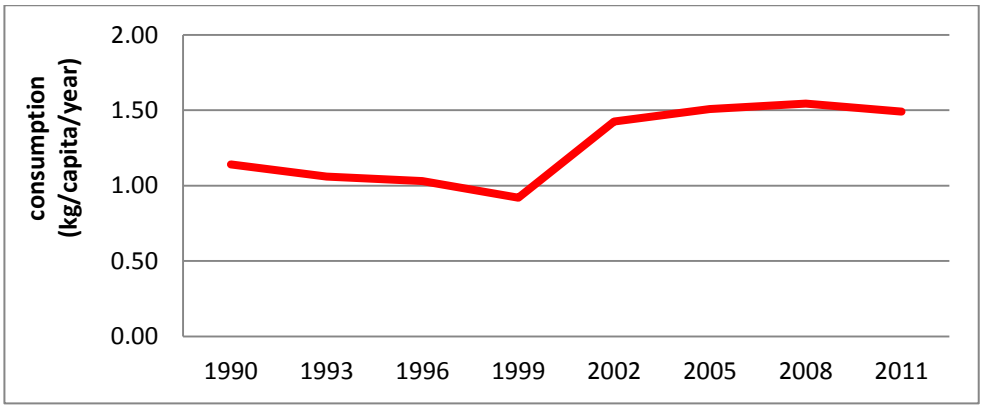


Source: Elaborated based on MoA (2005– 2011)

3.2 Demand characteristic of Red chilli

According to Directorate General of Horticulture (2012), per capita consumption of red chilli is about 1.49 kg per person per annum, and has increasing trend in the last decade. Figure 9 presents the consumption of red chillies in Indonesia.

Figure 9 Consumption of red chilli in Indonesia



Source: Elaborated based on MoA (1990– 2011)

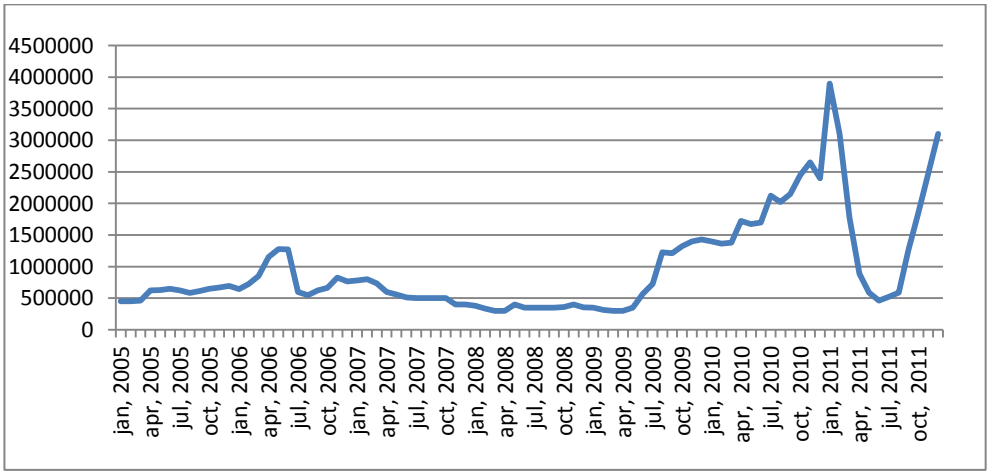
There is significant increasing in demand and prices of vegetables and other products i.e. in the holy month of Ramadhan. Based on study by Webb and Kosasih, this condition was empirically estimated have an effect on the chillies' price retail in some cities in Indonesia. Also supported by Wamdana (2006: 18), "although all people (moslem) do fasting in Ramadhan, but the food consumptions is not necessary decrease because they tend to have additional foods or dessert during fast breaking". However, this predicted demand have led to increase of food price and processed food price in most regions. (Ibid).

Actually, there is no data on real chilli demand in Indonesia. However, the data consumption of chilli is annually and only available in the national level that provided by Ministry of Agriculture every three years. In this paper, the local trade opportunity for chilli can be identified through the large of consumer in every region, by looking at the population in each place.

3.3 Red chilli commodity prices

This paper aims to investigate price transmission and market integration of red chilli markets commodity in Indonesia. Thus, before conducting a series of statistical techniques it is worth to describe the characteristic of red chilli prices in selected markets that will be examined. Generally, the trends of red chilli prices in Indonesia are fluctuate and seem to increase. In addition, price differences between regions also happened in Indonesia, due to the differences in geographical condition of the markets, natural resources and infrastructures. The description of red chilli prices that include in the study are presented in figure 10 below.

Figure 10 Plot of red chilli prices in PIKJ



However, in some discussion of the Indonesian context, usually provinces are grouping based on their location in the island. The classification of province based on location in the island within Indonesia is described as follow:

Table 1 Province classification based on location

Island	Province
Sumatera	ACH, NSM, RIAU, JBI, WSM, BKL, LPG, SSM
Java	WJV, CJV, EJV, YOG
Nusa Tenggara Island	BALI, WNT, ENT
Bali	BALI
Kalimantan	WKL, EKL, CKL, SKL
Sulawesi	NSW, CSW, SSW, SESW

Below is illustrated the plot of producer prices that are grouped by island classification. Figure 11 and 12 describe price time series for Sumatera Island (Jambi, South Sumatera, Bengkulu and Lampung). Figure 13, 14, 15 and 16 illustrate the price series in Java Island, Kalimantan Island, Sulawesi Island, and East Island.

Figure 11 Price time series for Sumatera Island (Jambi, South Sumatera, Bengkulu and Lampung)

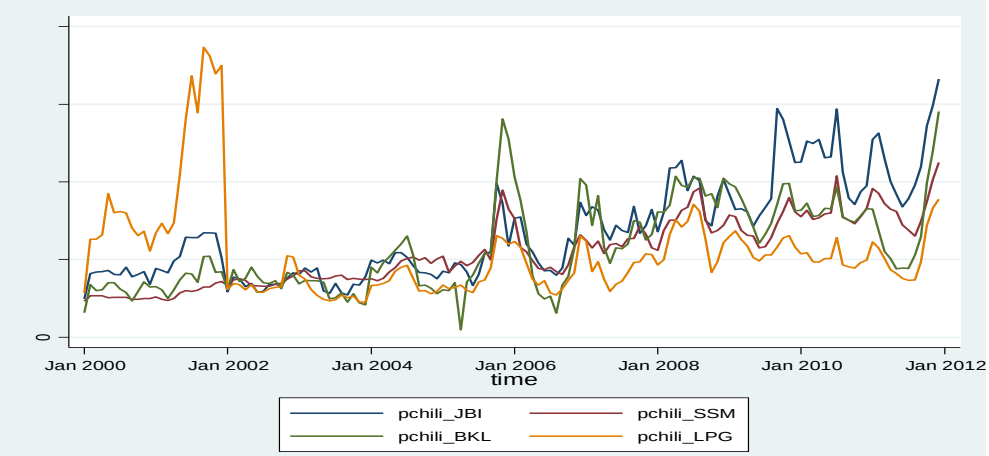
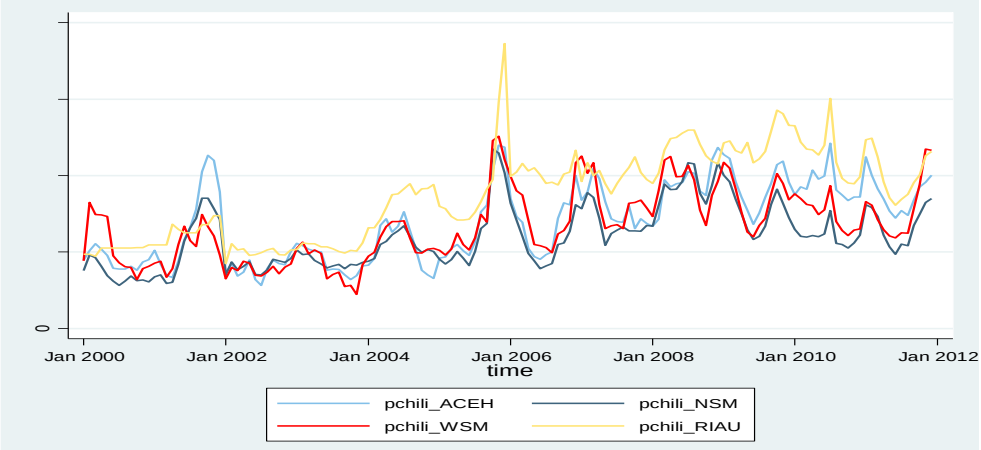


Figure 12 Price time series for Sumatera Island (Aceh, West Sumatera, North Sumatera and Riau)



According to the graph, we can see that the prices in the same island tend to move together in the long period, except prices in Kalimantan Island and East Island. However, this implies that long-run cointegration may exist in these markets. While, the prices in Kalimantan, especially EKL and CKL have different pattern with others. In the East Island the price pattern of ENT is quite distinct with others.

Figure 13 Price time series in Java Island (West Java, East Java, Central Java and Yogyakarta)

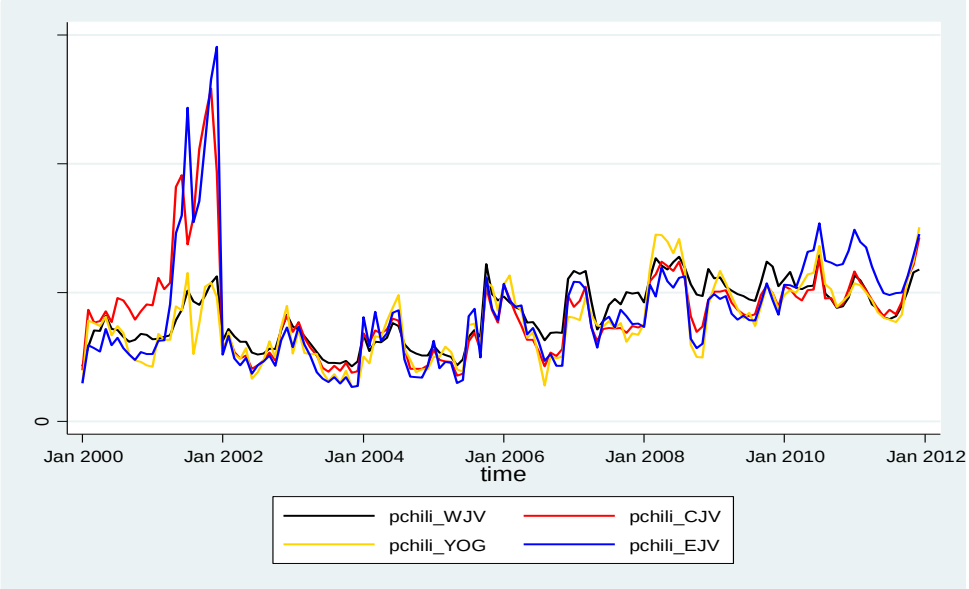


Figure 14 Price time series in Kalimantan Island (West Kalimantan, South Kalimantan, Central Kalimantan and East Kalimantan)

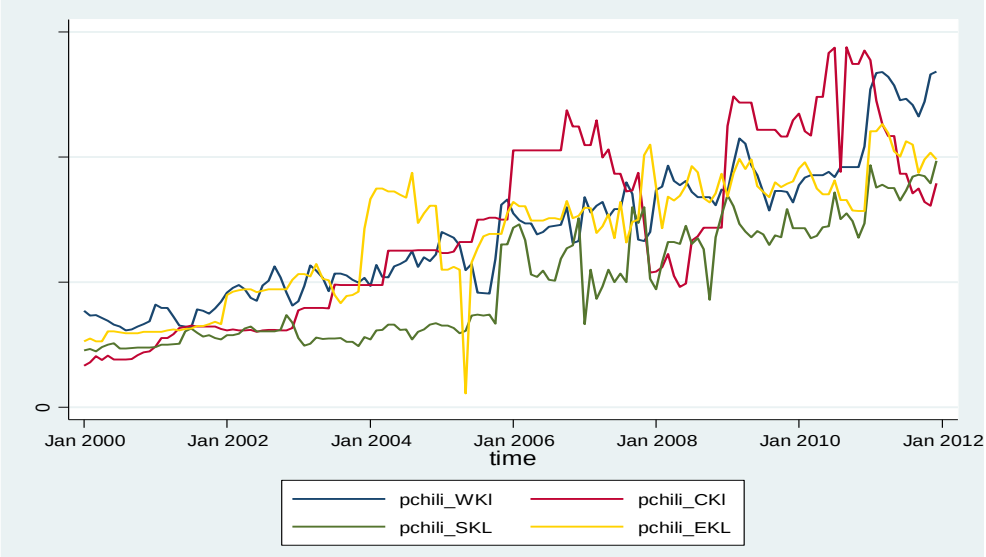


Figure 15 Price time series in Sulawesi Island (North Sulawesi, South Sulawesi, Central Sulawesi, South East Sulawesi)

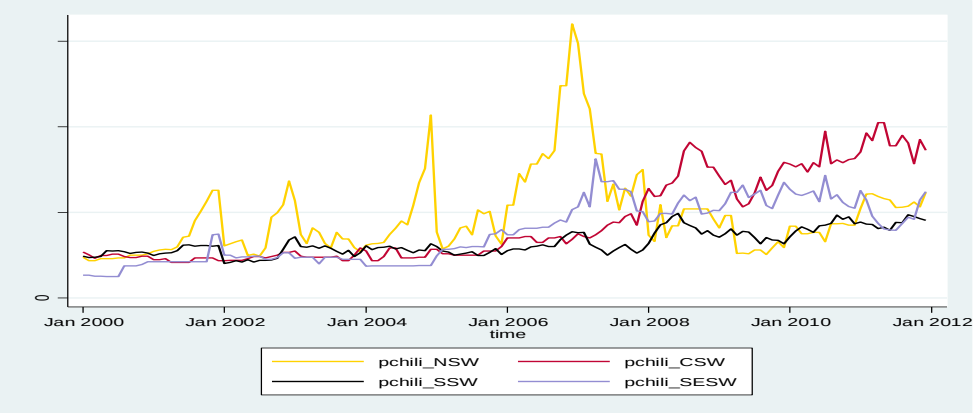
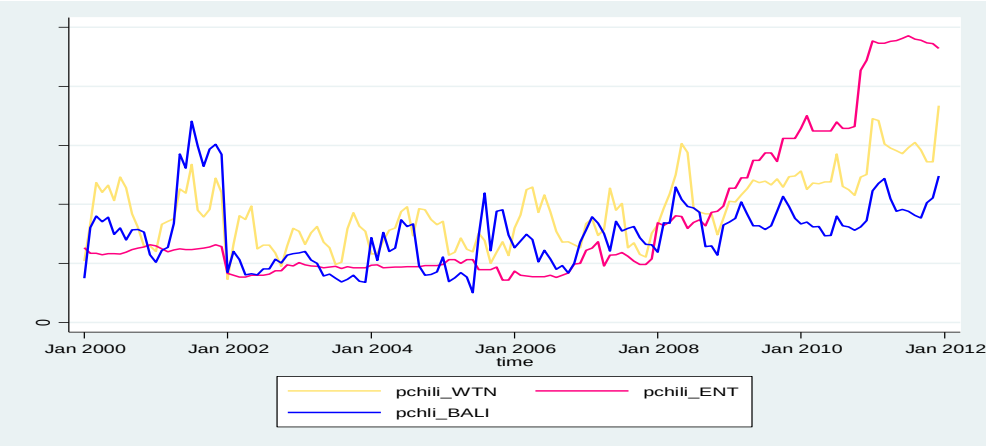
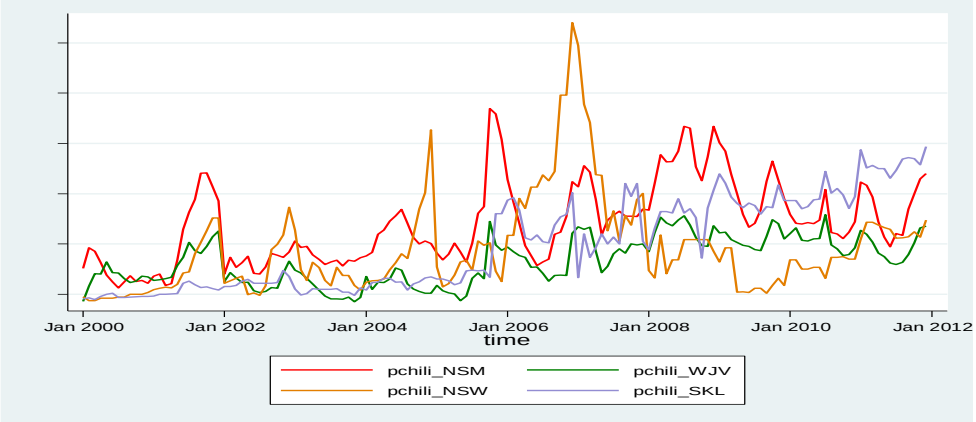


Figure 16 Price time series in East Island (Bali, West Nusa Tenggara and East Nusa Tenggara)



Meanwhile, to give a little view on price differences in different islands, then figure 17 presents the example of price series in four different islands.

Figure 17 Price time in different island (North Sumatera, North Sulawesi, West Java, and South Kalimantan)

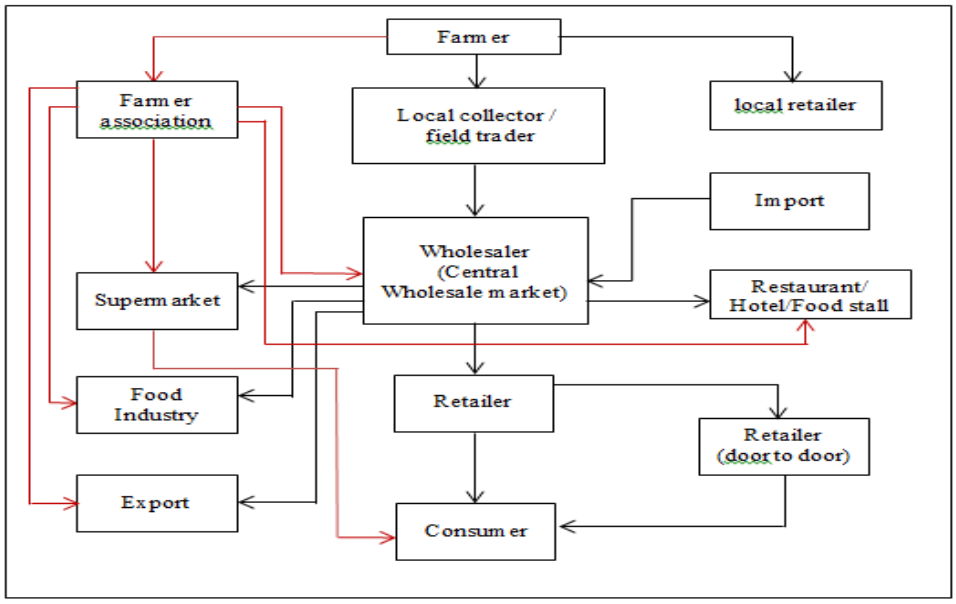


Although, we already seen that most of prices in the same island move closely together, next the series of statistical techiques will be conducted in order to test whether the long-run cointegration exist or not in Indonesian red chilli markets. These analytical tools will provide some evidences of market integration, and to which markets are price transmitted.

3.4 Marketing channel of Red chilli commodity

Market channel of vegetables differ by commodity and region, but some features are similar throughout the country. Vegetables marketing channel embraces link that happened between farms gate (producers) and final consumer. According to Stern et al. (1996: 1), "marketing channels can be viewed as sets of interdependent organizations involved in the process of making a product or service available for consumption or use". In the case of vegetable markets in Indonesia, we will focus on analysing the existence of all trade intermediaries, economics facilities and institutions that operate in different channels of distribution as well as the availability of marketing infrastructure. Indonesian red chilli's marketing channel is illustrated in Figure 18.

Figure 18 Market channel of red chilli produce in Indonesia



According to Shepherd and Schalke, five marketing options that usually do by the farmer are as followed;

> "First, farmers go to the local assembly market, either with their own or a rented vehicle, where they sell to traders who supply wholesale markets. Second, traders buy the field (standing crop purchase) and deliver to wholesale markets. Third, traders collect from farmers at or close to farm gate and deliver to wholesale

> markets. Fourth, field-traders collect from farmers and sell to the retail market or to traders for delivery to wholesale markets, and. Lastly, farmers sell, either through an agent or directly, to a packing house which prepares shipments for institutional buyers, supermarkets or export" (1995: 5-7).

Below is presenting the description of red chili marketing chain that applied in Indonesia. Marketing channel of Indonesian chili is starting in the stage of transaction between trader and farmers. Traders sometimes buy vegetables in the field before the harvest time. This condition is known as standing crop purchase (*tebasan)*. The farmers faced the risk of the agreement that may undervalue the crop. This practice provide the availability of cash before harvest and assurance of outlet, therefore farmers likely to choose this approach (ibid: 6).

In addition, before transaction usually farmers offer their expected price to trader at which they want to sell their products. After deal with the price, then trader usually rent trucks and send it to field in order to pick up the products, and then go to the wholesale market or send a shipment of products to other islands. However, a trader usually has several sub-collectors that are called field-traders. Then, in order to gather a large consignment, trader purchases the product through these field traders, as well as directly from farmers (Ibid: 6).

The next stage, trader sends shipments of vegetables from the production provinces to a consignee before further distribute to wholesale market. In the responsibility of consignee, the products are usually unload and pack in a 50 kg bag (Ibid: 6).

The central wholesale market in Jakarta, which is known as Pasar Induk Kramat Jati (PIKJ) is the destination of many traders. Because PIKJ has a large number of consumers, since the large of inhabitants who live there (9.8 million), and many people from nearby Jakarta work and stay for a half of day in that city. Therefore, this creates great trade opportunity. However, PIKJ market receives shipment of vegetables and fruits from all over producers' area such as Java and Sumatra Island. PIKJ usually distribute the products into retailers such as grocers (*warung*), street vendors and pedlars; yet, it also has a retail section. Retail markets are called '*pasar*' at both village and city level, which provide by the municipal government. The prices in retail markets are generally highly competitive, with a large number of buyers and sellers (Ibid:6).

Additional channel that occurs in the vegetable market chain is farmer associations. They sell the products through packinghouses to institutional buyers and supermarkets. The transaction between these usually based on long-term contract basis with a fixed price and pre-determined delivery conditions, such as timing, quantity and quality of the product. The contract could be revised in term of the price and delivery conditions at specified intervals (e.g. every two weeks). All post-harvest treatments (grading, sorting, packing) are treated according to the requests of the supermarkets or

institutional buyers such as restaurants and hotels (ibid: 7). As mentioned in the previous chapter, Indonesia has experienced with the rapid increase of supermarket. The number of markets tend to increase in all provinces in Indonesia, but with different trend of growth. Therefore, it is interesting to examined whether or not the increasing of number of markets in some provinces influence the market integration.

In order to enhance our understanding of red chilli market system. Below is presented review of additional activities that perform by traders that described as the marketing value added functions. Webb et al. (2012: 9-10) stated that in the farm level there is no sorting done by farmers. They left this activity to the traders that will sort chilli based on color and physical condition. The estimation of sorting cost was Rp 50,000 per day to sort 100 kg of chilli or it accounts Rp 500 per kg. There is no storage cost include in this marketing chain, due to the consignment was usually done in the end of the day, after the transaction and sorting. Further, the transportation cost is distinguished based on the types of transportations and the distance. Local transport is charged if chili distribute within island that can be reached through land transportation. The cost was estimated at Rp 3000/km for paying a driver and a truck with capacity of a five-tons chili. It means the island local transport is about Rp 0.6 per km per kg. Take for example, a chili distribution of 795 km trip from East Java to Jakarta would cost about Rp 477 per kg. On the other hand, to deliver chili from Kalimantan to Jakarta by ship was Rp 25 million for a 5 tons amount of chilies or around Rp 5,000 per kg. Meanwhile, the cost for distributing chilies by air craft was Rp 32.5 million or around Rp 6,500 per kg (Ibid). Thus, it can be seen that the longest the distance the highest the transportation cost.

Now, the focus will turn on obstacles that faced by marketing system in Indonesia. According to ACIAR (2007), lack of infrastructure investment especially in the eastern part of Indonesia and lack of refrigeration (cold chain system for perishable products) are identified as the major constrain in the distribution system. Recently, vegetables are distributed throughout Indonesia in non-refrigerated trucks.

However, in order to find out the market power that occurs in the marketing channel, a direct survey and interview must be conducted to asses this information. Meanwhile, the research has a limitation to do this activity, then we did not further study about market power. In the previous, a case study by Webb et al. (2012: 14) that have aimed to assess the role of market intermediaries in setting and adjusting prices in chilli market chain reported "traders play a crucial role in the efficient functioning of any commodity markets. They bring buyers and sellers together, assure efficient price transmission and the movement of product to where it is needed most". Thus, we can conclude that traders or intermediaries are the one that has market power despite of the producers.

Regarding the market information system, a price monitoring system in Indonesia has implemented since 1950's and it was transformed into the present service between 1978 and 1985 with technical assistance through German Government. Furthermore, the marketing information system (MIS) covered vegetables and a number of secondary food crops. The program collected data and relayed by phone, fax or radio to provincial Headquarters. Thus, in the same day, they pass through this information to the local radio for broadcast in the evening. The data prices in production level are collected from 23 cities in six provinces (West Java, East Java, Central Java, North Sumatera, West Sumatera and Bengkulu). Meanwhile, the wholesale data prices are collected from 20 cities in 19 provinces (Jakarta, West Java, East Java, Central Java, Yogyakarta, North Sumatera, West Sumatera, South Sumatera, Jambi, Riau, Lampung, Aceh, South Sulawesi, North Sulawesi, West Kalimantan, East Kalimantan, South Kalimantan, Bali, and West Nusa Tenggara) (Shepherd and Schalke 1995: 10-18). However, we never know whether or not this MIS well-functioning in Indonesia. The MIS supposes to give valuable information to the agents in the market structure, and it will lead to competitiveness and efficiency pricing.

Chapter 4 Data and Methodology

This study concentrates on price transmission and market integration of red chilli commodity markets in geographically separated markets. The concerns of market integration analyses are to exploit price movements in one market for the prediction of price movements in another market, to assess the long-run and short run dynamics of red chilli market integration in Indonesia and to identify the factors that might explain market integration.

4.1 Data

This paper will identify two types of spatial market integration of red chilli markets. The first analysis will be conducted to examine market integration between PIKJ the wholesale market in Jakarta and producer markets that are located in different provinces in Indonesia. Further, this study will investigate relationship across 23 producer markets that are placed in different provinces in Indonesia.

This study uses secondary data got from Statistic Indonesia and Ministry of Agriculture. The research employs 2 kinds of variable to test integration between separate markets, which are data price in the producer and wholesale market. Province is used as the unit analysis, and the market integration will be identified in 23 provinces. The data price in producer level is monthly data available from January 2000 to December 2011. Since 2000, there are 23 provinces surveyed by Statistic Indonesia, but it has expanded to 33 provinces in 2008. However, we use only 23 provinces in this study. In addition, the data price in PIKJ as the reference market is monthly start from January 2005 to December 2011. Therefore, the study of market integration between wholesale market and 23 provinces in Indonesia will use 72 observations, and the analysis of red chilli market integration across 23 producers in different provinces in Indonesia will employ 144 observations.

In addition, after knowing the relationship between vegetable markets in Indonesia, then the study will explore some factors that might drive or impede integration between markets. The variables of interest that might affect the process of market integration are productions, populations, infrastructure, distances between markets, and numbers of markets.

The definition and source of all variables that include in this research will be explained clearly. According to Statistic Indonesia (2011), price in the producer level is defined as the price agreed at the time of transaction between the producer and purchaser for a unit of products as output that excludes any transport charges by the producer and minus any tax. The producer's price

data are taken from Statistic Indonesia from various years and various provinces. The data is in Indonesian currency per volume of the products, which is called as Rupiah per hundred kilograms (Rp/100 kg).

Second, wholesale price is the cost of a product sold by a wholesaler. The wholesaler usually sells the products to intermediaries in the supply chain who then distribute the products to the retail sellers. According to Statistic Indonesia (2011), the wholesale prices data are collected from respondents every month, by direct interview in the wholesale markets, through recording the price between the 1st to the 20th day of the reporting month. The wholesale price in PIKJ - Jakarta will be employed in this paper. This data is taken from Statistic Indonesia, and in scale of Rupiah per hundred kilograms (Rp/100 kg).

Third, data of vegetable's production was obtained from Directorate General of Horticulture, Ministry of Agriculture from various years and various provinces. In this paper, production is defined as the volume of vegetable that produced by farmers or growers or producers in cultivation area.

In this research, population is defined as the number of inhabitant in a region or a province. The source of demographic data in Indonesia is population census, which is organized every ten years. According to Statistic Indonesia (2011), this "census count all residents who are domiciled in all territory of Republic of Indonesia include foreign citizen. However, this census excludes the diplomatic corps members and their families". The annual data of population by province have been made available by Statistic Indonesia.

Infrastructure is the important aspect that facilitates the process of distributions of goods. Statistic Indonesia has been identified and recorded the length of road based on surface type and road condition. In addition, the length of road in good condition also will take into consideration, as well as the length of damaged road. Those variables on infrastructure are measure in kilometre (km). Meanwhile, in order to figure out the development that has been improved between 2003 and 2011, then this paper also put emphasis on the percentage of length of road from its total road.

Distance is the length of the space between one markets to another market that are investigated in this paper. This data is taken from Google maps. The distance is measure in kilometre (km), the time of transportation (hours), and type of transportation (land or land and sea).

Numbers of markets differ in each province, and it might affect the marketing channel or distribution of the vegetable. Numbers of markets that will be employed in this study consist of number of supermarket, hotel, restaurant and traditional market without permanent building. We use number of market despite of size of market due to only this data that available. This data will reveal the number of consumers or trade possibility. This data provide by Statistic Indonesia.

4.2. Selection of markets in producer level

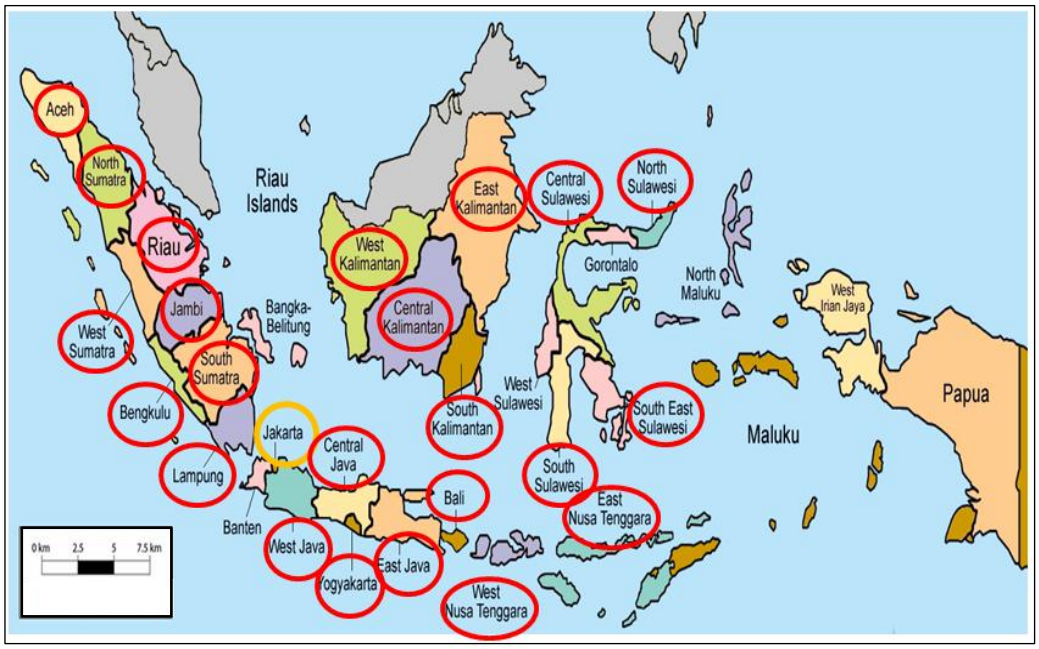
As discussed in the previous section this research will be conducted on red chilli commodity in 23 producers' area in different provinces. The data prices of some provinces are only available since 2008; therefore, they cannot be included in the study. These provinces are Banten, Riau Islands, Bangka Belitung, West Sulawesi, Gorontalo, Maluku, North Maluku, Papua and West Papua. Provinces include in the study are listed in table 2.

Table 2 List of provinces for testing red chilli market integration

No	Province		No	Province	
1	Aceh	(ACH)	13	Bali	(BALI)
2	North Sumatera	(NSM)	14	West Nusa Tenggara	(WNT)
3	West Sumatera	(WSM)	15	East Nusa Tenggara	(ENT)
4	Jambi	(JBI)	16	West Kalimantan	(WKL)
5	Bengkulu	(BKL)	17	Central Kalimantan	(CKL)
6	Riau	(RIAU)	18	South Kalimantan	(SKL)
7	Lampung	(LPG)	19	East Kalimantan	(EKL)
8	South Sumatera	(SSM)	20	South Sulawesi	(SSW)
9	West Java	(WJV)	21	Central Sulawesi	(CSW)
10	Central Java	(CJV)	22	North Sulawesi	(NSW)
11	East Java	(EJV)	23	South East Sulawesi	(SESW)
12	DI.Yogyakarta	(YOG)			

To help place the area in the context of Indonesia, then the geographical location will be shown in map 1, the provinces in the red circle are those provinces which will be studied and also Jakarta as the location of wholesale market (as reference market) PIKJ in the yellow circle.

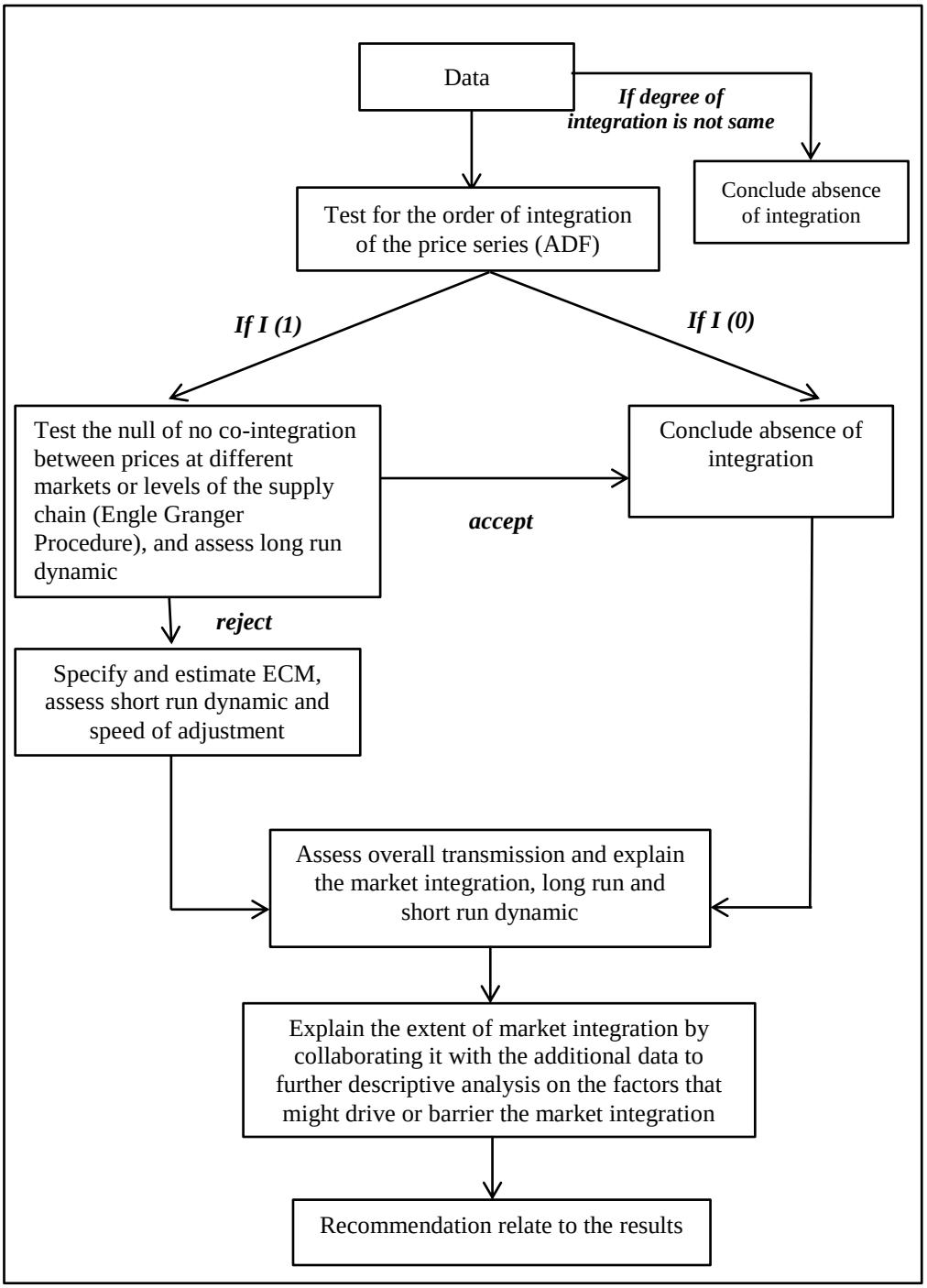
Map 1 Provinces include in the study



4.3 Methodology

In order to assess the price transmission and market integration from one market to other markets in separated markets that are located different provinces in Indonesia, the analysis steps are described in figure 19.

Figure 19 Price transmission and market integration analysis framework



Source: Rapsomanikis et al. (2003)

The first step that will be conducted in this research is **stationarity test**. According to Sjoo (2008), stationarity test or unit root test is crucial in order to avoid spurious regression. Information from unit root test can help to set up a model and produce a meaningful statistical inference (Ibid:2). We use Augmented Dickey Fuller (ADF) and estimates following Gujarati (2009: 757), with the specifications as follow:

$$\Delta P_t^r = \beta_1 + \beta_2 t + \delta PP_{t-1}^r + \sum_{i=1}^{l} \alpha_1 \Delta P_{t-1}^r + \varepsilon_t \quad \ldots\ldots\ldots \text{(4. 1)}$$

$$\Delta P_t^v = \beta_1 + \beta_2 t + \delta PP_{t-1}^v + \sum_{i=1}^{l} \alpha_1 \Delta P_{t-1}^v + \varepsilon_t \quad \ldots\ldots\ldots \text{(4. 2)}$$

$$\Delta P_t^i = \beta_1 + \beta_2 t + \delta PP_{t-1}^i + \sum_{i=1}^{l} \alpha_1 \Delta P_{t-1}^i + \varepsilon_t \quad \ldots\ldots\ldots\ldots \text{(4. 3)}$$

$$\Delta P_t^j = \beta_1 + \beta_2 t + \delta PP_{t-1}^j + \sum_{i=1}^{l} \alpha_1 \Delta P_{t-1}^j + \varepsilon_t \quad \ldots\ldots\ldots\ldots \text{(4. 4)}$$

Where:

P_t^r = Represent red chili prices in central market PIKJ in Jakarta at time t

P_t^v = Represent red chili prices in producer level at time t

P_t^i = Represent red chili prices in producer level in province i at time t

P_t^j = Represent red chili prices in producer level in province j at time t

t is time trend, *l* is optimum lag, Δ is first difference operator, ε is error term, β1 is drift, and β2 is trend.

The null hypothesis is δ equal to zero or the model has a unit root which means that the variable is non-stationary. If the null hypothesis is rejected, then variables are said integrate in order one I(1), it means they are stationary in first differences.

However, specification test and determination of optimum lag will be conducted before the ADF test. Specification test in this paper is followed the steps in appendix 4.[4] According to Kwiatkowski et al. (1992), we need to choose lag length appropriately due to inappropriate lag length will cause correlation in the errors that will bias the test. In this paper, the optimum lags will be defined by using Bayesian Information Criteria (BIC). Since, BIC perform more consistent rather than Akaike Information Criteria (AIC) based on some empirical studies (Zhang 1993; Acquah 2010).

[4] The decision tree is following lecture notes in 3203 course by Newman (2013)

Regarding the main question, to figure out whether the price signal is transmitted between producer level and wholesale market, and between markets across provinces, this paper will apply **cointegration test**. According to Asche et al. (1999: 571), cointegration tests for market integration are tools that show the evidence of statistical linear relationship between different time series. In addition, co-integration analysis implies that prices of homogenous products in varies markets move together overtime in long run relationship, although they might drift apart in the short run (Enders 2010: 358-360). This is consistent with the concept of market integration. The cointegration test will follow these equations:

Model 1, for testing cointegration between wholesale market and producer markets that are located in different province in Indonesia:

$$P_t^v = \beta_1 + \beta_2 P_t^r + u_t \quad \text{..... (4.5)}$$

Model 2, for testing cointegration across 23 producer markets in different province in Indonesia:

$$P_t^i = \beta_1 + \beta_2 P_t^j + u_t \quad \text{..... (4.6)}$$

Where:

P_t^v = Represent red chili producer prices in provincial market at time t

P_t^r = Represent red chili wholesale prices in reference market (PIKJ) at time t

P_t^i = Represent red chili prices in producer level in province i at time t

P_t^j = Represent red chili prices in producer level in province j at time t

u_t = Error term

β_1 = The parameter

β_2 = The co-integrating parameter

Next, stationarity of the residual (ε_t) is checked by unit root test using ADF test. If residual is stationary I(0), then we can say that these two prices are cointegrated.

$$u_t = P_t^v - \beta_1 - \beta_2 P_t^r \quad \text{..... (4.7)}$$

$$u_t = P_t^i - \beta_1 - \beta_2 P_t^j \quad \text{.....(4.8)}$$

Furthermore, the Engle-Granger two steps **Error Correction Model (ECM)** will be employed to assess the long-run and short-run dynamics relationship between two prices in separated markets. Then, the results will help to answer the sub-question in this paper. As starting, first, we will estimates the co-integrating regression, which is exactly the same in equation

(4.3) and (4.4). Secondly, the ECM can be estimated by following these equations:

For model 1:

$$\widehat{\Delta P}_t^l = \alpha_0 + \alpha_1 \Delta P_{t-1}^r + \alpha_2 \hat{u}_{t-1} + \varepsilon_t \quad \text{..... (4.9)}$$

$$\hat{u}_{t-1} = \widehat{\Delta P}_t^l - \alpha_0 - \alpha_1 \Delta P_{t-1}^r - \alpha_2 \quad \text{..... (4.10)}$$

For model 2:

$$\widehat{\Delta P}_t^i = \alpha_0 + \alpha_1 \Delta P_{t-1}^j + \alpha_2 \hat{u}_{t-1} + \varepsilon_t \quad \text{..... (4.11)}$$

$$\hat{u}_{t-1} = \widehat{\Delta P}_t^i - \alpha_0 - \alpha_1 \Delta P_{t-1}^j - \alpha_2 \quad \text{..... (4.12)}$$

Where, α_1 represents the short term effects, and α_2 denotes the speed of error correction. At most, α_2 is the subject interest of ECM because it imply the dynamic of the system, which explain the rate at which the variable adjusts to the equilibrium.

According to Engle and Granger (1987), "ECM model demonstrated that once a number of variables are found to be co integrated, then there existed a corresponding error correction representation which implied that changes in the dependent variables are a function of the level of disequilibrium in the co integrating relationship as well as changes in other variables". (as stated in Acquah and Owusu 2012: 211) . In addition, the analysis dynamic of system in the short-run will describe the speed of price transmission. Hence, it can explains the time that is needed for prices to be transmitted from one location to another, and the result can be used for the policy maker to make a well planning of food distribution and price stabilization (Goletti et al. 1995: 191)

4.4 Analysis of factors generate market integration

Previous empirical evidences indicate some factors may affect market integration overtime in a country such as supply and demand side (productions or productivity, consumption, population size), infrastructure, communication and institutions (Goodwin and Schroeder 1991, Goletti et al. 1995, and Varela et al. 2012).

It is interesting to analyse why some markets are integrated and others not. Therefore, this study will identify some factors that might generate or hinder integration between markets in Indonesia. To asses these information the research applies descriptive analysis, and identify the factors that can answer the question on what are the factors that explain spatial market integration or the lack of integration of red chilli commodity markets in Indonesia. In this case, the research did not conduct econometric technique to

determine the driver of integration because of limitation on data availability. Variables that include in this analysis are only available in annual data and has different period with data prices for market integration analysis. For example, the infrastructure data is annually and only available from 2003 to 2011, while production is available from 2001 to 2011. Therefore, we decide to conduct descriptive analysis despite econometric approach in determining the main drive of red chilli market integration in Indonesia.

The analysis starting with depicting the correlation of integrated market and infrastructure, population, production and institution (supermarket, and other economic facilities) in the market chain into a table. The next step is mapping all those information and describe in the graphic. Therefore, it could present complete information on market integration of vegetable markets in Indonesia.

Chapter 5 Results and analysis

To assess information about spatial market integration of red chilli markets in Indonesia, series of techniques are employed, which are stationary test, cointegration test, and error correction model. This research employs STATA 11.2 as software analysis.

In this section, the results and analysis will be divided into two groups, since this paper examines two types of spatial market integration. First, it will presents result and analysis of market integration between producer markets and PIKJ a wholesale market in Jakarta, in the following of this study is called model 1. Second, it will explains the result of market integration across separated producer markets overtime, in the next discussion is named model 2.

In the rest of the chapter, this paper employs a descriptive analysis to examine factors behind market integration in Indonesia.

5.1 Result of market integration between producer markets and central market (PIKJ): Model 1.

5.1.1 Stationarity

Specification test and determination of lags length are conducted prior to stationarity test. The results of specification test for variables include in model 1 indicates all variables which are central market prices at PIKJ, and all producers prices in 23 provinces are pure random walk, except random walk with drift for WSM, JBI and random walk with trend for RIAU, BALI, SKL and EKL. Lag determination using Bayesian Information Criteria (BIC) indicates lag twelve as the appropriate lag for all series. Details of specification test, and lag length determination for red chilli are provided in Appendix 4.

The next step is identifying the existence of unit root. The stationarity test is tested by utilizing the ADF. The null hypothesis for ADF test is the existence of unit root or non-stationary. The null hypothesis will be rejected if the critical value from ADF test is less than critical value. The results presented in Table 3 indicate that all price series are stationary in first difference or I(1). Interesting to note, PIKJ, BKL and ENT are stationary in 20% level of significance. The graphs describe the prices series in their level and first difference are shown in Appendix 5.

Table 3 ADF Test for all variables in the analysis of market integration model 1

Variable	Specification	Lag	Level	First Difference	Order of Integration
PIKJ	Pure random walk	12	-0.625	-2.276	I(1)
ACH	Pure random walk	12	-1.636	-5.328***	I(1)
NSM	Pure random walk	12	-1.483	-4.191***	I(1)
WSM	Random walk with drift	12	-2.033	-5.184***	I(1)
RIAU	Random walk with trend	12	-2.080	-3.851***	I(1)
JBI	Random walk with drift	12	-0.556	-4.278***	I(1)
SSM	Pure random walk	12	-0.352	-4.171***	I(1)
BKL	Pure random walk	12	-1.424	-2.487	I(1)
LPG	Pure random walk	12	-1.439	-3.964***	I(1)
WJV	Pure random walk	12	-1.797	-5.355***	I(1)
CJV	Pure random walk	12	-0.768	-4.752***	I(1)
YOG	Pure random walk	12	-1.271	-4.532***	I(1)
EJV	Pure random walk	12	-0.475	-4.216***	I(1)
BALI	Random walk with trend	12	-2.970	-4.801***	I(1)
WTN	Pure random walk	12	0.481	-3.099**	I(1)
ENT	Pure random walk	12	1.036	-2.356	I(1)
WKL	Pure random walk	12	0.676	-2.724*	I(1)
CKL	Pure random walk	12	-2.285	-2.859*	I(1)
SKL	Random walk with trend	12	-3.215	-3.765**	I(1)
EKL	Random walk with trend	12	-2.801	-3.824**	I(1)
NSW	Pure random walk	12	-2.487	-3.134**	I(1)
CSW	Pure random walk	12	-0.797	-2.893*	I(1)
SSW	Pure random walk	12	-1.251	-3.295**	I(1)
SESW	Pure random walk	12	-2.404	-2.768*	I(1)

*Note: *** is significant in the 1% level, ** is significant in 5% level and * is significant in 10%*
In the first difference: the t-critical value for pure random walk in 1%, 5% and 10% are -3.552, -2.914 and -2.592
the t-critical value for random walk with trend in 1%, 5% and 10% are -4.106, -3.480 and -3.168
the t-critical value for pure random walk with drift in 1%, 5% and 10% are -2.395, -1.673 and -1.297

5.1.2 Long-run and short-run dynamics

The concept of integration has been widely used to estimate a co-integrated relation or system. This technique will identify the long run equilibrium relationship between two spatially separated markets. Further, the null hypothesis of this method is no co-integration. Failure to reject the null hypothesis means that the two prices drift apart in the long-run. Then, the markets can be said as segmented, rather than integrated. However, the evidence rejects the null of no co-integration means that prices and markets are integrated.

According to market integration framework in the previous chapter, we just apply co-integration test for the series that are integrated in the same order (I(1)). The cointegration test in equation (4.5) and (4.7), and ECM in equation (4.9) and (4.10) are estimated and the results are provided in Table 4.

Table 4 Engle- Granger co-integration and Error Correction Model results for red chilli market integration model 1

Markets		T-stat residual (cointegration)	Long-run coefficient	Error short term coefficient	Speed adjustment
Dependent	Independent		(β)	(α_1)	(α_2)
ACH	PIKJ	-3.121*	0.141**	0.016	-0.204***
			(2.60)	(0.22)	(-3.07)
NSM	PIKJ	-2.810	-0.045	0.092	-0.181***
			(-0.84)	(1.31)	(-2.99)
WSM	PIKJ	-3.031	0.018	0.126	-0.231***
			(0.33)	(1.49)	(-3.28)
RIAU	PIKJ	-3.895**	0.101*	0.103	0.005
			(1.80)	(0.95)	(0.06)
JBI	PIKJ	-2.865	0.449***	0.208**	-0.153**
			(6.29)	(2.03)	(-2.26)
SSM	PIKJ	-2.679	0.212*	0.064	-0.172**
			(1.94)	(1.11)	(-2.55)
BKL	PIKJ	-2.422	0.152***	0.203	-0.156**
			(5.34)	(1.95)	(-2.45)
LPG	PIKJ	-2.376	0.075	0.103*	-0.164**
			(1.85)	(1.83)	(-2.49)
WJV	PIKJ	-3.142*	0.058**	0.050	-0.218***
			(2.01)	(1.22)	(-3.29)
CJV	PIKJ	-3.075	0.122***	0.055	-0.210***
			(4.06)	(1.20)	(-2.91)
YOG	PIKJ	-3.118*	0.116***	0.078	-0.212***
			(3.17)	(1.40)	(-2.96)
EJV	PIKJ	-4.106***	0.232***	0.034	-0.333***
			(7.31)	(0.60)	(-3.99)
BALI	PIKJ	-3.545**	0.100***	0.042	-0.293***
			(3.58)	(0.91)	(-3.79)
WNT	PIKJ	-2.557	0.234***	0.018	-0.156**
			(6.21)	(0.34)	(-2.42)
ENT	PIKJ	-1.680	0.576***	-0.011	-0.003
			(7.22)	(-0.38)	(-0.21)
WKL	PIKJ	-1.862	0.263***	0.033	-0.077
			(4.98)	(0.69)	(-1.79)
CKL	PIKJ	-2.576	0.367***	-0.091	-0.165**
			(6.14)	(-1.14)	(-2.58)
SKL	PIKJ	-3.452**	0.210***	-0.038	-0.232***
			(4.66)	(-0.55)	(-3.24)
EKL	PIKJ	-3.654**	0.123***	-0.059	-0.294***
			(2.76)	(-0.83)	(-3.93)
NSW	PIKJ	-2.082	-0.057	0.079	-0.094*
			(-0.75)	(0.99)	(-1.95)
CSW	PIKJ	-1.781	0.278***	-0.022	-0.057*
			(4.43)	(-0.52)	(-1.82)
SSW	PIKJ	-2.073	0.085***	-0.001	-0.063
			(4.56)	(-0.09)	(-1.44)
SESW	PIKJ	-2.803	0.088**	0.022	-0.147**
			(2.65)	(0.56)	(-2.57)

*Note: ***is significant in 1% level, ** is significant in 5% level, and * is significant in 10% level.*
t-statistic is in parentheses, for cointegration t-statistic is the t-stat of residual

Table 4, column 2 shows the t-statistic of residual obtained for the red chilli markets, column 3 shows the long run coefficient and column 4 to 5 describe the short-run dynamics (error correction term coefficient and speed adjustment). Take for example the cell in the second column and twelve row: the t-statistic of residual obtained when testing co-integration between the red chilli price series of EJV and PIKJ is -4.106. This is lower than the critical value -4.008 (1% significance level)[5] and thus strongly recommends a high degree of co-integration, which in turn implies the two markets are spatially integrated. Looking at the second column, second row, the evidence suggests that NSM and PIKJ are not spatially integrated, as the value of t-statistic (-2.810) is lower than the critical value. The lower the t-statistic of residual, the higher is the significance level of co-integration. The critical values for two variables case and 84 observations in 1%, 5% and 10% significance level are -4.008, -3.398, and -3.087, this is using critical values in 100 observations (MacKinnon 1991 as stated in Enders 2010).

Among 23 cointegration tests (all pairs of provincial prices and central market prices) are performed, of which 8 suggest spatial integration (34.78% of cases), and 15 show provincial markets and PIKJ are segmented (65.22% of cases). On the other words, the red chilli producers' price in 15 production provinces detected do not integrate in the long-run with red chilli's price at PIKJ. It means that the price changes in PIKJ are not well transmitted to the producer level that are located in different provinces. Similar results also reported by Firdaus and Gunawan (2012: 101-102), who found PIKJ are not cointegrate with vegetable producer markets in four different provinces in Indonesia. PIKJ has not yet become the price barometer for red chilli and due to its volatility, red chilli price contribute to Indonesian general price volatility (Ibid: 105).

Further, table 4 column 3 shows the long run coefficient are ranging from -0.057 to 0.576. For instance, take the cell in first row, third column, the long run coefficient is 0.141. It means increase 1 rupiah per 100 kilograms in PIKJ will increase 0.141 rupiah per 100 kilograms in ACH's market. Meanwhile, an increase 1 rupiah per 100 kilograms in PIKJ will increase only 0.058 rupiah per 100 kilograms in WJV's market (ninth row, third column).

Based on equation (4.9) and (4.10), statistically the error correction terms (speed adjustment) are significant, except for RIAU, ENT, WKL, and SSW. In addition, those error correction terms has negative value as expected. It means if the provincial prices is above its equilibrium value, then it will start falling in the next period to correct the equilibrium error and vice versa. The highest

[5] The critical values are provided by table C (critical values for the Engle-Granger cointegration test) in Enders (2010: 490), see appendix

price adjustment coefficient is shown in the model with EJV and PIKJ (33%), while the lowest is indicated in the link of CSW and PIKJ (5%). In the market integration model 1, market pairs tend to have short-run relationship despite long-run relationship.

Take for example, the cell in twelve row, fifth column, indicates that EJV price will adjusts to PIKJ's price with a lag, about 33.3% within a month. Meanwhile, the short-term price elasticity that shows in column 4 is about 0.034, but not significant. On the other hand, if we look at twentieth row, fifth column, the results suggest that NSW's price adjusts to PIKJ's price with a lag, about 0.9% within a month. However, the short-run price elasticity for NSW's is also not significant, which is 0.079.

We can conclude from table 4, the provinces (ACH, RIAU, WJV, YOG, EJV, BALI, SKL, EKL) that are integrated with PIKJ (long-term relationship exists) also have short-run relationship, except with RIAU. This is show by the significant and expected sign of error correction term. Even, the short term effect are not significant in this relationship, we can said the short run dynamic occurs through the existence of significant speed adjustment. The findings in short-run dynamics are in line with what has been found in the previous findings for vegetable commodities (cabbages, onion and potatoes) in Myanmar that shown the error correction term (speed adjustment) were ranged from -0.007 and -0.309 (7% and 30%) (Myae et al. 2005: 981).

5.2 Result of market integration across 23 producer markets: Model 2.

5.2.1 Stationarity

One of the essential stages in the co-integration analysis is testing for the stationary of all variables in the model. Earlier we have to check the specification test that would help in determining whether the trend is stochastic or deterministic. Then, continue to determine the appropriate lag length for further ADF test. The specification test and lag length determination for variables included in model 2 shows that all variables are pure random walk, except random walk with drift for WJV, EJV, CJV, LPG, WTN, BALI, and random walk with trend for EKL, YOG, and SKL. BIC indicates that lag twelve as the proper lag for all price markets series. Details of specification test, and lag length determination for model 2 are provided in Appendix 6.

The ADF test has been used to check the order of integration in this paper. The results presented in Table 5, indicate that all price series are stationary in first difference or I(1). The graph of all prices series in model 2 are obtained in appendix 7.

Table 5 ADF test for all variables in the analysis of red chilli market integration model 2

Variable	Specification	Lag	Level	First Difference	Order of Integration
WJV	Random walk with drift	12	-1.066	-6.035***	I(1)
NSM	Pure random walk	12	-1.948	-5.817***	I(1)
EJV	Random walk with drift	12	-2.134	-4.845***	I(1)
CJV	Random walk with drift	12	-1.846	-4.694***	I(1)
SSW	Pure random walk	12	-0.453	-4.584***	I(1)
LPG	Random walk with drift	12	-2.078	-4.332***	I(1)
EKL	Random walk with trend	12	-3.051	-4.657***	I(1)
BKL	Pure random walk	12	-1.063	-4.696***	I(1)
ACH	Pure random walk	12	-1.342	-6.859***	I(1)
SSM	Pure random walk	12	-0.410	-6.073***	I(1)
WKL	Pure random walk	12	1.221	-4.097***	I(1)
WTN	Random walk with drift	12	0.861	-4.375***	I(1)
WSM	Pure random walk	12	-1.202	-6.865***	I(1)
JBI	Pure random walk	12	0.073	-5.710***	I(1)
YOG	Random walk with trend	12	-2.758	-5.782***	I(1)
BALI	Random walk with drift	12	-1.485	-5.281***	I(1)
RIAU	Pure random walk	12	-1.400	-4.951***	I(1)
SKL	Random walk with trend	12	-2.488	-3.906**	I(1)
CKL	Pure random walk	12	-1.692	-3.880***	I(1)
NSW	Pure random walk	12	-2.569	-4.149***	I(1)
CSW	Pure random walk	12	0.339	-3.837***	I(1)
ENT	Pure random walk	12	-0.680	-4.389***	I(1)
SESW	Pure random walk	12	-1.089	-3.773***	I(1)

*Note: *** is significant in the 1% level critical values, ** is significant in 5% critical values*
In the first difference: the t-critical value for pure random walk in 1%, 5% are -3.500 and -2.888
the t-critical value for random walk with trend in 1%, 5% are -4.030 and -3.446
the t-critical value for pure random walk with drift in 1%, 5% are -2.359 and -1.658

5.2.2 Long-run and short-run dynamics

Since the aims of the research are to be able to measure the integration in red chilli commodity markets and to exploit the long-run and short-run dynamic of the relationship, then an analysis technique associated with a pair of provincial prices needs to be introduced. For that, this paper conduct the concept of co-integration, which introduced by Engle and Granger (1987).

Cointegration analysis in this model is conducted for 506 pairs, about 164 (32.42%) are segmented and 342 (67.58%) pairs are cointegrated, with the values of long run coefficient distributed between -0.708 (Bengkulu and Central Sulawesi) and 3.482 (Jambi and South Sulawesi). Therefore, there is evidence of price transmission across producer markets that are located in different provinces in Indonesia. The price is transmitted from one market to other markets, even between provincial market in the west part of Indonesia and another market in the east part of Indonesia, which has a long-distance.

The results from equations (4.6) and (4.8) to test cointegration for 506 market pairs are described in Appendix 8a to 8b. The table in appendix show the t-statictic of the residual that present the fact whether there is cointegration or no cointegration between the two markets. In addition, the long run coefficient for market pairs are presented in Appendix 9 a to 9d..

Another way to interpret the result of cointegration test in appendix 8a and 8b is by changing the information of significance with 1 if the t-statistic of residual is significant (cointegration exist), and 0 if the t-statistis is not significant (no cointegration).

Table 6 Cointegration results of model 2

	WJV	NSM	EJV	CJV	SSW	LPG	EKL	BKL	ACH	SSM	WKL	WTN
WJV	__	1	0	0	1	0	1	1	1	1	1	1
NSW	1	__	0	0	1	0	1	1	1	1	1	0
EJV	1	1	__	1	1	1	1	1	1	1	1	1
CJV	1	1	1	__	1	1	1	1	1	1	1	1
SSW	1	0	0	0	__	0	1	1	1	1	1	1
LPG	0	0	1	1	0	__	1	0	0	1	1	0
EKL	1	1	0	0	1	0	__	1	1	1	1	1
BKL	1	1	0	0	1	0	1	__	1	1	1	0
ACH	1	1	1	0	1	0	1	1	__	1	1	1
SSM	0	0	0	0	1	0	1	1	0	__	1	0
WKL	0	0	0	0	1	0	1	0	0	1	__	1
WTN	1	1	1	1	1	0	1	1	1	1	1	__
WSM	1	1	0	0	1	0	1	1	1	1	1	1
JBI	1	0	0	0	1	0	0	1	1	1	1	1
YOG	1	0	1	1	1	1	1	1	1	0	1	1
BALI	1	1	1	1	1	1	1	1	1	1	1	1
RIAU	1	1	0	0	1	0	1	1	1	1	1	1
SKL	1	0	0	0	1	0	1	1	1	1	1	1
CKL	0	0	0	0	0	0	1	0	0	0	0	0
NSW	0	1	0	0	0	1	0	1	1	1	1	0
CSW	0	0	0	0	1	0	0	0	0	1	1	1
ENT	1	0	1	0	1	0	1	1	1	1	1	1
SESW	1	0	0	0	0	0	1	1	1	1	0	0

Note: 1 denotes cointegration

0 denotes no cointegration

Table 6 Cointegration results of model 2 (continued..)

	WSM	JBI	YOG	BALI	RIAU	SKL	CKL	NSW	CSW	ENT	SESW
WJV	1	1	1	1	1	1	1	0	1	1	1
NSM	1	0	1	0	1	1	0	0	1	0	1
EJV	1	1	1	1	1	1	1	1	1	1	1
CJV	1	1	1	1	1	1	1	1	1	1	1
SSW	0	1	1	0	0	1	0	0	1	1	0
LPG	0	0	0	1	0	1	1	1	1	1	1
EKL	1	1	1	0	1	1	1	0	1	1	1
BKL	1	1	1	0	1	1	0	0	1	0	1
ACH	1	1	1	1	0	1	1	0	1	0	1
SSM	0	1	1	0	1	1	0	0	1	1	0
WKL	0	1	0	0	0	1	0	0	1	1	0
WTN	1	1	1	1	1	1	1	1	1	1	1
WSM	__	1	1	1	1	1	1	0	1	1	1
JBI	0	__	1	0	0	1	0	0	1	1	1
YOG	1	1	__	1	1	1	1	1	1	1	1
BALI	1	1	1	__	1	1	1	1	1	1	1
RIAU	1	1	1	0	__	1	1	1	1	1	1
SKL	1	0	1	0	1	__	0	0	1	1	1
CKL	0	0	0	0	1	1	__	0	0	0	1
NSW	1	0	0	0	1	1	1	__	0	0	1
CSW	0	1	1	0	0	1	0	0	__	1	0
ENT	1	1	1	1	1	1	1	0	1	__	1
SESW	1	0	1	0	1	1	1	0	0	0	__

Note: 1 denotes cointegration

0 denotes no cointegration

Regarding the result on table 6, then we can interpret those information as following.

Table 7 Information of cointegration relationship

Province	Relationship within regions
ACH	Cointegrate with Sumatera (except LPG and RIAU), Java (except CJV), Kalimantan, Sulawesi (except NSW), BALI and WNT, except ENT
NSM	Cointegrate with Sumatera (except LPG and JBI), Java (except CJV and EJV), Kalimantan (except CKL), Sulawesi (except NSW) except WNT, ENT and BALI
WSM	Cointegrate with Sumatera (except LPG), Java (except CJV and EJV), Kalimantan, Sulawesi (except NSW), BALI, WNT and ENT
RIAU	Cointegrate with Sumatera (except LPG) Java (except CJV and EJV), Kalimantan, Sulawesi, WNT and ENT except BALI
JBI	Cointegrate with Sumatera (except NSM, LPG, WSM and RIAU), Java (except CJV and EJV), Kalimantan (except EKL and CKL), Sulawesi (except NSW), WNT and ENT, except BALI.
SSM	Cointegrate with Sumatera (except NSM, LPG, ACH, WSM), Java (except WJV, CJV and EJV), Kalimantan (except with CKL), Sulawesi (except NSW and SESW), and ENT, except BALI and WNT.
BKL	Cointegrate with Sumatera (except Lampung), Java (except Central Java and East Java), Sulawesi (except North Sulawesi), Kalimantan (except Central Kalimantan), except Bali, West Nusa Tenggara and East Nusa Tenggara.

Province	Relationship within regions
LPG	Cointegrate with Java (except WJV and YOG), Sulawesi (except SWS), Kalimantan, BALI and ENT, except Sumatera and WNT
WJV	Cointegrate with Sumatera Islands (except LPG), Java (except CJVand EJV), Kalimantan, Sulawesi (except NSW), BALI, WNT and ENT
CJV	Cointegrate with all regions
EJV	Cointegrate with all regions
YOG	Cointegrate with Sumatera (except North Sumatera and South Sumatera), Java, Kalimantan, Sulawesi, Bali, West Nusa Tenggara and East Nusa Tenggara.
BALI	Cointegrate with all regions
WNT	Cointegrate with Sumatera (except LPG), Java, Kalimantan, Sulawesi, BALI and ENT
ENT	Cointegrate with Sumatera (except NSM, LPG), Java (except CJV), Kalimantan, Sulawesi (except NSW), BALI, and WNT
WKL	Not cointegrate with Java, Sumatera (except JBI), Kalimantan (except EKL and SKL), Sulawesi (except SSW and CSW), BALI, except WNT and ENT.
SKL	Cointegrate with Sumatera (except NSM, LPG, and JBI), Java (except CJV and EJV), Kalimantan (except CKL), Sulawesi (except NSW), WNT and ENT, except BALI.
EKL	Cointegrate with Sumatera (except LPG), Java (except CJV and EJV), Kalimantan, Sulawesi (except NSW), WNT and ENT, except BALI.
NSW	Cointegrate with Sumatera (except JBI), Kalimantan (except EKL), Sulawesi (except SSW and CSW), except Java, BALI, WNT and ENT.
CSW	Not cointegrate with Java (except YOG), Sumatera (except SSM and RIAU), Sulawesi (except SSW), BALI, except WNT and ENT.
SSW	Cointegrate with Sumatera (except NSM, LPG, WSM and RIAU), Java (except CJV and EJV), Kalimantan (except CKL), Sulawesi (except NSW and SESW),
SESW	Cointegrate with Sumatera (except NSM, LPG, and JBI), Java (except CJV and EJV), Kalimantan (except WKL), except Sulawesi, BALI, WNT and ENT.

Table 7 supports the fact that geographically separated markets are linked spatially in the long-run, which implies regional linkages among producer markets in Indonesia. These findings in line with previous argument that describe prices in markets that are placed in the same island tend to move together in the long-run. Moreover, former study found the same phenomena that 'markets within the same islands are more likely to be integrated' (Munir et al. 1997). However, cointegration results appear distorted by the small sample bias, because some results from market pairs are different, when we swap the dependent and independent variable in the model. Alexander and Wyeth (1995: 18) found the same problem when researched rice market integration in Indonesia. Thus, they conduct the regression twice in order to see if the same level of significance is resulted in either direction.

Regarding the short-term coefficient, 506 equations are calculated and 77 market pairs (15.22%) present the price in one market has short-term effect on other prices in producer markets that are placed in different provinces in Indonesia. The short-term price elasticities have a minimum of -0.529 (CKL and SSM) and a maximum of 0.774 (CKL and WJV). Both market pairs above have no long run relationship (markets are segmented in the long-run), yet those markets react immediately in the short-run.

Take for instance, the cell in the table in appendix 10a fourth column, sixth row, indicates CJV' price has short-run positive effect (0.460) to LPG's price. Meanwhile, looking at first row, second column, the NSM's price has no short-run effect to WJV's price. However, as mentioned in the previous that the cointegration (long-run relationship) exists between NSM and WJV. This result explains that even stable long-run relationship occurs between the two markets, the prices in these different provinces do not respond immediately in the short-run.

Table in Appendix 11a to 11d show the error correction term or speed adjustment from 506 market pairs. The results show 404 market pairs (79.84%) have significant coefficients and correctly sign, with the slowest of -0.036 (CSW and YOG) and the fastest of -0.738 (EJV and CJV). The results suggest that around 3.6% and 73.8% of the deviation in YOG's price and CJV's price are eliminated by changes in the CSW's price and EJV's price per month. Another example, the cell in table of appendix 11a, first column, ninth row (ACH and WJV) the error correction mechanism is negative and significant, the result indicates that deviations from equilibrium are corrected at about 15.2% per month. However, based on table of appendix 11a, first column, ninth row, WJV's price does not seem to have significant short-term effects on ACH's price.

The results of short-run dynamic, especially the error correction term (speed adjustment) that are presented in Appendix 11 are summarized in Table 8 below. We have 23 x 23 matrix of speed adjustment coefficient. Following Wimanda (2006), in order to have understanding about which province has high speed adjustment with others, and which province has moderate and low speed adjustment with others, we make arrangement into three groups. Those group are high, moderate, and low speed adjustment, where high speed adjustment is less than -0.200 (in red color), moderate is -0.100 to - 0.200 (in green color) and low is greater than -0.100 (in yellow color), with the requirement that the coefficient must be significant.

From Table 8, we can summarize that EJV, YOG and BALI are the provinces, which have high speed adjustment. Meanwhile, fourteen provinces have moderate speed adjustment (WJV, CJV, NSM, LPG, BKL, ACH, WSM,

JBI, RIAU, WNT, ENT, EKL, SKL, and NSW). In addition, six provinces have low speed adjustment, which are SSM, SKL, WKL, CSW, SSW, SESW.

Table 7 Short run dynamic (speed adjustment) by regions and by classifications

Province	Speed adjustment by region and by classification
ACH	Moderate with Java (except CJV), Sumatera (except LPG, JBI), except WTN and insignificant with YOG, EJV and EKL
NSM	Moderate with Sumatera (except LPG), Java (except CJV) Sulawesi (except SESW) , Kalimantan , ENT, except low with Bali and WTN insignificant with Java (EJV, YOG) and Sumatera (ACH , WSM, RIAU)
WSM	Moderate with Sumatera (except LPG, BKL), Kalimantan, Sulawesi, ENT, except low with Bali, WNT, except insignificant with WJV, EJV and YOG
RIAU	Moderate with Java, Sumatera (except SSM, WSM, JBI), Kalimantan, Sulawesi (except NSW), ENT, except low with Bali, except insignificant with WNT
JBI	Moderate with SSW, CSW, WKL, SKL, ENT except low with EKL, CKL and SESW, and insignificant with the rest of regions
SSM	Low with CSW, ENT and EKL, except moderate with JBI, SSW and WKL, and insignificant with Java, Sumatera (except JBI), Sulawesi (except SSW, CSW), Kalimantan (except EKL, WKL),
BKL	Moderate with Sumatera (except WSM, LPG), Kalimantan (except CKL), Sulawesi (except NSW), ENT, except insignificant with Java (WJV, YOG, CJV), BALI, RIAU, WTN
LPG	Moderate with all regions except high only with CJV, except insignificant with EJV
WJV	Moderate with Sumatera (NSM, SSM, LPG), Java (CJV), Kalimantan (EKL, CKL, WKL), Sulawesi (NSW, SSW, SESW, CSW), Bali, WTN, ENT, except high with Sumatera (BKL, ACH, WSM, JBI, RIAU), Kalimantan (SKL), except insignificant with Java (EJV)
CJV	Moderate with all regions, except high with Bali, except insignificant with EJV
EJV	All regions
YOG	High with Java, Sumatera, Sulawesi, except moderate with Bali, WNT, ENT, LPG, NSW, except low only with EJV.
BALI	High with Java, Sumatera (except SSM, RIAU), SKL, Sulawesi (except NSW), Bali, ENT, WNT, except insignificant with EJV
WNT	Moderate with Java (except YOG), Sumatera (except ACH, JBI,), Sulawesi (except (SSW, CSW), Kalimantan (except SKL), ENT, Bali except insignificant with WKL
ENT	Moderate with Java, Sumatera (except JBI), Kalimantan (except WKL, SKL), Sulawesi (except (CSW, SSW), except insignificant with NSM
WKL	Low with EKL, JBI, CKL, CSW, ENT, except high only with SSM, except moderate only with SKL and insignificant with the rest of provinces.
SKL	Low with Java, Sumatera (except BKL, ACH, JBI RIAU, SSM), Kalimantan (except EKL, WKL, CKL), Sulawesi (except CSW, SSW), WNT, BALI, except insignificant with NSW and SESW

Province	Speed adjustment by region and by classification
CKL	Low with Java, Sumatera, Kalimantan, Sulawesi, Bali, ENT, except moderate only with Riau, and insignificant with WNT and NSW
EKL	Moderate with Java (except EJV, CJV, YOG) Sumatera (except LPG), Sulawesi (except NSW), Kalimantan (except WKL), ENT, except low with Bali, WTN.
NSW	Moderate with all provinces
CSW	Low with WJV, YOG, RIAU, SSM, JBI, SSM, WKL, SKL, SSW, SESW, except insignificant with the rest of regions
SSW	Low with Sumatera (except JBI), YOG, Sulawesi (except EKL, SKL), except ENT, and high only with WKL, CSW Not significant with Java (CJV, EJV, WJV), Sumatera (ACH, LPG) and Bali
SESW	Low with Java (except WJV), Sumatera (except ACH, SSM, JBI, RIAU), Kalimantan (except CKL), Sulawesi, except insignificant with SKL and CSW

Note : *is high speed adjustment*
is moderate speed adjustment
is low speed adjustment

In order to have information on the pattern of short-run and long-run relationship between 23 provinces, then we try to summarize the information of cointegration in appendix 8a and 8b with the information of short-run dynamic in appendix 11a to 11d. From these information, then we can classify whether the market pair have only long-run relationship, only short-run relationship, neither long-run nor short-run relationship or they have both long-run and short-run relationship. Summarize of those information are obtained in Table 10.

Table 8 Information of short-run and long-run relationship across 23 producer markets in different provinces in Indonesia.

Province	Relationship			
	Only Long-run (LR)	Only Short-run (SR)	No LR and No SR	LR and SR
ACH	EJV, YOG, EKL,	CJV, LPG, RIAU, NSW, ENT	_	WJV, NSM, BKL, SSM, WSM, JBI, BALI, WNT, WKL,SKL, CKL, SSW, CSW, SESW
NSM	WJV	CJV, LPG, JBI, BALI, CKL, NSW, ENT, WNT,	EJV	BKL, SSM, WKL, SKL, EKL, CSW, SSW, SESW
WSM	WJV, YOG,	CJV, LPG, NSW	EJV	NSM, BKL, ACH, SSM, WKL, JBI, RIAU, SKL, CKL, EKL, SSW, CSW, SESW, BALI, ENT WNT

Province	Relationship			
	Only Long-run (LR)	**Only Short-run (SR)**	**No LR and No SR**	**LR and SR**
RIAU	WNT	EJV, CJV, LPG, BALI,	_	WJV, YOG, NSM, BKL, ACH, SSM, WSM, JBI, WKL, SKL, EKL, CKL, SSW, NSW, CSW, ENT, SESW
JBI	WJV, BKL, ACH, SSM, WNT,	EKL, CKL	NSM, EJV, CJV, LPG, WSM, BALI, RIAU, NSW	WKL, SKL, SSW, CSW, SESW, ENT
SSM	YOG, BKL, RIAU, SKL,	_	WJV, EJV, CJV, NSM, LPG, ACH, WSM, WNT, BALI, CKL, NSW, SESW	JBI, SSW, EKL, WKL, CSW, ENT
BKL	WJV, YOG, RIAU	LPG, CKL, NSW, ENT	EJV, CJV, WNT, BALI	NSM, ACH, SSM, WSM, JBI, EKL, WKL, SKL, SSW, CSW, SESW
LPG	EJV	WJV, NSM, SSW, BKL, ACH, WNT, WSM, JBI, YOG, RIAU	_	CJV, EKL, SSM, BALI, WKL, SKL, CKL, NSW, CSW, SESW, ENT,
WJV	-	NSW, LPG, CJV	EJV	NSM, RIAU, BKL, ACH, SSM, WSM, JBI, SKL, WKL, EKL, CKL, CSW, BALI, ENT, WNT, SSW SESW
CJV	EJV	_	_	All regions
EJV	_	_	_	All provinces
YOG		NSM, SSM		WJV, CJV, EJV, LPG, BKL, ACH, EKL, WKL, JBI, RIAU, SKL, CKL, SSW, NSW, CSW, SESW, BALI, ENT, WNT,
BALI	EJV	_	_	All provinces
WNT	WKL	LPG	_	WJV, EJV, CJV, YOG, NSM, BKL, ACH, SSM, WSM, JBI, BALI, RIAU, SKL, CKL, EKL, SSW, NSW, CSW, SESW, ENT

Province	Relationship			
	Only Long-run (LR)	**Only Short-run (SR)**	**No LR and No SR**	**LR and SR**
ENT	_	CJV, LPG, NSW	NSM	WJV, EJV, SSW, EKL, BKL, ACH, SSM, WKL, WNT, WSM, JBI, YOG, BALI, RIAU, SKL, CKL, CSW, SESW
WKL	SSW, WNT,	CKL	WJV, EJV, CJV, NSM, LPG, BKL, ACH, WSM, YOG, BALI, RIAU, NSW, SESW	EKL, SSM, JBI, SKL, CSW, ENT
SKL	SESW	NSM, EJV, CJV, LPG, JBI, BALI, CKL,	NSW	WJV, YOG, WSM, RIAU, BKL, SSM, ACH, EKL, WKL, WNT, SSW, CSW, ENT
CKL		WJV, NSM, EJV, CJV, SSW, LPG, BKL, ACH, SSM, WKL, WSM, JBI, YOG, BALI, CSW,	WNT, NSW, ENT	RIAU, EKL, SKL, SESW
EKL	_	EJV, CJV, LPG, BALI, NSW	_	WJV, YOG, NSM, BKL, ACH, SSM, WSM, JBI, RIAU, SKL, WKL, CKL, SSW, CSW, SESW, ENT, WNT,
NSW	_	WJV, EJV, CJV, SSW, EKL, WNT, JBI, YOG, BALI, CSW, ENT	_	NSM, LPG, BKL, ACH, SSM, WKL, WSM, RIAU, SKL, CKL, SESW
CSW	WNT, ENT	WJV, RIAU, SESW	NSM, EJV, CJV, LPG, EKL, BKL, ACH, WSM, BALI, CKL, NSW	SSW, SSM, WKL, JBI, YOG, SKL

Province	Relationship			
	Only Long-run (LR)	Only Short-run (SR)	No LR and No SR	LR and SR
SSW	WJV, ACH,	WSM, RIAU, CKL, NSW, SESW	EJV, CJV, NSM, LPG, BALI,	YOG, BKL, JBI, ACH, SSM, WKL, EKL, SKL, WNT, CSW, ENT
SESW	SKL,	NSM, EJV, CJV, SSW, LPG, WKL, WNT, JBI, BALI, NSW, ENT	CSW	WJV, EKL, BKL, ACH, SSM, WSM, YOG, RIAU, CKL

It is worthy to note that when the market has cointegration or long-run relationship (LR) with other markets in different placed, and the short-run relationship (SR) also exist between them. For example, EJV which has cointegrated with all provinces, also have short-run relationship with all provinces too. Meanwhile, take for example CJV and BALI which also cointegrated with all provinces, they have short-run relationship with almost all provinces except with EJV. Other notable information is these provinces have high speed adjustment compare to other provinces.

Provinces which are located in Java and Sumatera island tend to have both LR and SR with other provincial markets in Java, Sumatera, Kalimantan, Sulawesi, Bali and Nusa Tenggara Island. With exception for SSM and JBI, which have all kinds of relationship, yet tend to have neither LR nor SR with other markets. On the other hand, provincial markets in the eastern part of Indonesia such as in CKL and SESW, they tend to have only short run relationship with other provincial markets in different islands. The reason behind this is due to the long distance between those markets, and the quality of road that may increase the cost of transportation affect the profitability of trade, and hinder long run relationship.

5.3 Analysis results of factors that explain spatial market integration or the lack of integration

In the previous section, the cointegration test has been calculated between provincial market pairs for two models, which are the market integration analysis between red chilli producers market and reference market PIKJ in Jakarta. Next, the analyses of market integration across producers red chilli markets that are located in different provinces in Indonesia.

Further, after knowing the long-run and short-run relationship between market pairs, then this paper will continue to investigate the influence of geographical distance, the quality of infrastructure, the number of population, the number of red chilli production and the numbers of markets on the cointegration relationship. This effort aims to increase knowledge surrounding the factors behind spatial market integration or market segmented, and to recognize its role in the red chilli markets in Indonesia.

5.3.1 Discussion of factors that may explain market integration or lack of integration at model 1

Table 11 present the information of cointegration result and combine with average data on the variables mentioned previous that will be investigated as the factors that might explain why markets are integrated and lack of integration in Indonesia.

As describe in table 11, at model 1, we can see from 23 market pairs only six provinces are integrated with PIKJ. Then, these findings support the previous evidence by Firdaus and Gunawan (2012: 102), who reported that cointegration did not exist between local markets in four different provinces and PIKJ. Therefore, they suggest, "red chilli markets should receive more attention as both approaches show that market efficiency has not yet been reached.. … red chilli price was categorized as one of the major contributor to Indonesian general price volatility" (Ibid: 105)

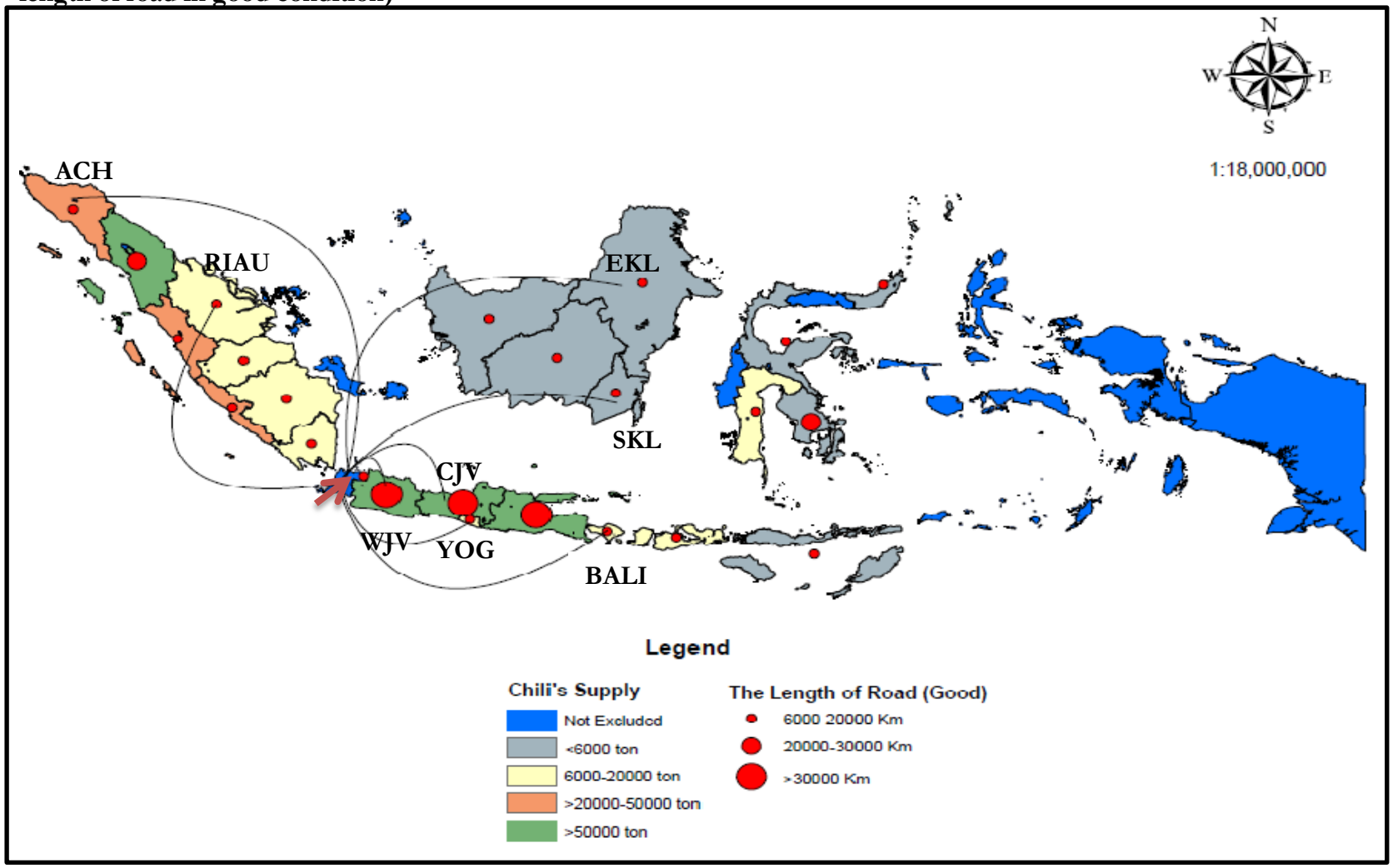
In explaining the reason behind market integration or the lack of integration, we can see the relationship between all variable in table 11. The table shows that almost all provinces in Java Island are integrated with PIKJ, expect for CJV. In this case, distance has an important role in explaining integration between these markets. The distance between province in Java Island and Jakarta can be reached by land transportation. Moreover, those provinces have good condition of infrastructure. It can be seen through the length of asphalted road, and the good condition of road compare to road in bad condition. We can see from map 4, it shows that provinces which have longer length of damaged road than others tend to be segmented. Therefore, it can be conclude that the length of the distance, the quality of infrastructure will affect the cost of transportation. Then, close distance, good quality of infrastructure will create better trading possibilities, including a closer connection with central market and international markets for further export the product to other countries. Due to PIKJ as the central market has function also as the collection market to and from international markets.

For other variables such as population and supply of red chilli's production, the pattern of relationship between these factors with long run cointegration is not clear. Therefore, it is hardly to explain the relationship based on the data. However, in my opinion the local market in the province, which has fewer inhabitants with surplus production or province that has deficit production with more inhabitants, these markets tend to integrate with PIKJ. The possible reason behind this is they seek an opportunity in gaining trade to fulfil the local demand in their place or transfer their surplus of production through competitive advantage with other markets. Map 2 to 5 are presented in order to describe the relationship between factors that may explain the existence of market integration or the lack of market integration between producer markets that are located in 23 provinces in Indonesia with PIKJ.

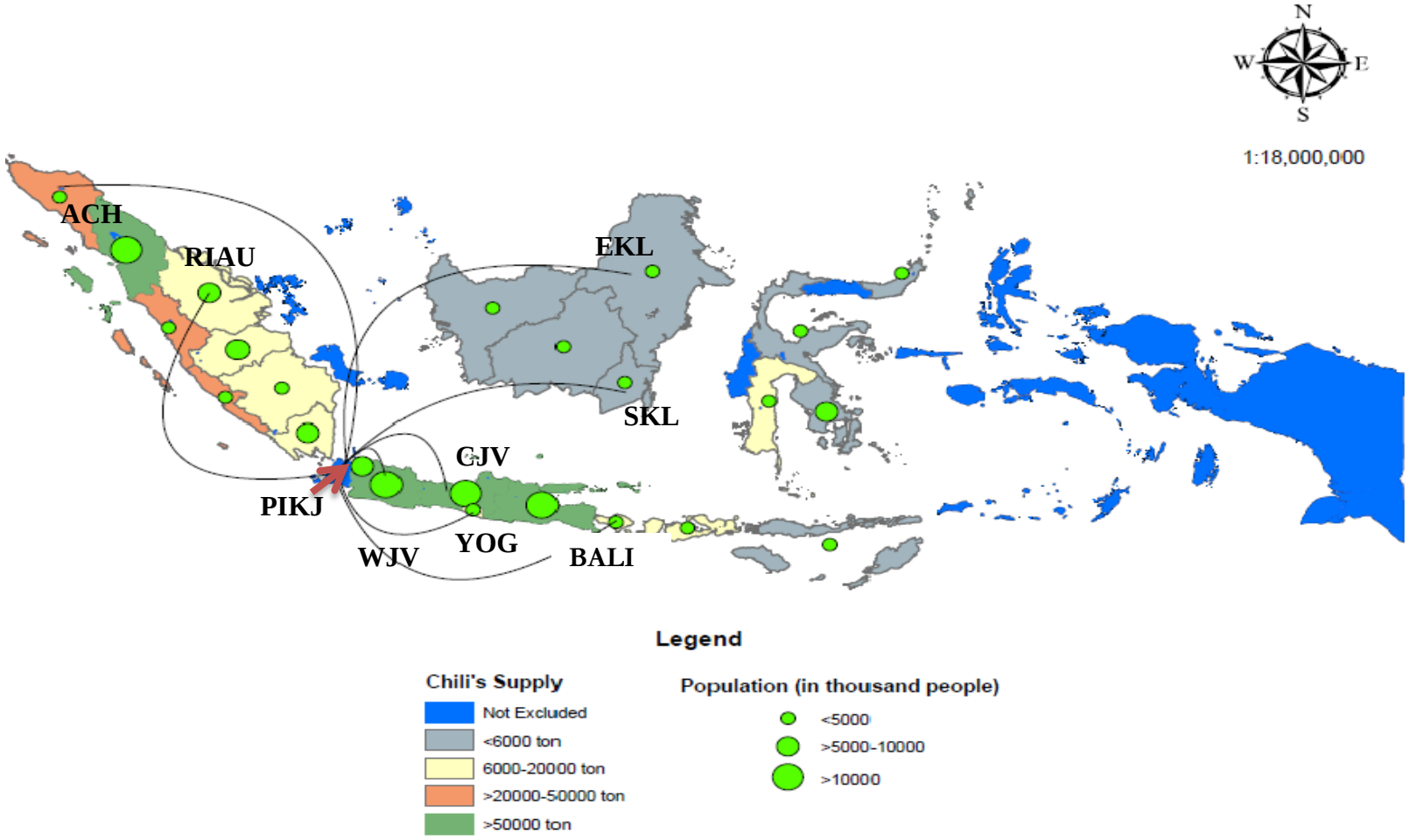
Table 9 Information of factors that influence red chilli market integration model 1

Province	Cointegra-tion (Yes/No)	Population (000 people)	Supply of red chilli Production (ton)	Distance (km)	Transpor-tation	The length of asphalted road		Quality of road condition				Economic facilities	
						(km)	(% of total)	Good (km)	% of total	Damaged (km)	% of total	Super-market	Traditional market
ACH	Yes	4,330	28,303.68	2,572	Land & Sea	10,869	51.39	7,047	39.46	5,694	30.72	86	416
NSM	No	12,692	115,076.36	1,968	Land & Sea	19,771	49.85	11,772	34.62	13,245	38.78	134	916
WSM	No	4,570	32,702.67	1,338	Land & Sea	13,026	57.63	7,485	41.66	7,444	39.86	88	365
RIAU	Yes	5,497	6,659.73	1,327	Land & Sea	8,619	38.55	5,715	29.43	6,670	35.90	126	321
SSM	No	2,658	15,704.26	598	Land & Sea	6,858	48.84	3,925	29.08	3,963	28.06	35	596
JBI	No	7,493	18,579.18	1,026	Land & Sea	9,955	59.57	6,246	55.39	4,378	43.16	51	210
BKL	No	1,695	31,495.12	799	Land & Sea	4,819	62.49	2,913	46.01	2,105	33.96	14	139
LPG	No	7,269	16,224.09	226	Land & Sea	9,801	54.10	5,698	37.21	5,255	34.89	30	199
WJV	Yes	38,479	179,135.64	154	Land	23,305	76.62	9,124	35.87	8,690	34.08	355	870
CJV	No	32,999	107,219.73	486	Land	25,363	75.06	12,502	44.52	7,396	26.28	236	1006
YOG	Yes	3,206	14,254.61	558	Land	5,297	68.31	2,563	42.62	1,100	20.31	92	79
EJV	Yes	35,944	81,416.36	795	Land	34,126	81.32	19,329	52.30	8,420	22.69	315	1118
BALI	Yes	3,366	12,545.64	1,205	Land & Sea	6,515	78.16	3,534	50.10	1,584	22.15	85	111
WNT	No	4,329	7,197.45	1,339	Land & Sea	5,477	60.38	2,851	38.85	2,828	38.36	29	163
ENT	No	4,172	2,203.94	2,088	Land & Sea	9,595	42.86	6,964	36.47	6,578	34.54	27	245
WKL	No	4,355	3,142.51	800	Land & Sea	6,545	45.37	4,056	33.32	5,628	47.01	66	117
CKL	No	2,045	1,659.09	1,313	Land & Sea	4,692	35.60	3,333	29.40	5,392	49.20	29	343
SKL	Yes	3,215	3,725.99	1,502	Land & Sea	7,257	63.33	4,164	43.99	2,784	27.89	28	597
EKL	Yes	2,750	5,368.64	1,844	Land & Sea	5,494	41.53	4,301	39.11	3,320	30.86	106	419
NSW	No	2,125	2,942.67	3,315	Land & Sea	6,445	65.15	2,715	36.73	2,871	37.85	39	89
CSW	No	2,366	2,474.64	2,491	Land & Sea	8,277	55.55	5,328	41.66	4,565	31.47	25	103
SSW	No	2,020	19,312.39	1,606	Land & Sea	6,077	53.98	3,370	42.55	2,982	37.29	93	252
SESW	No	8,598	1,599.85	2,592	Land & Sea	17,898	48.88	12,735	40.54	11,098	35.64	34	125

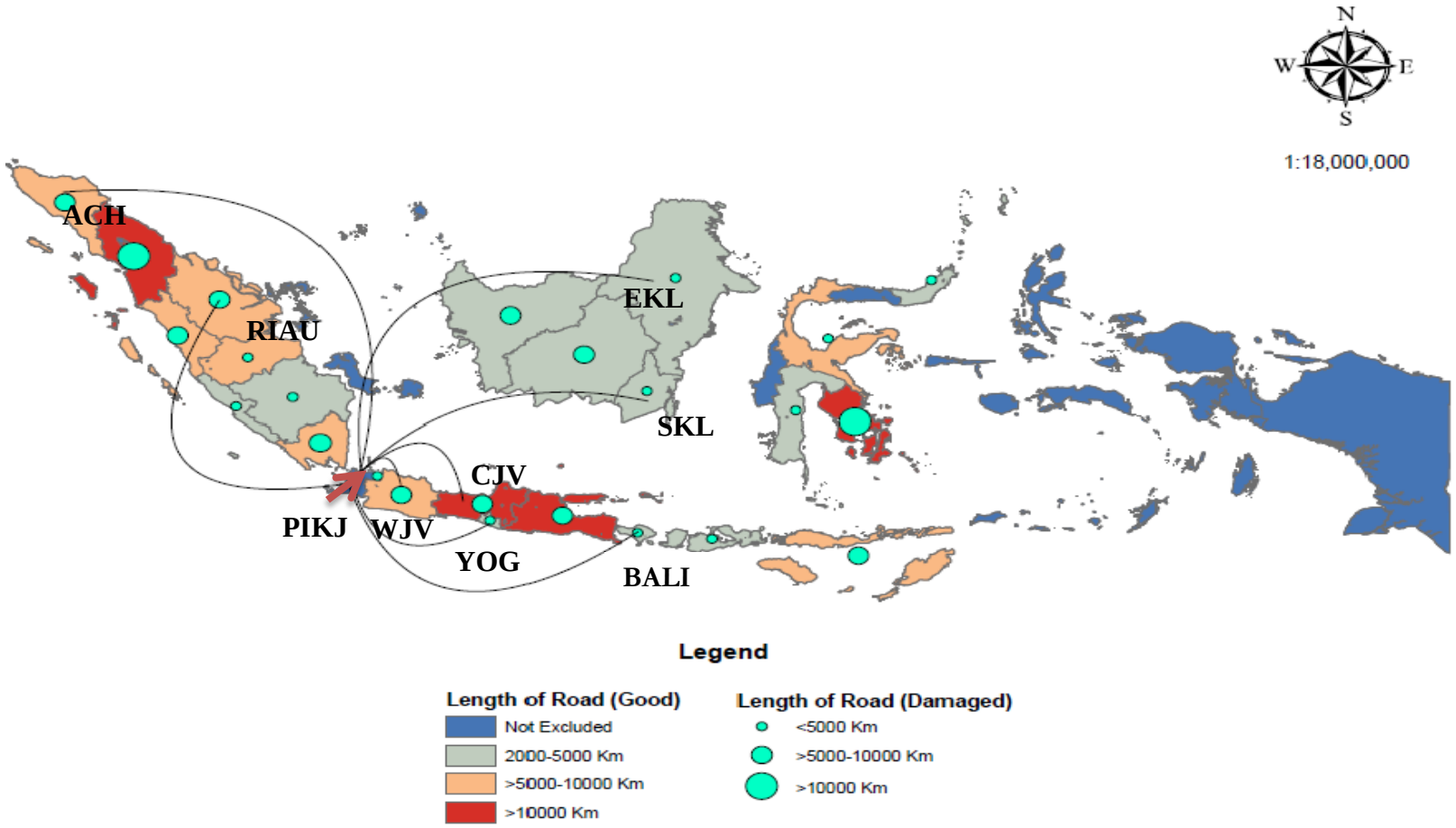
Map 2 Factors influence market integration model 1 (relationship between market integration, chilli supply and the length of road in good condition)



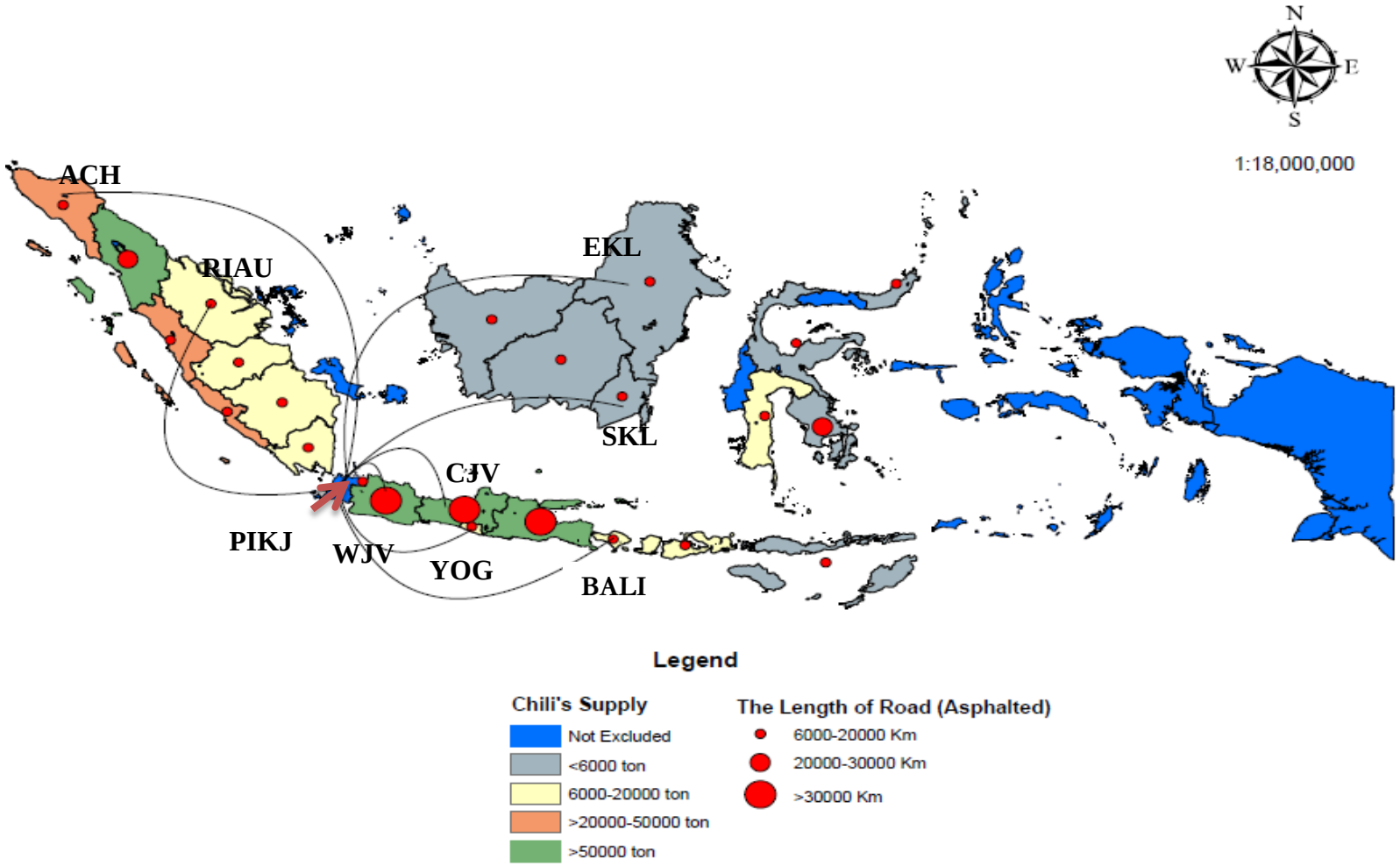
Map 3 Factors influence market integration model 1 (relationship between market integration, chilli supply and population)



Map 4 Factors influence market integration model 1 (relationship between market integration, the length of road in good condition and in bad condition)



Map 5 Factors that affect market integration model 1 (relationship between market integration, the length of asphalted road and chilli's supply)



5.3.2 Discussion of factors that may explain market integration or lack of integration at model 2

In this section, the research try to determine why some markets at producer levels, which are geographically separated in different provinces are integrated and others are not. To answer this question, understanding whether the integration are driven by long distance, poor infrastructure, the number of production or the numbers of markets, will provide beneficial information for policymaker to escalate the commodity market development.

Regarding distance as one of factors that may generate interconnectedness between provincial markets, table 12 is presented to describe the distance between those markets. However, in order to have better understand the connection between all factors that may affect market integration, thus we try to describe all variables in one table in Appendix 12.

According to the data, it is very difficult to see the interconnectedness between two markets if we only look at distance, because not always close distance market are more integrated than other markets which have relative long distance. Therefore, we try to connect the analysis by looking at quality of infrastructure such as the length of asphalted road, the length of road in good condition and the length of road in damaged condition in both kilometre and percentage.

Based on previous results on cointegration test at model 2, we know that there are 67.58% market pairs are cointegrate and 32.42% market pairs are segmented. Tables in appendix 12 depict the data and support the evidence that spatial market integration is associated with the infrastructure, populations, productions, and the numbers of markets. The variations of those factors in each province will be resulted differently on the relationship between markets. Figure 20 explain the condition of infrastructure from 23 provinces and help us to understand whether those factors drive or cause integration between markets or not.

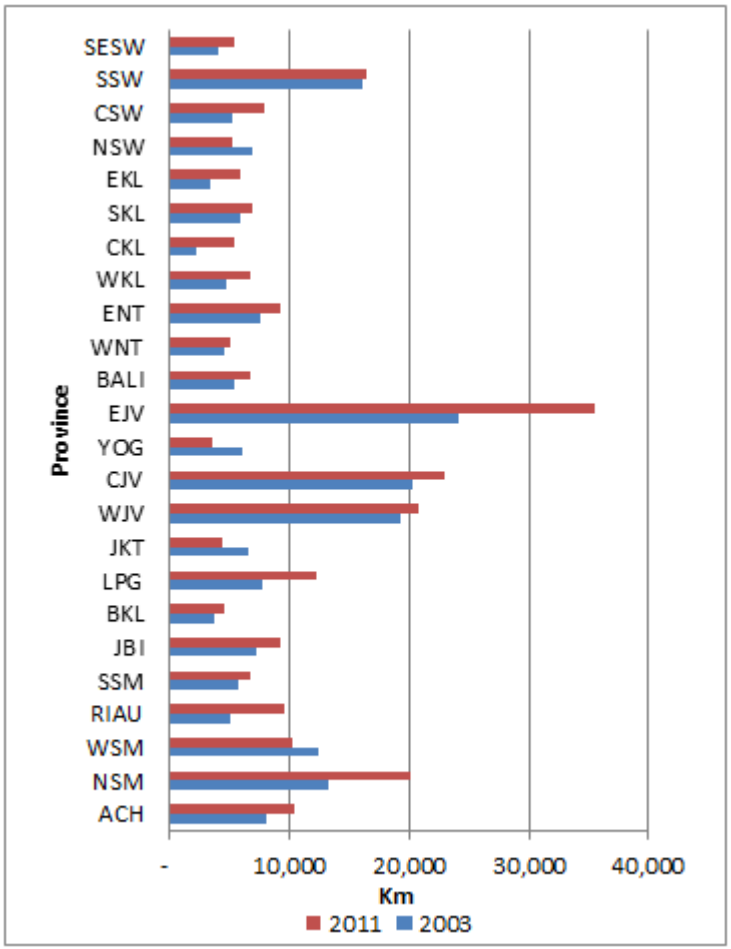
According to the graph, we can see that there is a strong connection between the market integration with the quality of infrastructure. As we know from the previous section, CJV, EJV and BALI are the provinces which have cointegration with all provinces. In constrast, CKL, WKL, CSW, SESW, SSM, NSW, LPG, JBI and SSW are the provinces that tend to be segmented rather than integrated with other provincial markets. Further, based on the development of infrastructure in these provinces that are illustrated in figure 20 to 23 together with cointegration results, we can see the connection between all these information.

Table 10 Road distance between 23 provinces (in km)

WJV																						
2,120	NSM																					
686	2761	EJV																				
373	2448	312	CJV																			
1,495	3570	824	1,122	SSW																		
374	1750	1013	705	1,824	LPG																	
1,734	3809	1063	1361	728	2067	EKL																
946	1387	1585	1276	2,396	571	2,634	BKL															
2,725	608	3364	3055	4,174	2352	4413	1991	ACH														
747	1373	1386	1077	2,197	375	2435	450	1,997	SSM													
944	2772	1172	865	2,237	1030	2014	1604	3,376	1402	WKL												
1,251	3326	570	877	821	1583	1628	2157	3,929	1955	1739	WNT											
1,492	752	2130	1822	2,941	1120	3180	713	1,355	796	2145	2,529	WSM										
1,024	1099	1663	1354	2,473	651	2712	449	1,703	278	1677	2,233	528	JBI									
397	2516	331	132	1,141	773	1380	1347	3,119	1146	991	851	1,885	1,421	YOG								
1,096	3171	416	723	846	1428	1473	2002	3,775	1801	1584	164	2,541	2,076	691	BALI							
1,479	660	2118	1809	2,929	1107	3167	758	1,264	734	2132	2,689	308	460	1,876	2,527	RIAU						
1,479	3466	852	1019	766	1723	606	2297	4,070	2096	1473	1,423	2,836	2,371	1,169	1,262	2,825	SKL					
1,197	3271	769	824	960	1529	737	2103	3,875	1901	1226	1,340	2,641	2,177	1,087	1,179	2,630	195	CKL				
3,202	5277	2531	2829	1,713	3534	1403	4108	5,881	3907	3069	2,534	4,647	4,182	2,848	2,551	4,636	1,762	1,894	NSW			
2,381	4455	1709	2007	891	2713	502	3287	5,059	3085	2181	1,712	2,641	3,361	2,026	1,730	3,814	861	993	953	CSW		
2,469	4544	1789	2096	821	2802	1895	3376	5,148	3174	2725	1,358	3,914	3,450	2,064	1,375	3,903	1,931	2,124	2,883	2,059	ENT	
2,482	4556	1810	2108	992	2814	1247	3388	5,160	3186	3015	1,814	3,926	3,462	2,128	1,831	3,915	1,606	1,738	1,612	788	2,160	SESW

Figure 20 The development of infrastructure in 2003 and 2011

a. The length of asphalted road (in km and percentage)



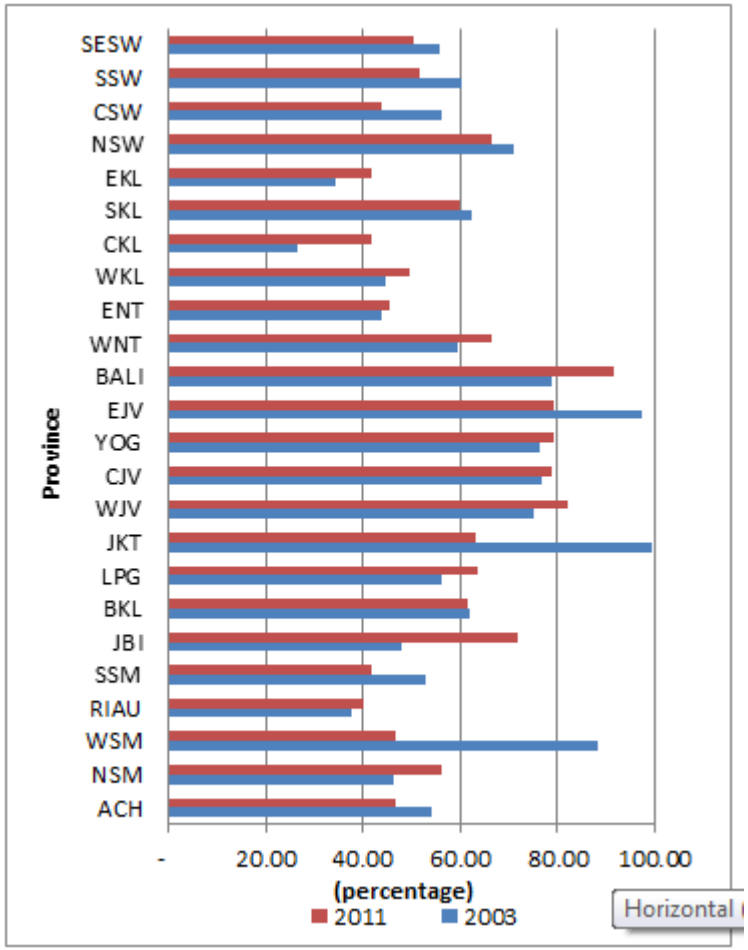
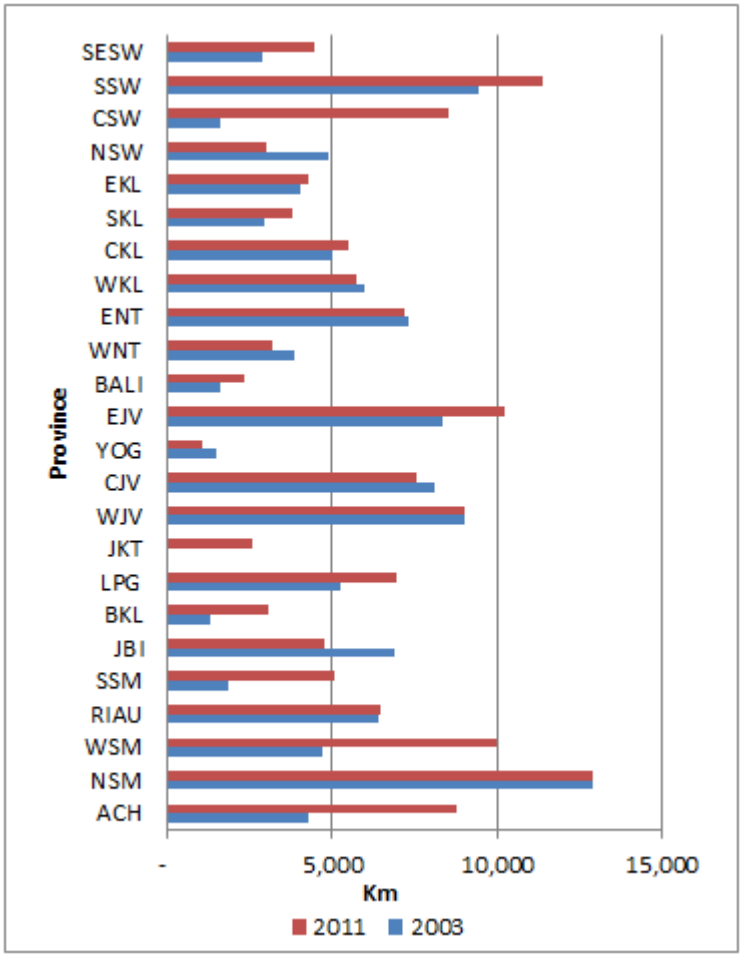


Figure 21 The development of infrastructure in 2003 and 2011

b. The length of road in damaged condition (in km and percentage)



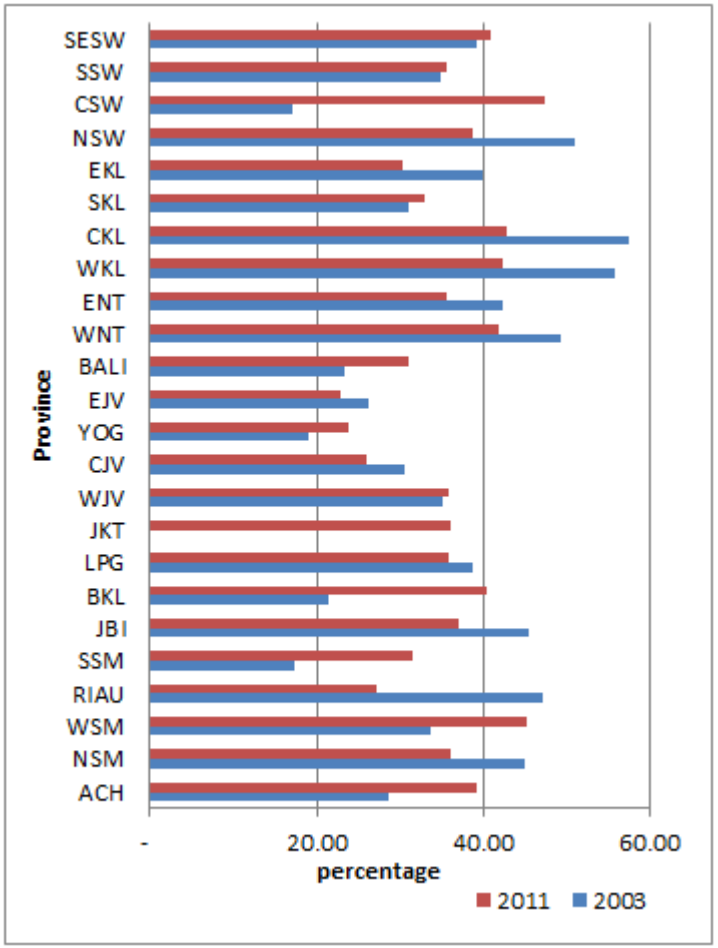
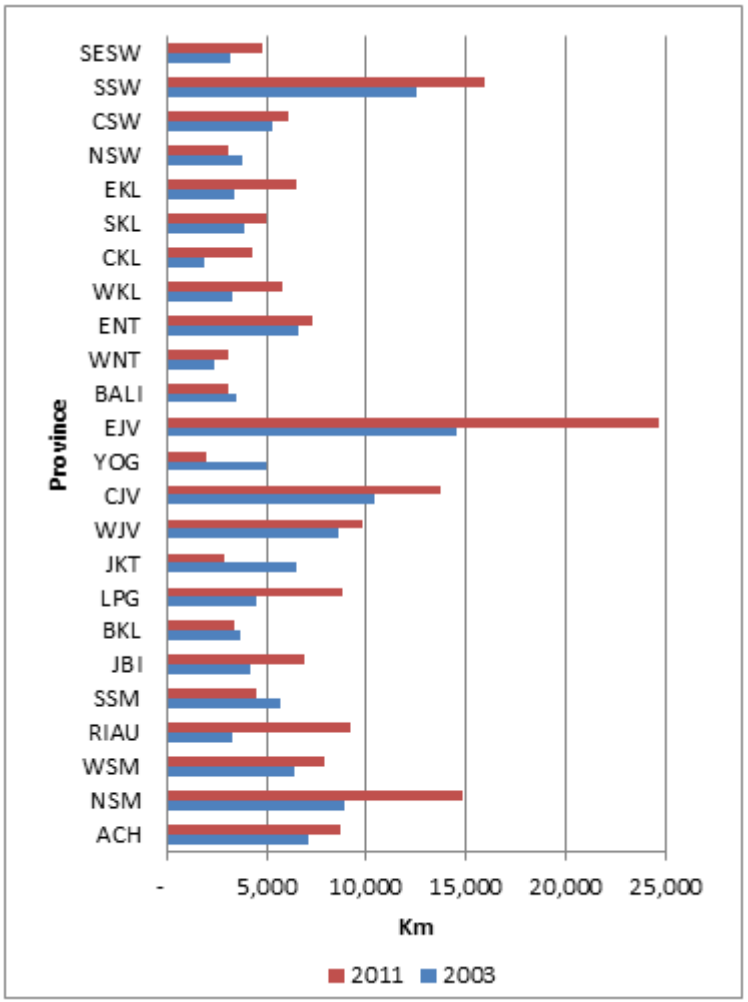


Figure 22 the development of infrastructure in 2003 and 2011

c. The length of road in good condition (in km and percentage)



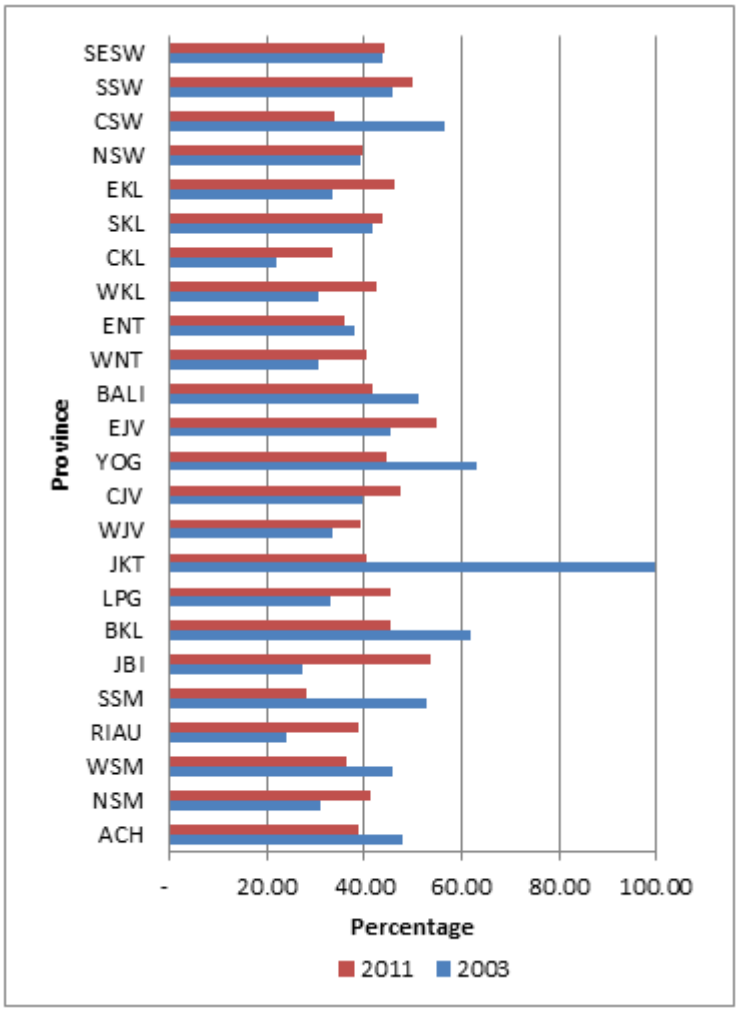
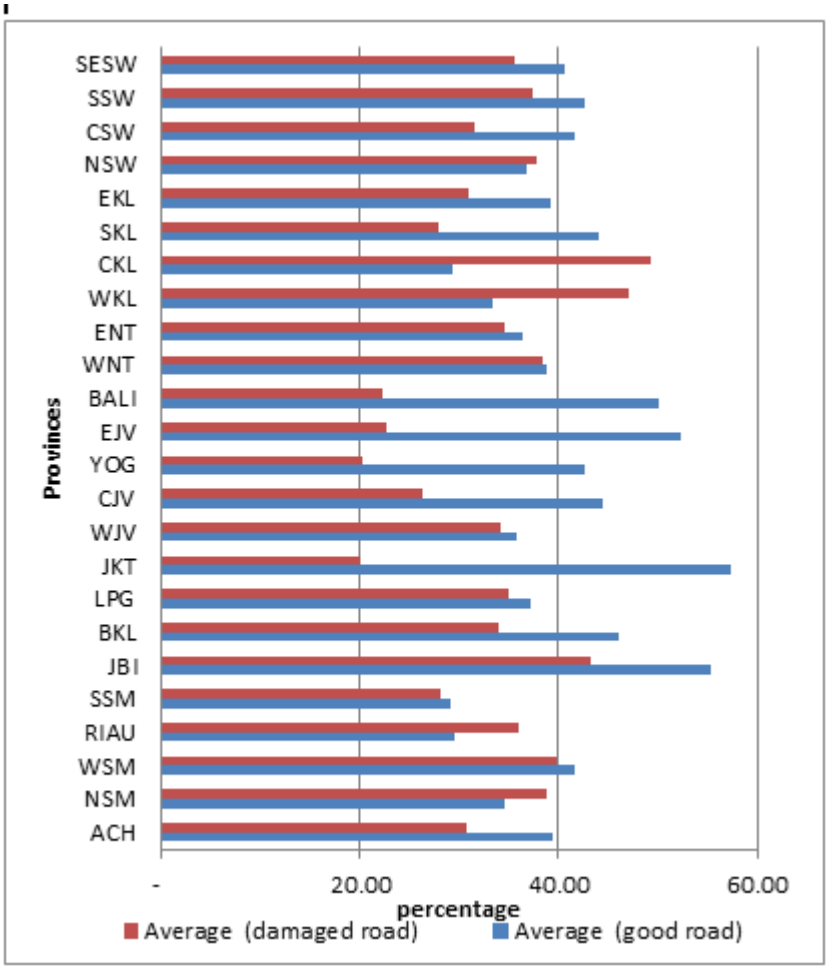


Figure 23 Comparison of the percentage of good road and damaged road (in average)



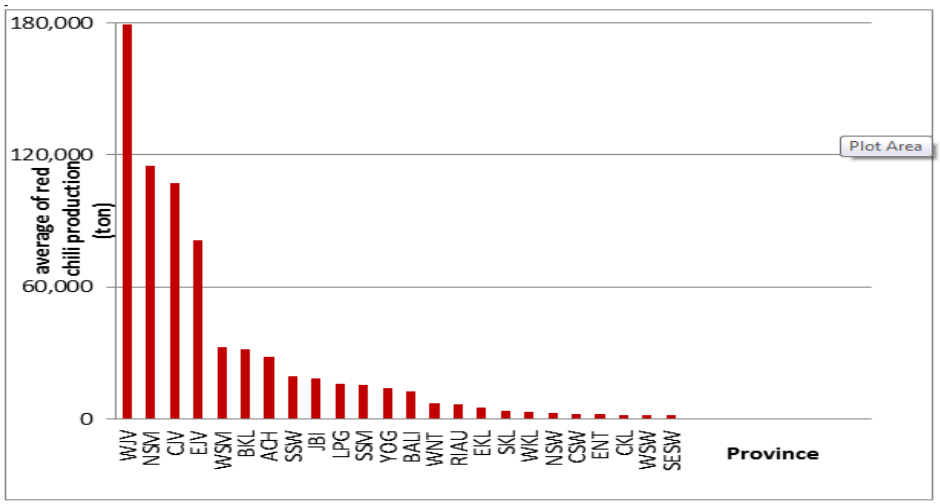
Based on the information depict from the graph, the provinces which have better development of infrastructure tend to be more integrated than other provinces that have poor infrastructure. It means the good quality of infrastructure drive the market integration between separated markets in different provinces The development of infrastructure are observed by comparing some criteria that relate to the quality of infrastructure in 2003 and 2011. By observing the difference in infrastructure development that occurs in the past and recent years, then it will give us better understanding to determine the key drives or causes of market integration. If we take a look at figure 25a the length of asphalted road increase in almost all provinces. However, the explanation will be different, if it is compare to the percentage of the length of asphalted road from its total. Figure 25, 26 and 27 depicts the graph of the length of asphalted road, the length of damaged road and the length of road in good condition in 2011 compare to 2003.

However, the trend of length of road in good condition increases during 2003 to 2011. On the other hand, if we compare to the percentage of length of good road and damaged road in average the percentage of both road are quite the same. Therefore, it could be generate market integration. The graph is illustrated in figure 28.

At most, provinces where the length of asphalted road, and damaged road are higher both in kilometre and percentage resulted poor cointegration. Therefore, these condition may affect the lack of cointegration between producer markets that are placed in different provinces in Indonesia. However, we cannot generate the analysis due to there are other factors that may drive interconnectedness in those provinces. According to study done by Hernández-Villafuerte (2010), poorly integrated markets also can be triggered by the location of the markets that is nearby the port or neighboring country. This will influence the trade opportunity, because the producer will look into the lowest transaction cost and the highest profit. Hence, the trade will flow to those markets which more profitable. However, some provinces in Indonesia that share land border with other countries are EKL and WKL with Malaysia and Brunei Darussalam, ENT with East Timor, and Papua with Papua New Guenia. Thus, we can see that this factor have an impact on the results of market integration in WKL, since this province tend to have neither long-run or short-run relationship with other provinces.

Overtime, the provinces which have largest supply of production tend to be segmented, due to they can achieve food sufficiency. These fact are supported by the evidence in NSM, with exception in WJV, EJV and CJV. On the other side, the supply of production also could generate market integration, due to the provinces with deficit of red chilli production will try to trade with provinces which have surplus of red chilli production. The graph of red chilli's production is described in figure 24.

Figure 24 Average of red chilli's production between 2001 and 2011



Population is one of factors that potential to be examined as the reason behind market integration. Place that have high population but have low production, will tend to integrate to other markets to fulfil their demand. However, it happens for those provinces which cannot meet their demand by their own production. This finding is supported by Delgado (1986), he argued that market integration would ensure a regional balance that occurs among food-deficit and food-surplus regions. Figure 25, 26 and 27 describe the graph of population and the numbers of markets.

Figure 25 Population of each province in 2000 and 2011

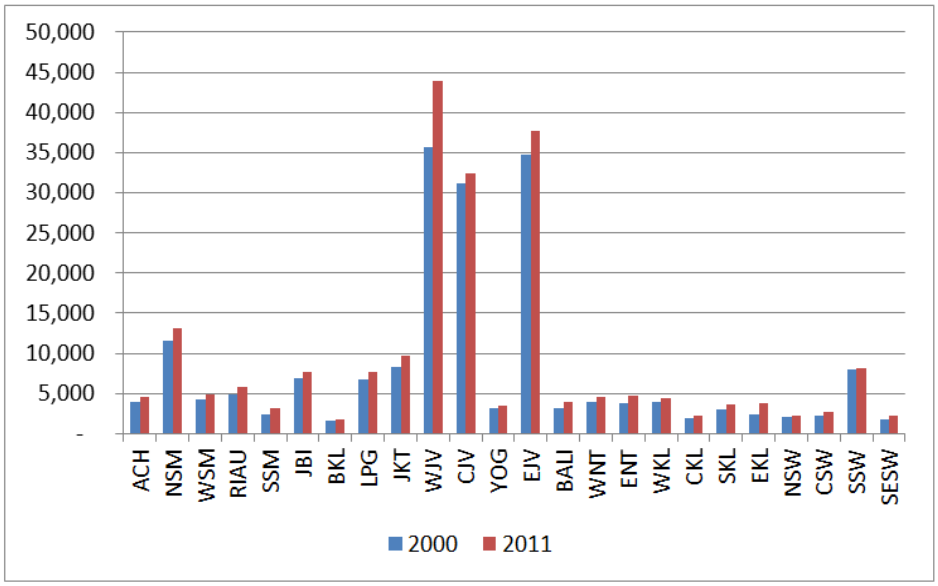


Figure 26 Numbers of markets in each province (supermarket and market without permanent building)

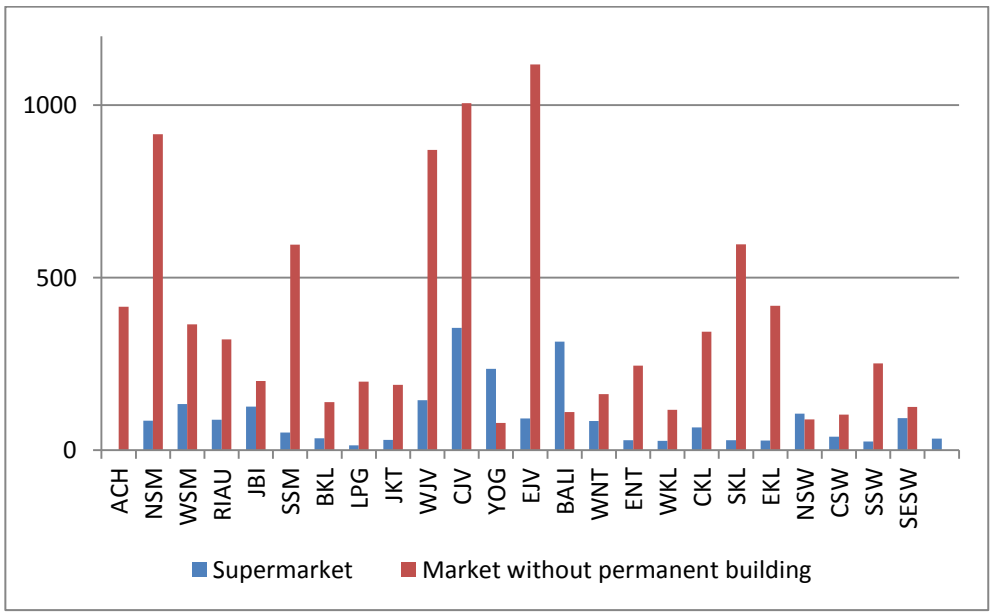


Figure 27 Numbers of markets in each province (supermarket and market without permanent building)

Now, the focus moves to number of markets. As described in figure 26 and 27, it shows that the higher the number of markets (supermarket, traditional market, restaurant and hotel) describe the higher trade possibility that exist in the location. As we can see, this condition has led to generate market integration. For example, all provinces in Java Island have great number of markets, and they tend to have cointegration with almost all provincial markets in other islands. Meanwhile, the provinces in Kalimantan and Sulawesi Island such as WKL, CKL, CSW and SESW, which tend to be segmented also has little number of markets. From this explanation, we can conclude that the smaller possibility to trade that indicates by the smaller number of markets, and then the smaller the opportunity to be integrated.

Chapter 6 Conclusion

Conclusion

Many studies have been done to investigate price transmission and market integration of staple food in Indonesia, while relatively few studies are there on market integration of vegetable commodities markets. In addition, there is scarce literature that determines the factors influence market integration or lack of integration. Therefore, the author undertakes to study the market integration of red chilli commodity markets as the focus. The market integration analysis is conducted using two models, first to identify whether price transmission and market integration exist between PIKJ a wholesale market in Jakarta and 23 producer markets in different provinces. Second, this paper sought to find the answer whether price transmission and market integration occurs in producer markets across 23 producer markets in Indonesia. Furthermore, this paper analyzed the long-run and short run relationship between prices in order to better understand the dynamic of price relationship in those markets. Finally, the paper emphasized the identification of the factors that generate the integration or the lack of integration in red chilli commodity markets in Indonesia.

For this study, the monthly data price in producer level and wholesale markets have been obtained from Statistic of Indonesia. The statistical techniques including stationarity test, Engle-Granger cointegration test and ECM have been used to analyze price transmission, long-run and short-run dynamic. Some variables such as the number of production, population, distance between markets, the quality of infrastructure, and the numbers of markets have been obtained to discuss on factor that might drives interconnectedness between red chilli markets. Statistic Indonesia and Ministry of Agriculture Republic of Indonesia provide all those variables.

The long-run analysis for red chilli markets gave mixed results. The cointegration test for model 1 supports evidence of long run market integration in some provinces, and also no cointegration in other provinces. For example, the producer markets in EJV, CJV and BALI were found to be integrated with PIKJ, even in the short run. Through 23 market pairs cointegration test, 8 markets pairs were reported to be integrated (34.78% of cases), while 15 market pairs were found to be segmented (65.22% of cases). This finding gave similar result with what have found by Firdaus and Gunawan (2012: 101-102), who found PIKJ are not cointegrate with vegetable producer markets in three different provinces of four that are studied in Indonesia. They concluded PIKJ has not yet become the price barometer for red chilli. Because of its volatility, then contribute to Indonesian general price volatility (Ibid: 105).

The result from ECM in model 1 reported that about 82.60% of market pairs show price changes in PIKJ tend to have an immediate impact to price changes in local markets. The market pairs of EJV and PIKJ (33%) indicated the highest coefficient for price adjustment, and market pairs CSW and PIKJ (5%) gave the lowest. This results in line with the previous findings by Myae et al. (2005: 981), the error correction term (speed adjustment) were ranged from -0.007 and -0.309 (7% and 30%) for vegetable commodities (cabbages, onion and potatoes) in Myanmar.

Turning on model 2, the finding has shown evidence of price transmission across producer markets that are located in different provinces in Indonesia. The price is transmitted from one market to other markets, even between provincial market in the western part of Indonesia and another market in the eastern part of Indonesia, which has a long-distance. In total 506 pairs, about 164 (32.42%) are segmented and 342 (67.58%) pairs are integrate with the values of long run coefficient distributed between -0.708 (BKL and CSW) and 3.482 (JBI and SSW).

Regarding the short-term coefficient, based on these result that has been examined by ECM about 77 market pairs (15.22%) presently the price in one market has short-term effect on other prices in producer markets that are placed in different provinces in Indonesia. The minimum value of short-term price elasticities is shown by market pair CKL and SSM (-0.529) and maximum coefficient is given by market pair of CKL and WJV (0.774). The error correction term or speed adjustment shows 404 market pairs (79.84%) have significant coefficients and correctly sign, with the slowest is indicated by CSW and YOG (-0.036 or 3,6%) and the fastest is presented by EJV and CJV (-0.738 or 73%).

In addition, this paper indicates EJV, YOG and BALI are the provinces, which have high-speed adjustment (less than -0.200 or greater than 20%). Meanwhile, fourteen provinces have moderate speed adjustment (-0.100 to -0.200 or 10% to 20%), which are WJV, CJV, NSM, LPG, BKL, ACH, WSM, JBI, RIAU, WNT, ENT, EKL, SKL, and NSW. Further, six provinces have low speed adjustment (less than -0.100 or greater than 10%), which are SSM, SKL, WKL, CSW, SSW, SESW. This analysis is conducted by classifying the speed adjustment coefficient into three groups in order to have better knowledge on which province has higher speed adjustment than others.

Furthermore, this study has argued that provinces which are located in Java and Sumatera island tend to have both LR and SR with other provincial markets in Java, Sumatera, Kalimantan, Sulawesi, Bali and Nusa Tenggara island. With exception for SSM and JBI, they tend to have neither LR nor SR with other markets. On the other hand, provincial markets in the eastern part of Indonesia such as in CKL and SESW tend to have only short run relationship with other provincial markets in different islands.

Finally, the study has continued to exploit the reason behind market integration or lack or integration of red chilli commodity markets in Indonesia. By displaying, comparing and analyzing all data together, the research has shown evidence that red chilli commodity market integration tend to be well integrated with regard to good quality of infrastructure, location or distance between markets, and trade opportunity that can be indicated by the large consumer area such as the number of population and the numbers of markets. However, the lack of integration of red chilli markets may be affected by some barrier in the marketing infrastructure, such as long distance between markets that is complemented by poor infrastructure. Thus, it will lead to high cost of transportation and hinder market integration. However, other factors also may stimulate poor integration between markets. According to study done by Hernández-Villafuerte (2011:10), poorly integrated markets also can be triggered by the location of the markets that is nearby some points such as the port or neighboring country as an export destination. This will influence the trade opportunity, because the producer will look into the lowest transaction cost and the highest profit. Hence, the trade will flow to those markets which more profitable. In this paper, we did not properly exploit this condition by measure the distance to that point.

Based on the above findings some policy recommendation could be offered to improve red chilli marketing chain in Indonesia. The first thing that could be done in order to achieve better market integration is increase the development of infrastructure. The development of infrastructure needs to expand its focus, not only on constructing the new road, but also on improving the roads that are damaged and in a bad condition. In addition, government needs to attract private sector to invest in infrastructure, to improve distribution system and provide cold storage and warehouse along the marketing chain. Furthermore, in order to have more clear information on commodity price and marketing opportunity, the government could expand the marketing information system all over the country. This study also supports the government to intervene in the red chilli marketing system, and establish the formal trading in order to ensure a balance profit received by farmers and trader. For future research, it might be better if the study could cover a longer period; therefore, the results would be more robust. In this paper, the scope of study was limited to only twenty-three provinces and one

commodity. Thus, there is a need to conduct similar studies, which cover all provinces with other vegetable commodities. In addition, special attention needs to be paid to the importance of transaction cost in the market integration analysis. Therefore, the research data has to be collected by surveying the real transport cost in the locations. Thus, in further studies other analytical tools need to be employed such as threshold cointegration model or parity bound approach which consider to include transportation cost in the market integration analysis.

Appendices

Appendix 1 Empirical evidence of market integration

Empirical evidence of market integration of staple food commodities

Author	Year	Commodity	Country	Approach
Ravallion	1986	Rice	Bangladesh	ECM, IV
Alexander and Wyeth	1995	Rice	Indonesia	ECM, Co-integration, Causality test
Baulch	1997	Rice	Philippines	Parity Bound Model
Tahir and Riaz	1997	Rice and Wheat	Punjab (Pakistan)	Ravallion model and Cointegration
Ismet et al.	1998	Rice	Indonesia	Multivariate co-integration
Badiane and Shively	1998	Maize	Ghana	ARCH test
Nyange	1999	Maize	Tanzania	Co-integration test
Rashid	2004	Maize	Uganda	Multivariate co-integration
Hossain and Verbeke	2004	Rice	Bangladesh	Co-integrations and VECM
Abdulai	2007	Maize	Ghana	Threshold co-integration
V an Campenhout	2007	Maize	Tanzania	Threshold autoregressive
Zahid et al.	2007	Wheat	Pakistan	Co-integration test
Varela et al.	2012	Rice, Maize	Indonesia	Johansen's co-integration

Empirical evidence of market integration of vegetable commodities

Author	Year	Commodity	Country	Approach
Sexton, et al	1991	Celery	United States	Spiller and Huang Model
Myae, *et al.*	2005	Tomatoes, cabbage, onion, potatoes	Myanmar	Johansen's co-integration, VECM
van Sickle	2006	Fresh vegetables	United States	Co-integration test
Adiyoga et al.	2006	Potatoes	Indonesia	Co-integration test
Amikuzuno	2010	Tomatoes	Ghana	Threshold model
Firdaus and Gunawan	2012	Shallot, red chili, potatoes, cabbage, tomatoes	Indonesia	Co-integration test, Ravallion Model
Adeoye *at al.*	2013	*Amaranthus cruentus* L, *Corchorus olitorius* L, and okra	Nigeria	Johansen's co-integration, causality test

Empirical evidence of factors influence market integration

Variables	Result	Author
Infrastructure (road density; asphalted road)	+	Goletti, Raisuddin and Farid (1995); Varela et.al (2012)
production	+	Goletti, Raisuddin and Farid (1995)
distance	-/+	Goletti, Raisuddin and Farid (1995); Goodwin and Schroeder (1991)
Telephone density	-	Goletti, Raisuddin and Farid (1995)
Remoteness	+	Varela et.al (2012)
Geographical condition (nearby port, export destination)		Hernández-Villafuerte (2011)

Appendix 2 Equation of Market integration analysis from first generation approach into the latest approach

a. Static price correlation

The correlation approach identifies the cointegration parameter from equation, rather than from residual. The estimation is following this equation:

$$P_{it} = \beta_0 + \beta_1 P_{jt} + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Then, if P_{it} and P_{jt} are correlated, we can say that correlation relationship occurs in the long-run.

In order to examine the long-run relationship, we can test whether the parameter β_1 is different from 1. However, if $\beta_1 = 1$, then market integration exist. Meanwhile, if $\beta_1 \neq 1$ then markets are segmented (Asche et al. 2003: 9).

b. Ravallion model

According to Ravallion (1986: 104-105), the spatial price differential is estimated as follow:

$$P_1 = f_1(P_2, P_3, \ldots, P_N, X_1)$$
$$P_i = f_i(P_1, X_i) \qquad (i = 2, \ldots, N)$$

Where P_1 is the price in central market, and X, (i = 1, . . . , N) is a vector of other influences on local markets. The functions f. (i = 1,..., N) can be assumed of as solutions of the appropriate conditions for market equilibrium.

The dynamic model is

$$P_{it} = \sum_{j=1}^{n} a_{ij} P_{it-j} + \sum_{j=0}^{n} b_{ij} P_{1t-j} + X_{it} c_i + e_{it} \quad (i = 2,.....N)$$

With the hypothesis:

- Market segmentation if central market prices do not influence prices in the i*th* local market if → $b_{ij} = 0$ (j = 0,…, n)
- Short-run market integration if $b_{i0} = 1$, $a_{ij} = b_{ij} = 0$ (j = 1,…, n), if both condition is accepted as restriction that we can say market i is integrated with central market.
- Long-run market integration exist if meet this condition:

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

c. Cointegration

Have described in chapter 4 data and methodology

d. ECM

Have described in chapter 4 data and methodology

e. Threshold model

Based on Abdulai (2000: 333-334), the Threshold Autoregressive (TAR) is following this equation:

The long-run relationship between two prices is:

$$P_t^1 = \propto_0 + \propto_1 P_t^2 + \mu_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where P_t^1 is price in local market and P_t^2 denote price in central market, μ_t is a random error term.

$$\Delta\mu_t = I_t \rho_1 \mu_{t-1} + (1 - I_t)\rho_2 \mu_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where, I_t represent the Heaviside indicator function, thus:

$$I_t = \begin{cases} 1 & \text{if } \mu_{t-1} \geq 0 \\ 0 & \text{if } \mu_{t-1} < 0 \end{cases}$$

The error correction term is:

$$\Delta \boldsymbol{x}_{1t} = \rho_{1.1} I_t \mu_{t-1} + \rho_{2.1}(1 - I_t)\mu_{t-1} + \sum_{j=1}^{\wedge} \beta_{2j} \Delta \boldsymbol{x}_{2,t-j} + \cdots + \sum_{j=1}^{k} \beta_{nj} \Delta \boldsymbol{x}_{n,t-j} + \boldsymbol{v}_{1t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(3)$$

where $\rho_{1.1}$ and $\rho_{2.1}$ are the adjustment coefficients for positive and negative discrepancies.

f. Parity Bound Model

According to Baulch, the "PBM assess the market integration by distinguishing three possible trade regimes which covers arbitrage condition. Those regimes are regime 1, at the parity bounds (in which spatial price differential equals to transfer costs); regime 2, inside the parity bounds (in which price differentials are less than transfer costs); and regime 3, outside the parity bounds (in which price differentials exceed transfer costs)" (1997: 480-481).

As stated in Negassa and Myers (2007: 339-340), the PBM estimation is following this step:

Regime 1 (at parity bounds) is:

$$P_{it} - P_{jt} = TC_{jit} \quad \text{.....(1)}$$

Where, P_{it} and P_{jt} are prices in market i and j, and TC_{jit} is transfer cost for trading from market j to market I at time j

Regime 2 (inside the parity bounds) is:

$$P_{it} - P_{jt} < TC_{jit} \quad \text{.....(2)}$$

Regime 3 (outside the parity bounds) is:

$$P_{it} - P_{jt} > TC_{jit} \quad \text{.....(3)}$$

Then, the estimation of PBM is specified as follow:

$$TC = \alpha + Z_t\beta + e_t \quad \text{.....(4)}$$

Where α and β are unknown parameters that can differ across market pairs, and *et* is a random shock. Then, by using equation (4) the condition of three regimes can be written as follow:

$$P_{it} - P_{jt} - \alpha - Z_t\beta = e_t \quad \text{.....(5)}$$

$$P_{it} - P_{jt} - \alpha - Z_t\beta = e_t - v_t \quad \text{.....(6)}$$

$$P_{it} - P_{jt} - \alpha - Z_t\beta = e_t + v_t \quad \text{..... (7)}$$

Where, *ut* and *vt* are non-negatively valued random variables that measure the negative (regime 2) and positive (regime 3) deviations (if any) between price differentials and transfer costs.

The joint density function is:

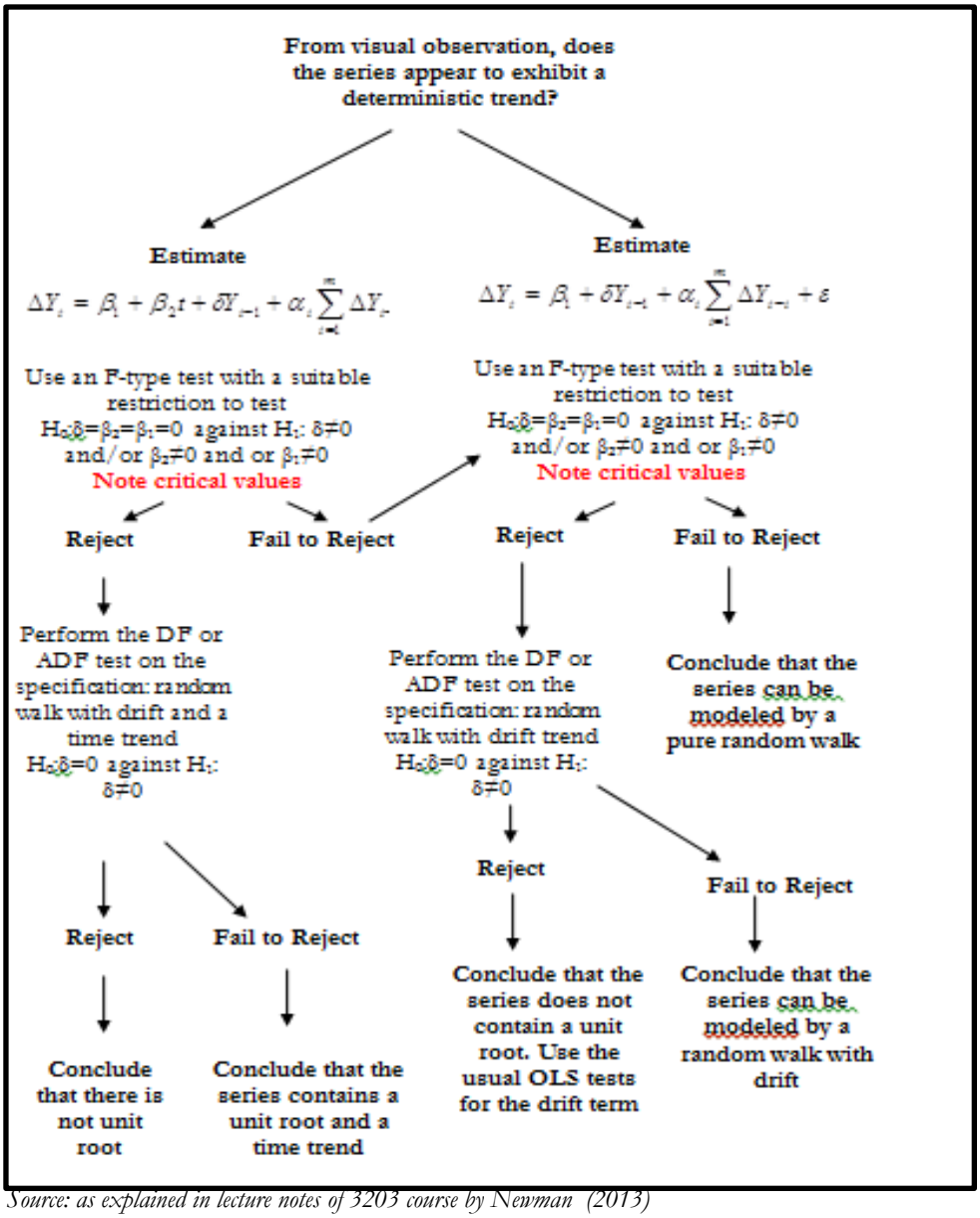
$$f_t(\pi_t \mid \theta) = \lambda_1 f_{1t}(\pi_t \mid \theta) + \lambda_2 f_{2t}(\pi_t \mid \theta) + \lambda_3 f_{3t}(\pi_t \mid \theta)$$

The likelihood function is:

$$L = \prod_{t=1}^{T} [\lambda_1 f_{1t} + \lambda_2 f_{2t} + \lambda_3 f_{3t}]$$

" The goal of the PBM is to estimate parameters λ_1, λ_2, and λ_3, which represent the probabilities of being in regimes 1, 2, and 3, respectively" (Negassa and Myers 2007: 340).

Appendix 3 Decision tree to conduct specification test before ADF test



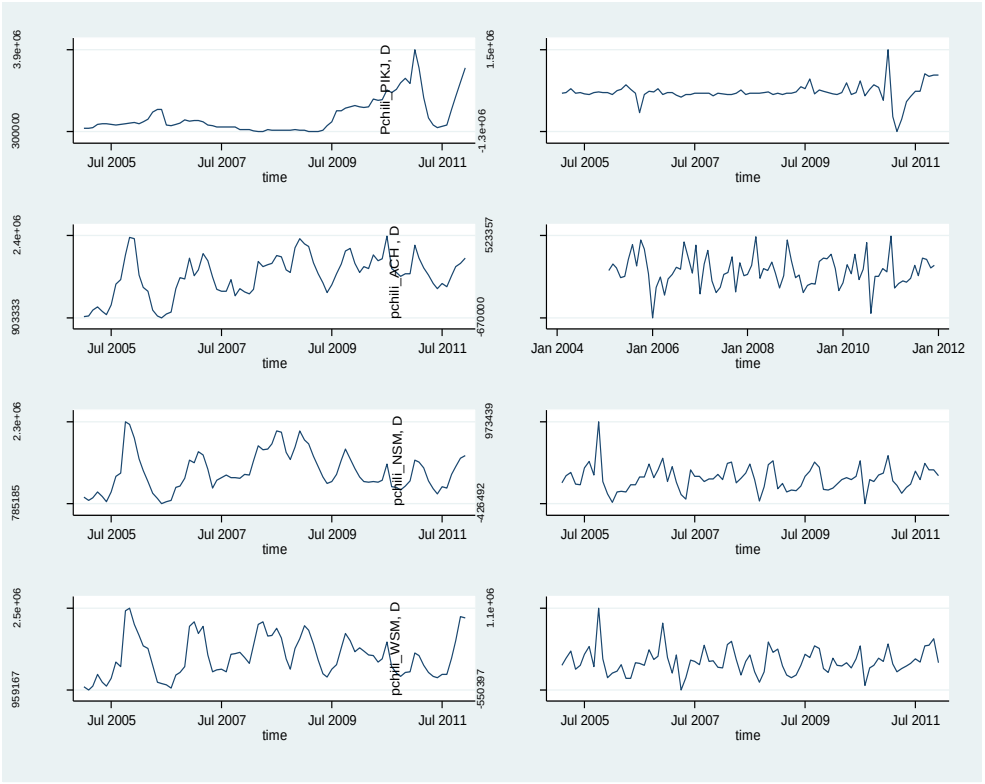
Source: as explained in lecture notes of 3203 course by Newman (2013)

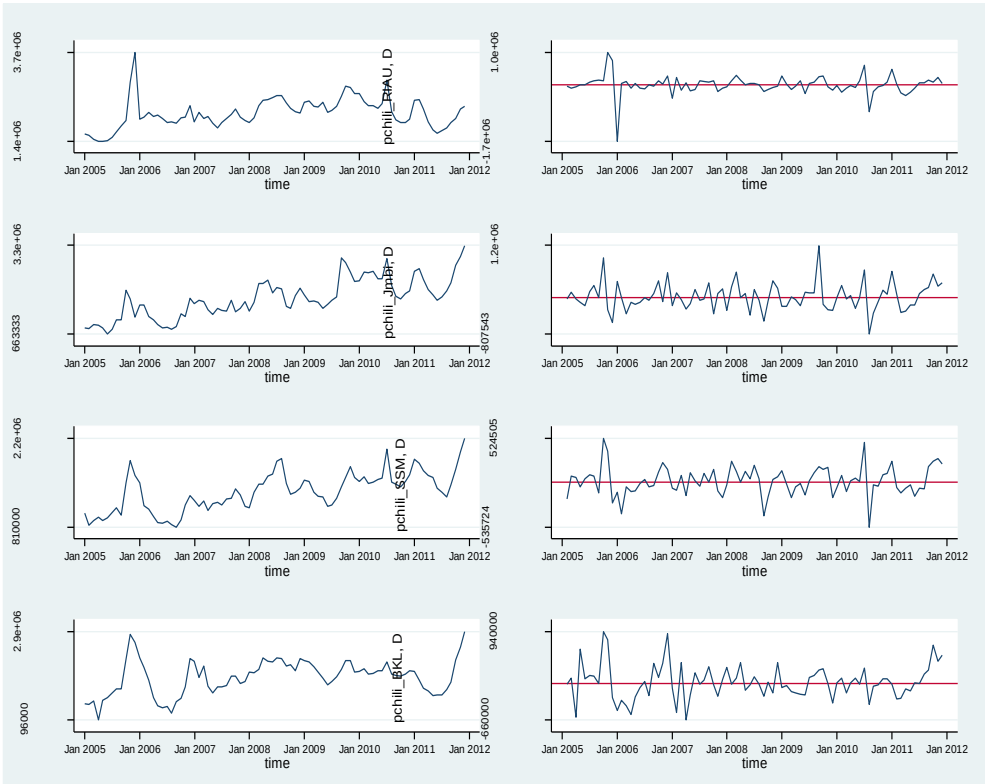
Appendix 4 Specification and lag determination for red chilli market integration model 1

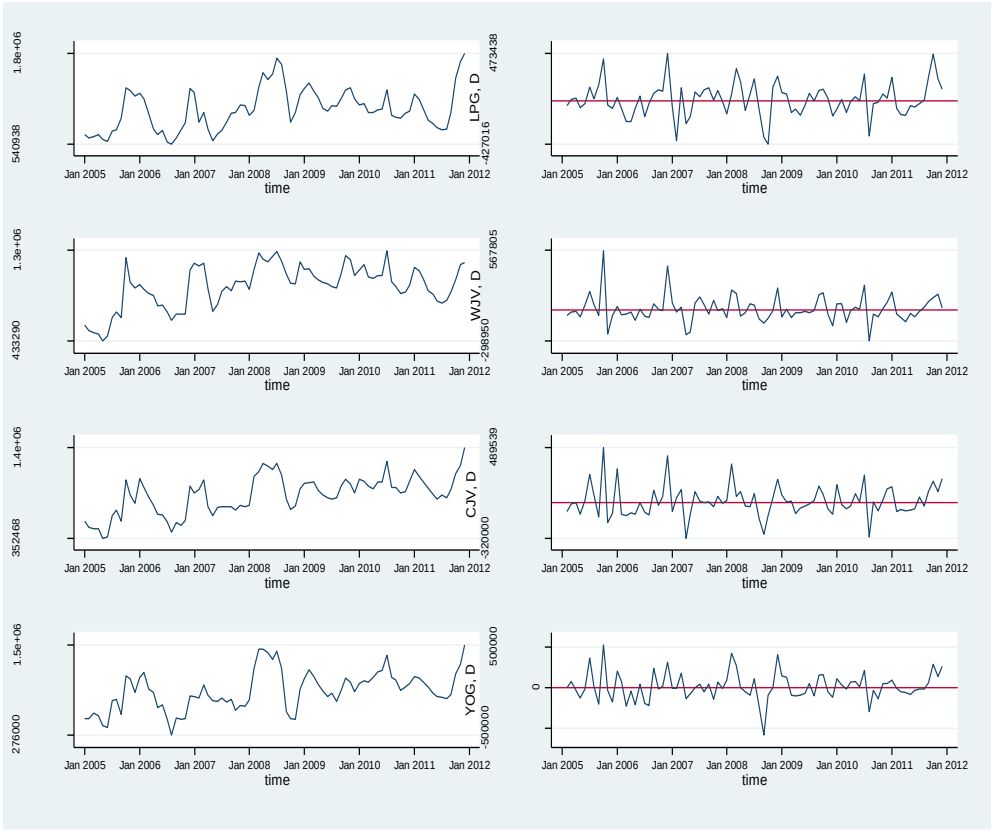
PROVINCE	SPECIFICATION TEST			LAG	
	F-VALUE TREND	F-VALUE DRIFT	TYPE	LENGTH	BIC
PIKJ	**1.70**	**0.91**	PRW	12	2052.605
ACH	**3.84**	**5.04**	PRW	12	1984.574
NSM	**2.57**	**3.91**	PRW	12	1955.245
WSM	**3.17**	**4.76**	RWD	12	1980.677
RIAU	**5.40**	**7.77**	RWT	12	1979.455
JBI	**5.04**	**2.21**	RWD	12	2035.619
SSM	**3.87**	**2.15**	PRW	12	1947.824
BKL	**2.25**	**2.78**	PRW	12	2002.942
LPG	**2.48**	**2.78**	PRW	12	1950.54
WJV	**4.08**	**4.97**	PRW	12	1888.565
CJV	**4.57**	**3.48**	PRW	12	1902.025
YOG	**3.74**	**3.97**	PRW	12	1934.427
EJV	**6.40**	**4.12**	PRW	12	1931.516
BALI	**6.81**	**5.01**	RWT	12	1888.004
WTN	**4.24**	**3.24**	PRW	12	1932.004
ENT	**4.28**	**2.81**	PRW	12	1871.752
WKL	**3.66**	**0.84**	PRW	12	1918.188
CKL	**2.03**	**2.96**	PRW	12	2008.084
SKL	**9.70**	**4.30**	RWT	12	1968.149
EKL	**9.73**	**6.17**	RWT	12	1943.988
NSW	**1.61**	**2.17**	PRW	12	2002.93
CSW	**3.79**	**1.32**	PRW	12	1916.922
SSW	**2.97**	**1.3**	PRW	12	1791.401
SESW	**3.18**	**4.16**	PRW	12	1911.242

Note: PRW = Pure random walk, RWD = Random walk with drift, RWT = Random walk with trend

Appendix 5 Graph of prices series include in model 1 in level and first difference



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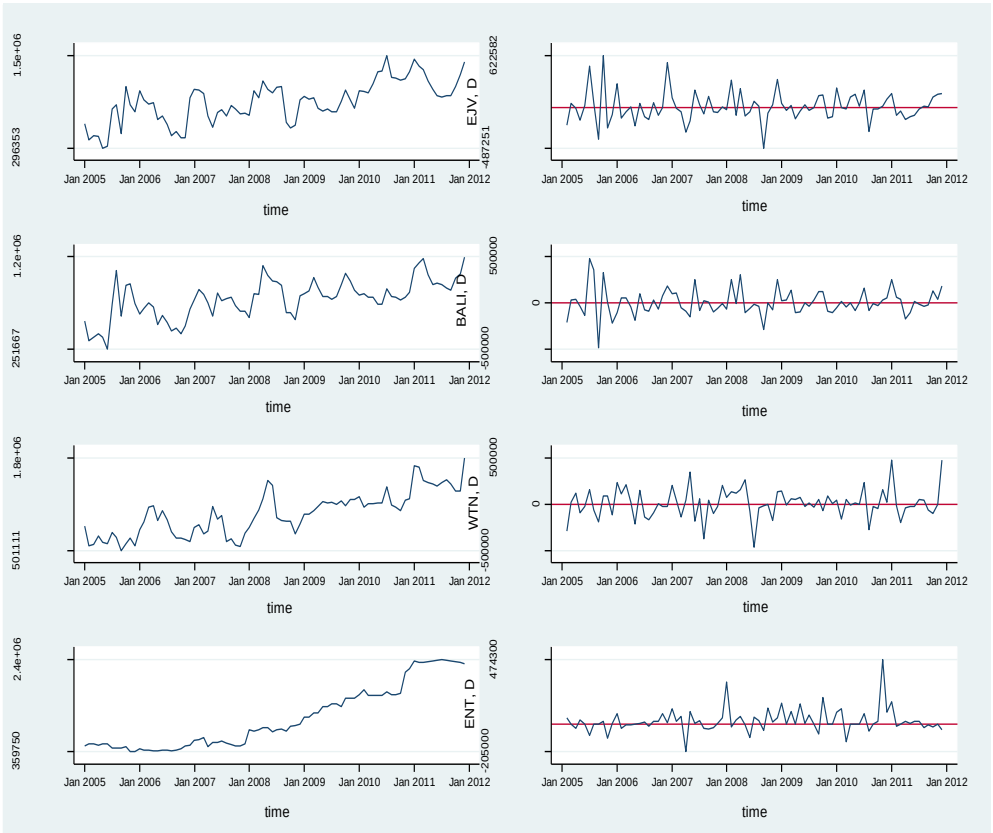
CJV, D
YOG, D
time
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012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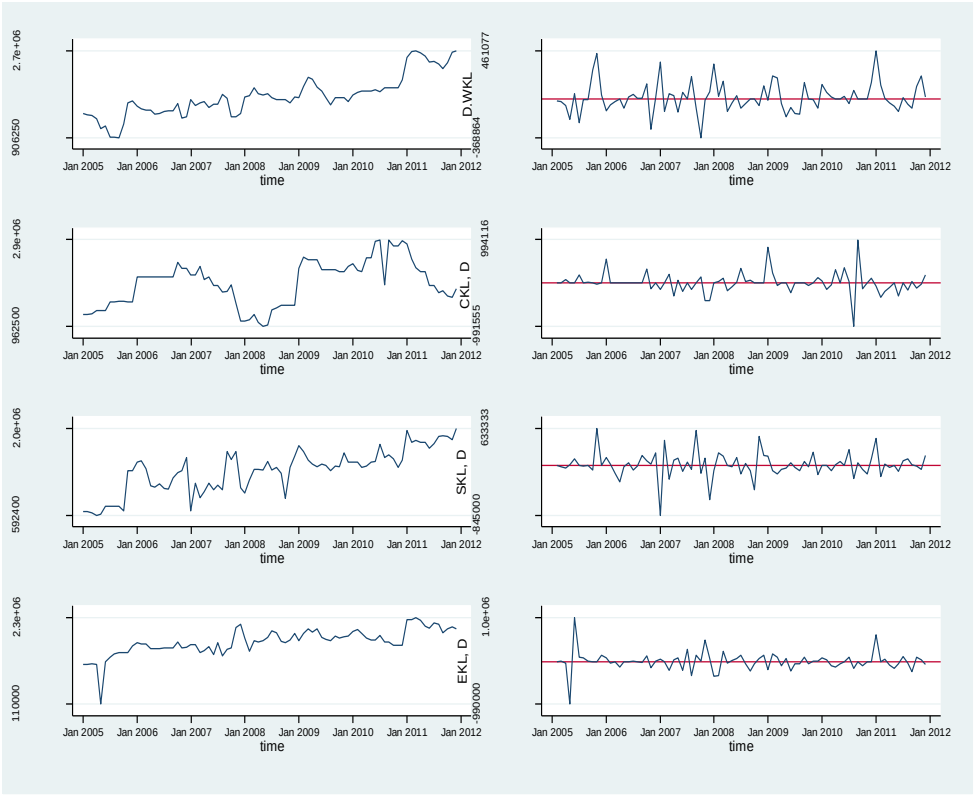
BALI, D
WTN, D
ENT, D
time
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012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D.WKL
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-388864
2.9e+06
962500
CKL, D
994116
-991555
2.0e+06
592400
SKL, D
633333
-845000
2.3e+06
110000
EKL, D
1.0e+06
-990000
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
time


3.2e+06
508910
NSW, D
759375
-766111
2.0e+06
500000
CSW, D
41.3556
-378358
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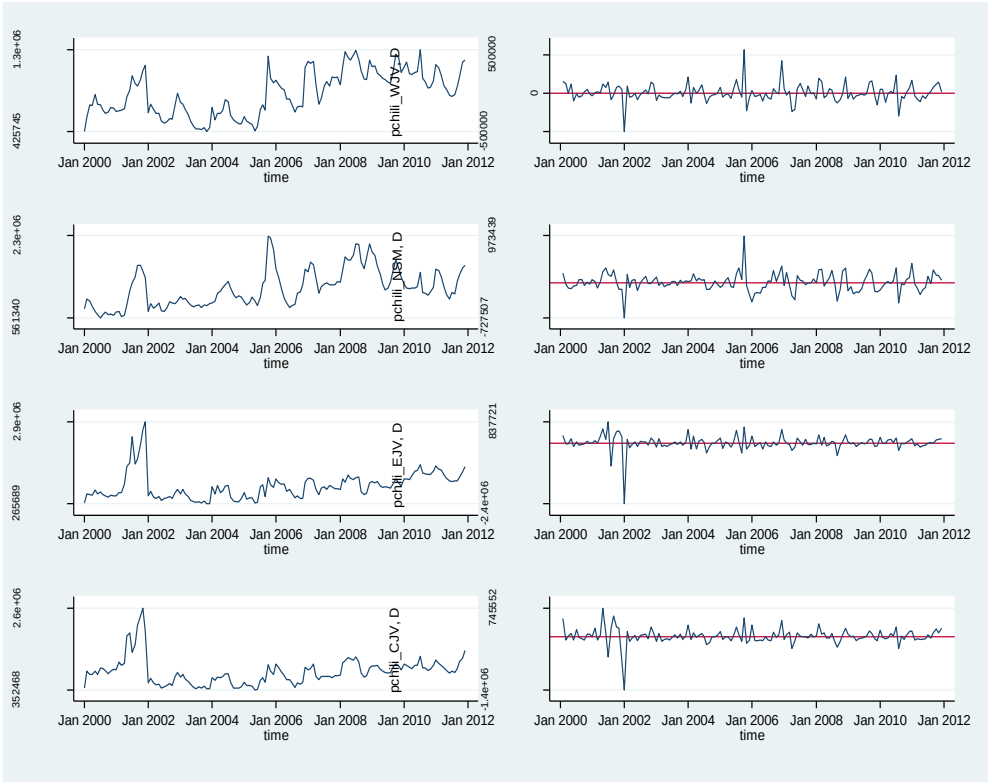
495370
SSW, D
119296
-136607
1.6e+06
493333
SESW, D
562500
-271806
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
time

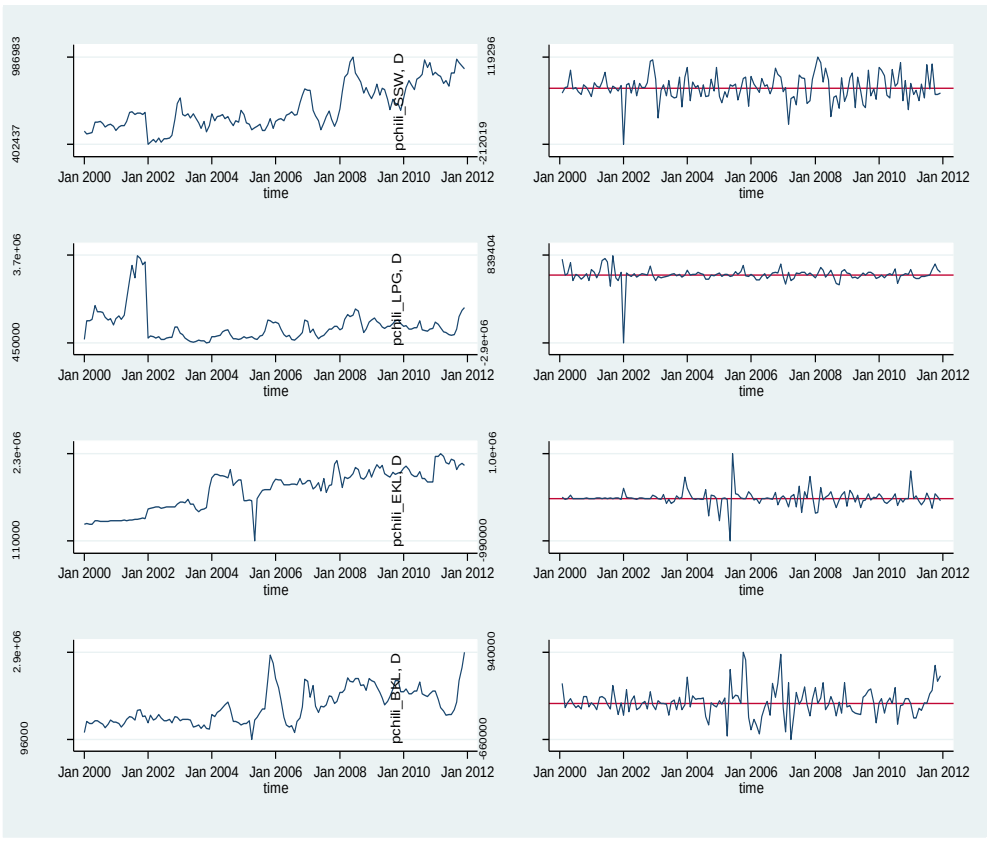
Appendix 6 Specification and lag determination for red chili market integration model 2

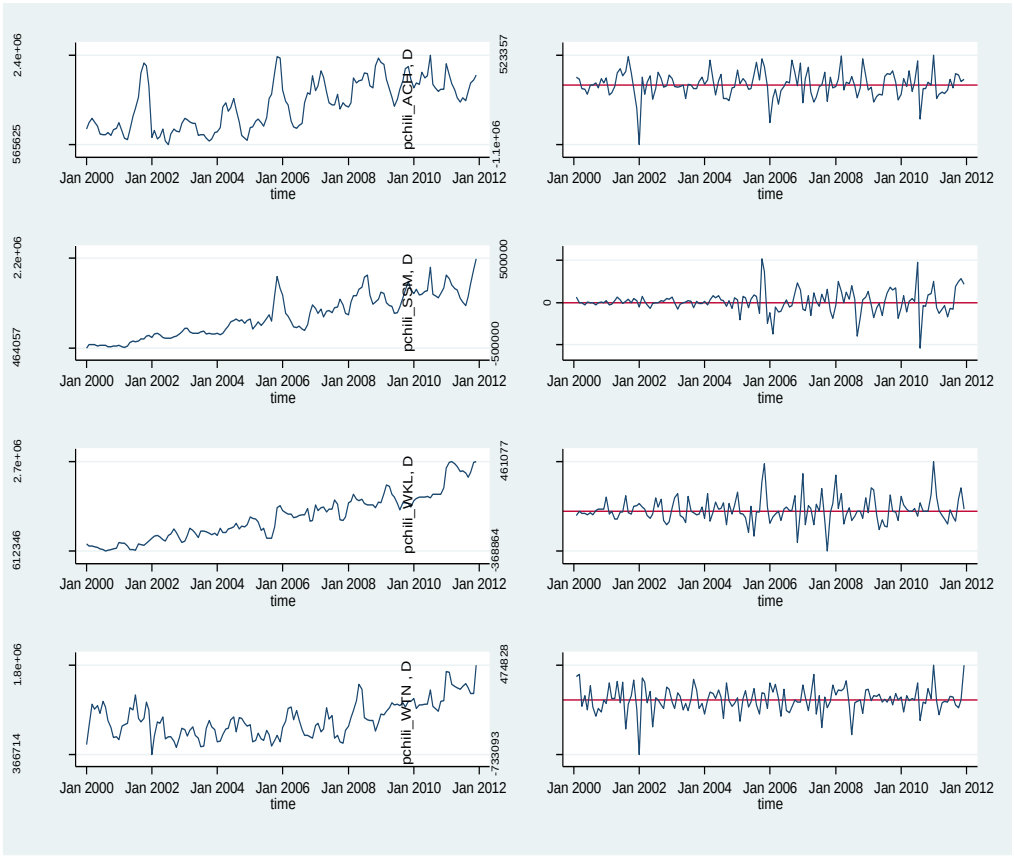
PROVINCE	SPECIFICATION TEST			LAG	
	F-VALUE TREND	F-VALUE DRIFT	TYPE	LENGTH	BIC
ACH	**4.79**	**3.62**	PRW	12	3646.74
NSM	**3.76**	**3.83**	PRW	12	3592.1
WSM	**4.64**	**3.88**	PRW	12	3636.59
RIAU	**6.28**	**3.61**	PRW	12	3679.43
JBI	**5.06**	**1.62**	PRW	12	3676.67
SSM	**6.70**	**1.34**	RWT	12	3520.28
BKL	**3.89**	**2.44**	PRW	12	3676.12
LPG	**3.35**	**4.91**	RWD	12	3732.15
WJV	**5.25**	**4.82**	RWD	12	3478.56
CJV	**3.85**	**5.77**	RWD	12	3608.66
YOG	**7.16**	**7.04**	RWT	12	3588.02
EJV	**6.21**	**8.61**	RWD	12	3716.65
BALI	**5.29**	**7.50**	RWD	12	3578.69
WNT	**5.62**	**5.07**	RWD	12	3564.04
ENT	**7.14**	**3.65**	RWT	12	3723.06
WKL	**5.85**	**1.04**	PRW	12	3472.99
CKL	**2.74**	**1.96**	PRW	12	3606.89
SKL	**11.26**	**1.84**	RWT	12	3545.51
EKL	**8.83**	**3.17**	RWT	12	3603.08
NSW	**3.29**	**4.70**	PRW	12	3679.84
CSW	**3.30**	**0.74**	PRW	12	3427.71
SSW	**4.11**	**1.85**	PRW	12	3263.62
SESW	**3.73**	**1.85**	PRW	12	3447.41

Note: PRW = Pure random walk, RWD = Random walk with drift, RWT = Random walk with trend

Appendix 7 Graph of prices series include in model 2 in level and first difference



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523357
-1.1e+06
Jan 2000 Jan 2002 Jan 2004 Jan 2006 Jan 2008 Jan 2010 Jan 2012
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464057
pchili_SSM, D
500000
-500000
0
2.7e+06
612346
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pchili_WTN, D
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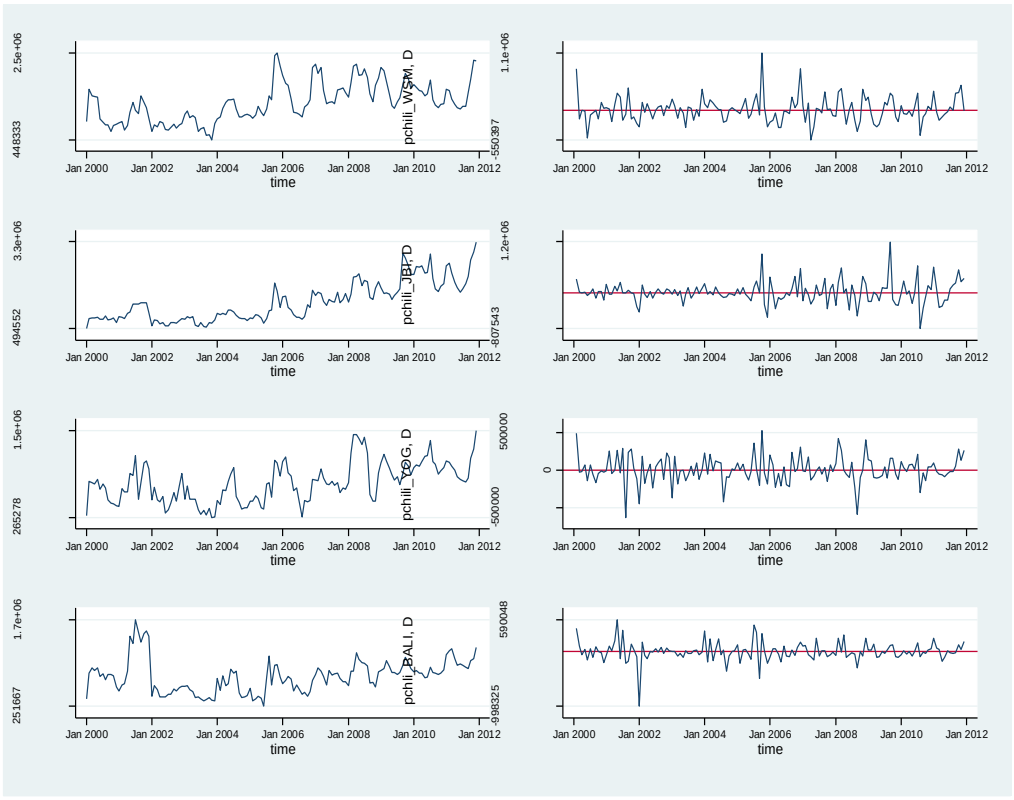
-733093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Jan 2000 Jan 2002 Jan 2004 Jan 2006 Jan 2008 Jan 2010 Jan 2012
time
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494552
pchili_JBP, D
1.2e+06
-807543
1.5e+06
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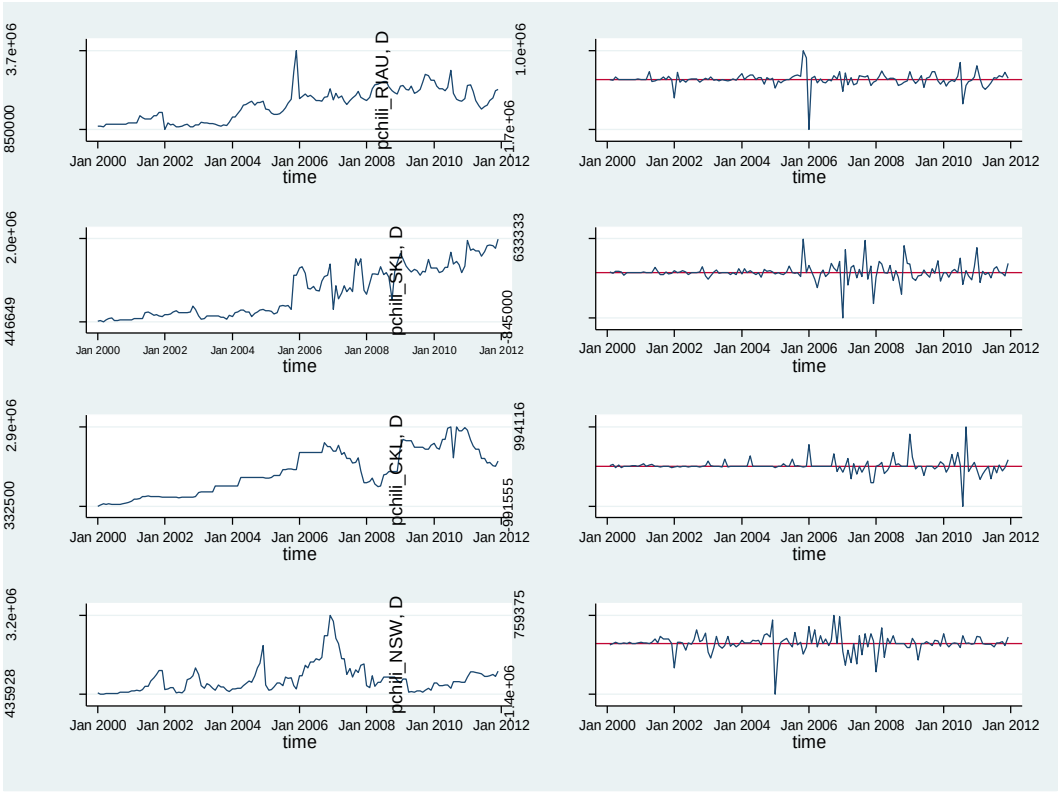
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pchili_SKL, D
633333
-845000
time
2.9e+06
332500
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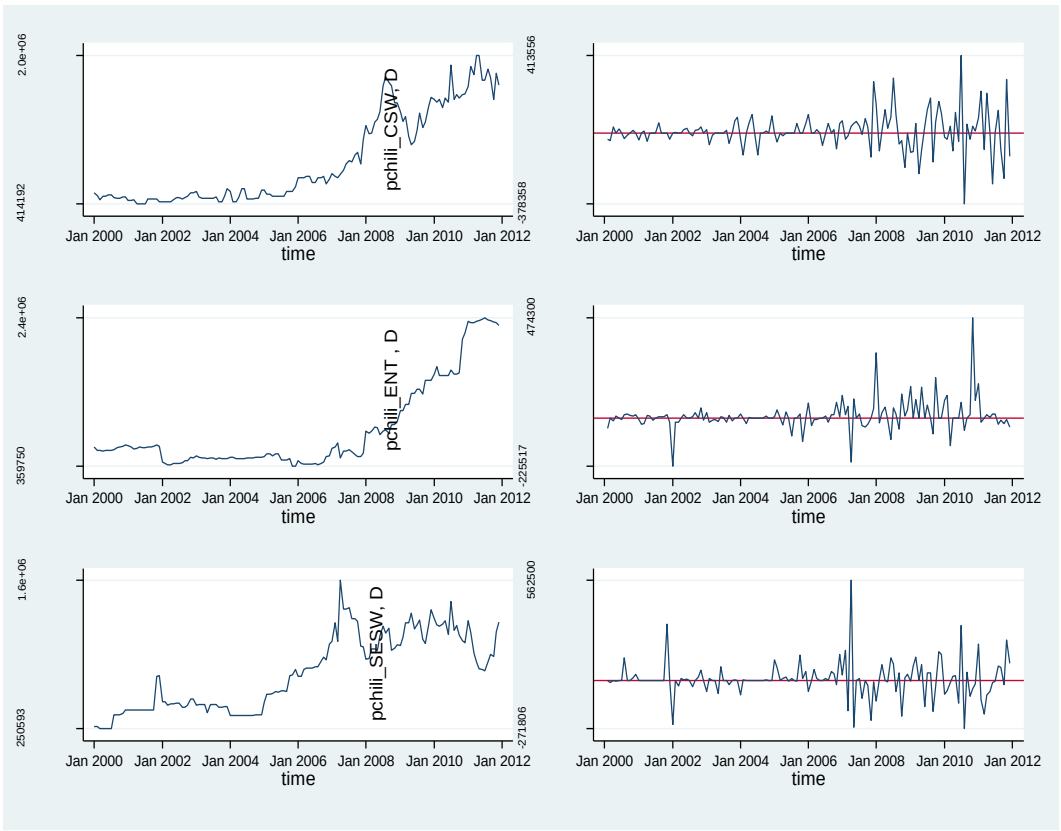
time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pchili_CSW, D
413556
-378358
Jan 2000 Jan 2002 Jan 2004 Jan 2006 Jan 2008 Jan 2010 Jan 2012
time
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pchili_ENT , D
474300
-225517
time
1.6e+06
250593
pchili_SESW, D
562500
-271806
time

Appendix 8a t-statistic of residual from Engle and Granger cointegration results of red chili market integration model 2

	WJV	NSM	EJV	CJV	SSW	LPG	EKL	BKL	ACH	SSM	WKL	WTN
WJV		-3.586**	-2.932	-2.957	-4.087***	-2.708	-3.769**	-4.784***	-5.424***	-3.869**	-3.941**	-3.648**
NSM	-3.304*		-2.758	-2.468	-3.215*	-2.416	-3.562**	-4.369***	-3.775**	-3.154*	-3.262*	-2.906
EJV	-4.024**	-4.144***		-7.096***	-4.466***	-4.165***	-4.220***	-4.318***	-4.783***	-4.313***	-4.408***	-4.322***
CJV	-3.272*	-3.138*	-6.498***		-3.492**	-6.090***	-3.369*	-3.391**	-3.381*	-3.351*	-3.422**	-3.670**
SSW	-3.169*	-2.43	-2.38	-2.003		-1.693	-3.281*	-3.127*	-3.122*	-3.695**	-3.789**	-3.651**
LPG	-2.778	-2.834	-3.163*	-5.886***	-3.057		-3.299*	-3.030	-2.863	-3.133*	-3.115*	-3.064
EKL	-3.245*	-3.316*	-2.555	-2..429	-3.697**	-2.641		-3.834**	-3.496**	-4.679***	-4.602***	-3.135*
BKL	-4.156**	-3.976**	-2.347	-2.060	-3.279*	-1.898	-3.614**		-4.045***	-4.075***	-3.292*	-2.898
ACH	-5.140***	-3.716**	-3.491**	-2.682	-3.728**	-2.368	-3.674**	-4.381***		-3.725**	-3.563**	-3.196*
SSM	-2.549	-1.923	-1.627	-1.152	-3.398**	-1.226	-4.099***	-3.657**	-2.778		-4.344***	-2.743
WKL	-2.298	-1.640	-1.333	-0.626	-3.241*	-0.477	-3.747**	-2.494	-2.219	-4.109***		-3.217*
WTN	-3.712**	-3.264*	-3.349*	-3.432**	-4.578***	-3.047	-3.736**	-3.781**	-3.607**	-4.067***	-4.670***	
WSM	-3.969**	-3.711**	-2.839	-2.446	-3.527**	-2.520	-3.718**	-5.248***	-4.078***	-3.769**	-3.638**	-3.235*
JBI	-3.238*	-1.481	-2.406	-1.617	-3.811**	-1.387	-3.035	-3.942**	-3.111*	-4.138***	-3.854**	-3.980**
YOG	-5.319***	-4.351	-3.697**	-3.818**	-5.204***	-3.484**	-4.38***	-5.357***	-5.277***	-5.022	-4.847***	-4.793***
BALI	-4.080***	-3.863**	-5.097***	-6.655***	-4.204***	-5.271***	-3.915**	-4.052**	-4.381***	-3.976**	-4.078***	-4.550***
RIAU	-4.641***	-4.052***	-2.876	-2.677	-3.536**	-2.609	-4.747***	-4.445***	-4.052***	-4.473***	-3.750**	-3.129*
SKL	-3.964**	-2.745	-2.466	-1.922	-3.847**	-1.747	-4.352***	-3.784**	-3.190*	-4.987***	-6.504***	-3.646**
CKL	-2.428	-2.238	-1.996	-1.839	-2.459	-2.086	-3.589**	-2.328	-2.866	-2.222	-2.769	-2.213
NSW	-3.019	-3.131*	-3.007	-3.043	-3.009	-3.096*	-3.075	-3.091*	-3.124*	-3.113*	-3.204*	-3.072
CSW	-2.953	-1.782	-1.751	-1.113	-4.191***	-0.643	-2.949	-2.560	-2.648	-3.295*	-3.432**	-3.679**
ENT	-3.754**	-2.979	-3.493**	-3.063	-5.266***	-2.701	-3.979**	-3.541**	-3.603**	-4.376***	-5.311***	-6.474***
SESW	-3.653**	-2.581	-2.064	-1.785	-2.800	-1.747	-3.106*	-3.438*	-3.294*	-3.238*	-3.025	-2.293

*Note: *** is significant in 1% critical values, ** is significant in 5% critical values and * is signifianct in 10% critical values.*
Critical values in 1%, 5% and 10% based on MacKinnon(1991) in Enders (2010: 490)

Appendix 8b t-statistic of residual from Engle and Granger cointegration results of red chili market integration Model 2 (continued)

	WSM	JBI	YOG	BALI	RIAU	SKL	CKL	NSW	CSW	ENT	SESW
WJV	-4.215***	-4.260***	-4.743***	-3.333*	-4.948***	-4.793***	-3.484**	-3.017	-4.348***	-4.066***	-4.535***
NSM	-3.692**	-2.678	-3.480**	-2.764	-4.123***	-3.492**	-3.038	-2.818	-3.266*	-3.044	-3.363*
EJV	-4.205***	-4.615***	-4.123***	-5.337***	-4.303***	-4.544***	-4.220***	-4.095***	-4.529***	-4.775***	-4.302***
CJV	-3.127*	-3.425**	-3.494**	-6.271***	-3.392*	-3.471**	-3.356*	-3.356*	-3.523**	-3.707**	-3.390*
SSW	-2.816	-3.939**	-3.830**	-2.399	-2.917	-3.866**	-2.451	-1.722	-4.618***	-4.760***	-2.834
LPG	-2.931	-3.047	-2.883	-4.658***	-3.084	-3.119*	-3.272*	-3.158*	-3.119*	-3.148*	-3.126*
EKL	-3.470**	-3.601**	-3.277*	-2.526	-4.608***	-4.705***	-3.983**	-2.450	-3.878**	-3.801**	-3.569**
BKL	-4.865***	-4.221***	-4.185***	-3.357	-4.151***	-3.954**	-2.570	-2.086	-3.277*	-3.048	-3.655**
ACH	-4.000***	-3.838**	-4.409***	-3.324*	-4.066	-3.810**	-3.499**	-2.737	-3.802**	-3.592	-3.912**
SSM	-2.745	-4.010***	-3.347*	-1.499	-3.710**	-4.778***	-1.869	-1.324	-3.490**	-3.541**	-2.963
WKL	-2.233	-3.465**	-2.818	-1.186	-2.515	-6.111***	-2.091	-0.918	-3.360*	-4.351***	-2.386
WTN	-3.566**	-4.974***	-4.310***	-3.923**	-3.566**	-4.581***	-3.409**	-3.130*	-5.033***	-6.854***	-3.477**
WSM		-3.504**	-4.104***	-2.952	-5.066***	-4.024***	-3.219*	-2.851	-3.502**	-3.274*	-3.868**
JBI	-2.573		-4.169***	-2.416	-3.737	-4.684***	-2.323	-1.490	-4.455***	-5.521***	-3.301*
YOG	-4.890***	-5.587***		-4.241***	-5.158***	-5159***	-4.008***	-3.691**	-5.114***	-4.968***	-4.687***
BALI	-4.013***	-4.358***	-4.362***		-3.948**	-4.245***	-3.877**	-3.847**	-4.265***	-4.633***	-3.966**
RIAU	-4.958***	-4.355***	-4.265***	-2.779		-4.264***	-4.363***	-2.858	-3.633**	-3.415**	-4.144***
SKL	-3.769**	-2.420	-3.723**	-2.420	-3.723**		-3.277	-1.913	-5.272***	-4.809***	-3.817**
CKL	-2.439	-2.449	-2.279	-1.898	-3.835**	-3.266*		-2.176	-2.326	-2.889	-3.272*
NSW	-3.159*	-3.033	-3.040	-3.054	-3.245*	-3.159*	-3.288*		-3.063	-3.063	-3.294*
CSW	-2.152	-4.109***	-3.233*	-1.762	-2.437	-4.873***	-1.518	-0.670		-4.665***	-2.051
ENT	-3.213*	-6.065***	-4.129***	-3.630**	-3.437**	-5.319***	-3.538**	-2.679	-5.574***		-3.490**
SESW	-3.169*	-3.393	-3.166*	-1.967	-3.567**	-3.796**	-3.236*	-2.105	-2.680	-2.811	

*Note: *** is significant in 1%, ** is significant in 5% and * is signifianct in 10%.*
Critical values in 1%, 5% and 10% based on MacKinnon(1991) in Enders (2010: 490)

Appendix 9a Long-run coefficient for all market pairs of red chilli market integration model 2

	WJV	NSM	EJV	CJV	SSW	LPG	EKL	BKL	ACH	SSM	WKL	WTN
WJV		0.468*** (16.54)	0.367*** (11.18)	0.402*** (9.71)	1.102*** (11.18)	0.174*** (6.11)	0.262*** (7.87)	0.345*** (17.85)	0.397*** (19.63)	0.410*** (13.39)	0.261*** (8.81)	0.442*** (7.86)
NSM	1.403*** (16.54)		0.460*** (6.80)	0.507*** (6.17)	1.477*** (7.44)	0.228*** (4.38)	0.458*** (7.99)	0.609*** (19.08)	0.712*** (22.61)	0.700*** (12.97)	-0.397*** (7.31)	0.386*** (3.45)
EJV	1.273*** (11.18)	0.533*** (6.80)		1.052*** (22.83)	1.427*** (6.44)	0.558*** (15.01)	0.154** (2.11)	0.318*** (5.39)	0.533*** (9.31)	0.363*** (4.53)	0.230*** (3.50)	0.826*** (7.89)
CJV	0.990*** (9.71)	0.416*** (6.17)	0.746*** (22.83)		0.945*** (4.81)	0.541*** (24.91)	-0.007 (-0.12)	0.237*** (4.66)	0.398* (7.78)	0.172** (2.43)	0.071 (1.25)	0.605 (6.53)
SSW	0.424*** (11.18)	0.189*** (7.44)	0.158*** (6.44)	0.148*** (4.81)		0.035* (0.071)	0.196*** (10.65)	0.157*** (9.24)	0.190*** (10.45)	0.259*** (13.99)	0.215*** (15.42)	0.340*** (11.12)
LPG	1.191*** (6.11)	0.521*** (4.38)	1.098*** (15.01)	1.502*** (24.91)	0.634* (1.82)		-0.305*** (-3.02)	0.213*** (2.39)	0.450*** (4.75)	-0.045 (-0.38)	-0.173* (-1.82)	0.656*** (3.93)
EKL	1.158*** (7.87)	0.676*** (7.99)	0.196** (2.11)	-0.013 (-0.12)	2.256*** (10.65)	-0.197*** (-3.02)		0.541*** (9.42)	0.586*** (8.93)	0.942*** (16.84)	0.781*** (18.93)	0.749*** (5.90)
BKL	2.003*** (17.85)	1.180*** (19.08)	0.533*** (5.39)	0.559 (4.66)	2.379*** (9.24)	0.181** (2.39)	0.710*** (9.42)		0.935*** (18.08)	1.118*** (18.84)	0.667*** (9.68)	0.698*** (4.61)
ACH	1.836*** (19.63)	1.098*** (22.61)	0.710*** (9.31)	0.749*** (7.78)	2.283*** (10.45)	0.304*** (4.75)	0.613*** (8.93)	0.744*** (18.08)		0.933*** (15.41)	0.600*** (5.95)	0.771*** (9.84)
SSM	1.359*** (13.39)	0.774*** (12.97)	0.347*** (4.53)	0.232** (2.43)	2.233*** (13.99)	-0.022 (-0.38)	0.706*** (16.84)	0.638*** (18.84)	0.669*** (15.41)		0.698*** (21.39)	0.776*** (7.47)
WKL	1.353*** (8.81)	0.688*** (7.31)	0.344*** (3.50)	0.151 (1.25)	2.904*** (15.42)	-0.131* (-1.82)	0.916*** (18.93)	0.596*** (9.68)	0.674*** (9.84)	1.092*** (21.39)		1.131*** (9.37)
WTN	0.685*** (7.86)	0.199*** (3.45)	0.368*** (7.89)	0.381*** (6.53)	1.368*** (11.12)	0.149*** (3.93)	0.262*** (5.90)	0.186** (4.61)	0.258*** (5.95)	0.363*** (7.47)	0.337*** (9.37)	

Note: t-statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

The cells in the blue color are those which are not cointegrated, based on the previous results on table 5a to 5d

Appendix 9b Long-run coefficient for all market pairs of red chilli market integration model 2 (continued)

	WSM	JBI	YOG	BALI	RIAU	SKL	CKL	NSW	CSW	ENT	SESW
WJV	0.415*** (17.30)	0.308*** (18.71)	0.712*** (19.71)	0.578*** (10.95)	0.307*** (13.85)	0.360*** (11.58)	0.172*** (7.37)	0.112*** (2.85)	0.315*** (10.97)	0.165*** (6.35)	0.501*** (13.28)
NSM	0.763*** (21.41)	0.433*** (11.19)	0.989*** (11.26)	0.768*** (7.24)	0.538*** (14.23)	0.515*** (8.38)	0.248*** (5.81)	0.228*** (3.37)	0.407*** (7.00)	0.157*** (3.19)	0.691*** (8.79)
EJV	0.388*** (5.41)	0.375*** (7.88)	1.086*** (11.71)	1.389*** (21.26)	0.250*** (4.19)	0.345*** (4.58)	0.147*** (2.97)	0.104 (1.39)	0.315*** (4.66)	0.250*** (4.93)	0.424*** (4.29)
CJV	0.309*** (5.06)	0.267*** (6.28)	0.850*** (10.22)	1.157*** (20.39)	0.144*** (2.77)	0.170** (2.56)	0.015 (0.35)	0.011 (0.18)	0.176*** (2.97	0.151*** (3.40)	0.213** (2.45)
SSW	0.169*** (7.68)	0.179*** (15.36)	0.339*** (10.37)	0.232*** (5.82)	0.154*** (9.29)	0.249*** (14.68)	0.122*** (9.05)	0.067*** (2.76)	0.244*** (19.07)	0.154*** (11.92)	0.268*** (9..97)
LPG	0.324*** (3.03)	0.225*** (2.90)	0.985*** (6.06)	1.769*** (15.48)	0.051 (0.58)	-0.020 (-0..18)	-0.172** (-2.46)	-0.049 (-0.47)	-0.103 (0.10)	0.064 (0.84)	-0.033 (-0.22)
EKL	0.612*** (8.42)	0.532*** (11.47)	0.812*** (6.25)	0.292* (1.97)	0.655*** (14.31)	0.881*** (16.46)	0.521*** (13.87)	0.327*** (4.05)	0.730*** (13.40)	0.410*** (7.94)	0.975*** (11.33)
BKL	1.072*** (22.29)	0.704*** (15.89)	1.515*** (13.76)	0.869*** (5.55)	0.796*** (16.75)	0.881*** (11.92)	0.429*** (7.74)	0.190* (1.97)	-0.708*** (9.72)	0.353*** (5.45)	1.116*** (11.31)
ACH	0.907*** (18.18)	0.644*** (17.12)	1.338*** (13.44)	1.085*** (8.72)	0.703*** (16.26)	0.798*** (12.28)	0.440*** (9.57)	0.267*** (3.17)	0.661*** (10.52)	0.369*** (6.66)	1.047*** (12.48)
SSM	0.699*** (13.99)	0.582*** (21.64)	1.047*** (11.41)	0.515*** (4.18)	0.637*** (20.40)	0.830*** (22.23)	0.448*** (13.63)	0.189** (2.62)	0.716*** (18.90)	0.406*** (9.77)	0.977*** (15.73)
WKL	0.652*** (8.21)	0.658*** (15.39)	1.047*** (7.90)	0.519*** (3.30)	0.665*** (12.35)	1.068*** (25.60)	0.578*** (14.66)	0.274*** (3.06)	0.932*** (22.11)	0.599*** (13.42)	1.169*** (14.03)
WTN	0.219*** (4.45)	0.311*** (11.71)	0.670*** (10.12)	0.659*** (9.41)	0.209*** (5.43)	0.391*** (9.13)	0.168*** (5.42)	-0.019 (-0.38)	0.398*** (11.33)	0.321*** (12.85)	0.359*** (5.66)

Note: t-statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

The cells in the blue color are those which are not cointegrated, based on the previous results on Appendix 5

Appendix 9c Long-run coefficient for all market pairs of red chilli market integration model 2 (continued)

	WJV	NSM	EJV	CJV	SSW	LPG	EKL	BKL	ACH	SSM	WKL	WTN
WSM	1.630*** (17.30)	0.999*** (21.41)	0.439*** (5.41)	0.493*** (5.06)	1.729*** (7.68)	0.186*** (3.03)	0.543*** (8.42)	0.725*** (22.29)	0.770*** (18.18)	0.828*** (13.99)	0.493*** (8.21)	0.556*** (4.45)
JBI	2.306*** (18.71)	1.081*** (11.19)	0.810*** (7.88)	0.813*** (6.88)	3.482*** (15.36)	0.247*** (2.90)	0.902*** (11.47)	0.908*** (15.89)	1.044*** (17.12)	1.316*** (21.64)	0.949*** (15.39)	1.503*** (11.17)
YOG	1.027*** (19.71)	0.476*** (11.26)	0.452*** (11.71)	0.498*** (10.22)	1.270*** (10.37)	0.208*** (6.06)	0.265*** (6.25)	0.376*** (13.76)	0.418*** (13.44)	0.456*** (11.41)	0.291*** (7.90)	0.624*** (10.12)
BALI	0.791*** (10.95)	0.351*** (7.21)	0.547*** (21.26)	0.643*** (20.39)	0.827*** (5.82)	0.354*** (15.48)	0.090* (1.97)	0.205*** (5.55)	0.321*** (8.72)	0.212*** (4.18)	0.136*** (3.30)	0.582*** (9.41)
RIAU	1.867*** (13.85)	1.091*** (14.23)	0.438*** (4.19)	0.355*** (2.77)	2.441*** (9.29)	0.045 (0.58)	0.900*** (14.31)	0.833*** (16.75)	0.924*** (16.26)	1.168*** (20.40)	0.778*** (12.35)	0.821*** (5.43)
SKL	1.346*** (11.58)	0.642*** (8.38)	0.371*** (4.58)	0.258** (2.56)	2.417*** (14.68)	-0.011 (-0.18)	0.744*** (16.46)	0.567*** (11.92)	0.645*** (12.28)	0.935*** (22.23)	0.769*** (25.60)	0.944*** (9.13)
CKL	1.607*** (7.37)	0.774*** (5.81)	0.396*** (2.97)	0.057 (0.35)	2.980*** (9.05)	-0.236** (-2.46)	1.103*** (13.87)	0.691*** (7.74)	0.890*** (9.57)	1.264*** (13.63)	1.041*** (14.66)	1.016*** (5.42)
NSW	0.479*** (2.85)	0.324*** (3.37)	0.128 (1.39)	0.019 (0.18)	0.718*** (2.76)	-0.030 (-0.47)	0.315*** (4.05)	0.139* (1.97)	0.264** (3.17)	0.243** (2.62)	0.224*** (3.06)	-0.052 (-0.38)
CSW	1.455*** (10.97)	0.629*** (7.00)	0.420*** (4.66)	0.331*** (2.97)	2.938*** (19.07)	0.006 (0.10)	0.764*** (13.40)	0.564*** (9.72)	0.662*** (10.52)	0.999*** (18.90)	0.831*** (22.11)	1.190*** (11.33)
ENT	1.334*** (6.35)	0.424*** (3.19)	0.582*** (4.93)	0.496*** (3.40)	3.233*** (11.92)	0.076 (0.84)	0.748*** (7.94)	0.489*** (5.45)	0.644*** (6.66)	0.988*** (9.77)	0.931*** (13.42)	1.671*** (12.85)
SESW	1.104*** (13.28)	0.508*** (8.79)	0.269*** (4.29)	0.190** (2.45)	1.535*** (9.97)	-0.010 (-0.22)	0.486*** (11.33)	0.424*** (11.31)	0.499*** (12.48)	0.650*** (15.73)	0496*** (14.03)	0.511*** (5.66)

Note: t-statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

The cells in the blue color are those which are not cointegrated, based on the previous results on Appendix 5

Appendix 9d Long-run coefficient for all market pairs of red chilli market integration model 2 (continued)

	WSM	JBI	YOG	BALI	RIAU	SKL	CKL	NSW	CSW	ENT	SESW
WSM		0.543*** (13.56)	1.255*** (14.01)	0.803*** (6.42)	0.638*** (15.56)	0.662*** (10.10)	0.334*** (7.17)	0.300*** (3.92)	0.483*** (7.34)	0.215*** (3.87)	0.829*** (9.45)
JBI	1.037*** (13.56)		1.787*** (15.10)	1.314*** (8.10)	0.854*** (14.39)	1.182*** (19.10)	0.588*** (10.40)	0.170 (1.54)	1.074*** (18.80)	0.701*** (12.66)	1.397*** (13.87)
YOG	0.461*** (14.01)	0.344 (15.10)		0.719*** (11.71)	0.307*** (9.67)	0.387*** (9.52)	0.166*** (5.56)	0.028 (0.58)	0.333 (8.88)	0.196*** 96.26)	0.456*** (8.14)
BALI	0.280*** (6.42)	0.240*** (8.10)	0.682*** (11.71)		0.157*** (4.19)	0.206*** (4.32)	0.056* (1.76)	0.001 (0.04)	0.197*** (4.63)	0.167*** (5.30)	0.221*** (3.49)
RIAU	0.987*** (15.56)	0.693*** (14.39)	1.292*** (9.67)	0.698*** (4.19)		1.004*** (15.19)	0.613*** (13.99)	0.338*** (3.52)	0.769*** (10.80)	0.375*** (5.72)	1.320*** (15.66)
SKL	0.630*** (10.10)	0.590*** (18.10)	1.003*** (9.52)	0.562*** (4.32)	0.616*** (15.19)		0.502*** (15.65)	0.246*** (3.24)	0.784*** (21.31)	0.485*** (12.11)	1.052*** (16.38)
CKL	0.795*** (7.17)	0.734*** (10.40)	1.075*** (5.56)	0.382* (1.72)	0.944*** (13.99)	1.258*** (15.65)		0.583*** (5.10)	0.945*** (10.62)	0.599*** (7.99)	1.661*** (16.29)
NSW	0.325*** (3.92)	0.096 (1.25)	0.082 (0.58)	0.005 (0.04)	0.236*** (3.52)	0.280*** (3.24)	0.265*** (5.10)		0.063 (0.79)	-0.047 (-0.78)	0.457*** (4.16)
CSW	0.569*** (7.34)	0.663*** (18.80)	1.069*** (8.88)	0.665*** (4.63)	0.586*** (10.80)	0.971*** (21.31)	0.467*** (10.62)	0.069 (0.79)		0.626*** (17.53)	1.075*** (17.21)
ENT	0.442*** (3.87)	0.755*** (12.66)	1.098*** (6.26)	0.986*** (5.30)	0.498*** (5.72)	1.046*** (12.11)	0.516*** (7.99)	-0.090 (-0.78)	1.091*** (17.53)		1.007*** (7.39)
SESW	0.465*** (9.45)	0.411*** (13.87)	0.696*** (8.14)	0.356*** (3.49)	0.479*** (15.66)	0.621*** (16.38)	0.391*** (16.29)	0.237*** (4.16)	0.512*** (13.21)	0.275*** (7.39)	

Note: t-statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

The cells in the blue color are those which are not cointegrated, based on the previous results on Appendix 5

Appendix 10a Short-run parameter for all market pairs of red chilli market integration model 2

	WJV	NSM	EJV	CJV	SSW	LPG	EKL	BKL	ACH	SSM	WKL	WTN
WJV		0.469 (0.92)	-0.031 (-0.94)	0.072 (1.58)	0.218 (1.18)	0.009 (0.31)	0.016 (0.33)	0.014 (0.38)	0.009 (0.23)	0.010 (0.15)	-0.100 (-1.26)	-0.047 (-0.82)
NSM	0.053 (0.40)		-0.044 (-0.84)	0.119 (0.112)	0.127 (0.42)	0.021 (0.44)	0.026 (0.33)	0.094 (1.55)	0.125* (1.83)	0.135 (1.16)	-0.037 (-0.28)	-0.088 (-0.96)
EJV	-0.148 (-0.72)	0.113 (0.90)		0.140 (1.34)	0.283 (0.62)	-0.012 (-0.18)	0.168 (1.35)	0.013 (0.15)	0.134 (1.33)	0.020 (0.11)	-0.007 (-0.04)	-0.139 (-0.99)
CJV	-0.162 (-1.10)	0.087 (0.97)	-0.109 (-1.89)		0.118 (0.36)	-0.0002 (-0.01)	0.073 (0.82)	0.023 (0.35)	0.091 (1.24)	-0.013 (-0.10)	-0.036 (-0.26)	-0.128 (-1.28)
SSW	0.010 (0.30)	-0.000 (-0.00)	-0.002 (-0.19)	0.040** (1.99)		0.004 (0.35)	-0.018 (-0.82)	0.004 (0.29)	-0.009 (-0.52)	-0.041 (-1.34)	-0.006 (-0.18)	-0.002 (-0.08)
LPG	0.077 (0.34)	0.362*** (2.65)	-0.117 (-1.29)	0.460*** (3.78)	0.468 (0.91)		0.054 (0.39)	0.105 (1.03)	0.325*** (2.90)	0.314 (1.62)	-0.137 (-0.62)	-0.112 (-0.72)
EKL	0.015 (0.12)	-0.033 (-0.41)	-0.002 (-0.05)	-0.007 (-0.11)	-0.448 (-1.47)	0.020 (0.42)		0.135** (2.24)	-0.038 (-0.56)	-0.071 (-0.62)	-0.174 (-1.37)	-0.173 (-1.88)
BKL	0.278 (1.51)	0.437*** (4.01)	-0.065 (-0.89)	0.104 (1.02)	0.711 (1.72)	0.034 (0.51)	-0.028 (-0.25)		0.175 (1.89)	0.406*** (2.63)	-0.066 (-0.37)	-0.225 (-1.79)
ACH	0.104 (0.64)	0.357*** (3.68)	-0.026 (-0.41)	0.218** (2.43)	0.088 (0.24)	0.013 (0.24)	-0.098 (-0.99)	0.127* (1.72)		0.180 (1.29)	0.006 (0.04)	-0.194* (-1.73)
SSM	0.162 (1.65)	0.216*** (3.66)	0.007 (0.19)	0.045 (0.82)	0.192 (0.85)	0.027 (0.78)	-0.036 (-0.59)	0.128*** (2.88)	0.081 (1.61)		0.029 (0.31)	-0.078 (-1.16)
WKL	0.281*** (3.33)	0.192*** (3.73)	0.062 (1.85)	0.086* (1.82)	-0.016 (-0.08)	0.031 (1.02)	-0.090 (-1.65)	0.121*** (3.13)	0.059 (1.34)	0.142* (1.89)		0.010 (0.16)
WTN	-0.081 (-0.68)	-0.012 (-0.16)	-0.068 (-1.43)	0.099 (1..49)	-0.503* (-1.87)	-0.007 (-0.18)	0.029 (0.40)	0.013 (0.24)	-0.037 (-0.61)	-0.052 (-0.51)	0.062 (0.54)	

Note: t statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

Appendix 10b Short-run parameter for all market pairs of red chilli market integration model 2 (continued)

	WSM	JBI	YOG	BALI	RIAU	SKL	CKL	NSW	CSW	ENT	SESW
WJV	0.043	0.021	-0.085	-0.085	0.014	0.057	0.004	-0.003	-0.109	-0.014	-0.175*
	(1.07)	(0.57)	(-1.54)	(-1.55)	(0.37)	(1.00)	(0.08)	(-0.09)	(-1.14)	(-0.52)	(-1.88)
NSM	0.152**	0.137**	0.015	-0.049	-0.013	-0.035	-0.006	-0.012	-0.164	0.008	-0.366**
	(2.30)	(2.26)	(0.18)	(-0.56)	(-0.22)	(-0.38)	(-0.08)	(-0.19)	(-1.04)	(0.18)	(-2.40)
EJV	0.132	0.061	-0.080	-0.321**	-0.055	0.042	0.013	0.047	-0.0006	-0.028	-0.028
	(1.33)	(0.67)	(-0.60)	(-2.40)	(0.58)	(0.30)	(0.11)	(0.48)	(-0.00)	(-0.42)	(-0.12)
CJV	0.040	0.022	-0.065	-0.118	0.062	0.007	0.0059	-0.023	-0.029	0.007	-0.205
	(0.56)	(0.33)	(-0.69)	(-1.20)	(0.93)	(0.07)	(0.07)	(-0.34)	(-0.17)	(0.15)	(-1.22)
SSW	0.005	-0.007	0.022	-0.003	-0.019	-0.071***	-0.047***	0.016	-0.035	0.010	-0.051
	(0.31)	(-0.43)	(0.92)	(-0.13)	(-1.15)	(-2.82)	(-2.11)	(0.95)	(-0.85)	(0.82)	(-1.22)
LPG	0.267**	0.229**	0.024	-0.052	0.113	0.241	0.087	0.090	-0.092	-0.004	-0.036
	(2.46)	(2.25)	(0.17)	(-0.34)	(1.08)	(1.51)	(0.62)	(0.83)	(-0.34)	(-0.06)	(-0.14)
EKL	-0.011	-0.070	-0.008	-0.019	0.003	-0.012	-0.049	-0.056	-0.300*	-0.003	-0.098
	(-0.16)	(-1.41)	(-0.10)	(-0.22)	(0.05)	(-0.14)	(-0.59)	(-0.87)	(-1.93)	(-0.08)	(-0.64)
BKL	0.297***	0.242***	0.030	-0.117	0..073	0.181	-0.009	-0.002	-0.197	-0.032	-0.060
	(3.34)	(2.98)	(0.25)	(-0.96)	(0.85)	(1.40)	(-0.09)	(-0.03)	(-0.91)	(-.052)	(-0.28)
ACH	0.194**	0.113	0.101	-0.094	-0.019	-0.078	-0.014	-0.084	-.0317*	-0.039	-0.442**
	(2.43)	(1.53)	(0.94)	(0.86)	(-0.26)	(-0.78)	(-0.14)	(-1.08)	(-1.68)	(-0.70)	(-2.37)
SSM	0.126***	0.054	0.102	-0.007	0.089	0.005	-0.003	0.0005	-0.136	-0.011	-0.047
	(21.64)	(1.19)	(1.59)	(-0.12)	(1.91)	(0.08)	(-0.06)	(0.01)	(-1.18)	(-0.33)	(-0.42)
WKL	0.117***	0.071*	0.141**	0.075	0.053	-0.071	-0.010	0.015	-0.050	0.022	0.034
	(2.80)	(1.78)	(2.54)	(1.32)	(1.31)	(-1.11)	(-0.18)	(0.38)	(-0.49)	(0.73)	(0.34)
WTN	0.048	0.020	0.010	-0.061	-0.017	-0.062	-0.065	0.002	-0.021	-0.041	0.036
	(0.81)	(0.38)	(0.13)	(-0.76)	(-0.31)	(-0.74)	(-0.86)	(0.04)	(-0.15)	(-1.03)	(0.26)

Note: t-statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

Appendix 10c Short-run parameter for all market pairs of red chilli market integration model 2 (continued)

	WJV	NSM	EJV	CJV	SSW	LPG	EKL	BKL	ACH	SSM	WKL	WTN
WSM	0.153	0.295***	-0.061	0.101	0.405***	-0.007	-0.038	0.140	0.124	0.234*	-0.100	-0.184*
	(0.94)	(3.04)	(-0.91)	(1.11)	(3.03)	(-0.13)	(-0.40)	(1.94)	(1.52)	(1.69)	(-0.63)	(-1.66)
JBI	0.016	0.125	-0.055	0.091	-0.114	-0.006	0.006	0.002	0.032	-0.010	-0.194	-0.189
	(0.09)	(1.12)	(-0.77)	(0.90)	(-0.28)	(-0.09)	(0.06)	(0.02)	(0.35)	(-0.07)	(-1.11)	(-1.50)
YOG	-0.044	0.082	-0.107**	0.125*	0.252***	-0.004	0.038	0.001	0.004	0.083	0.104	-0.177**
	(-0.36)	(1.10)	(-2.17)	(1.83)	(6.06)	(-0.11)	(0.51)	(0.02)	(0.07)	(0.79)	(0.89)	(-2.06)
BALI	0.089	0.138*	-0.037	0.105	0.326	0.028	0.205***	0.041	0.076	0.121	0.057	0.008
	(0.74)	(1.87)	(-0.77)	(1.60)	(1.21)	(0.66)	(5.55)	(0.76)	(1.26)	(1.17)	(0.49)	(0.11)
RIAU	0.152	0.299***	-0.008	0.133	0.298	0.007	-0.125	0.216	0.110	0.475***	0.397**	0.061
	(0.86)	(2.80)	(-0.12)	(1.36)	(0.72)	(0.12)	(-1.16)	(2.72)	(1.23)	(3.30)	(2.37)	(0.50)
SKL	0.010	0.101	0.013	0.011	-0.207	-0.0008	-0.196***	-0.029	-0.061	0.086	0.039	-0.128
	(0.09)	(1.40)	(0.28)	(0.17)	(-0.77)	(-0.02)	(-2.76)	(0.54)	(-1.02)	(0.86)	(0.36)	(-1.57)
CKL	0.774***	-0.149*	-0.018	-0.083	-0.255	-0.044	-0.123	-0.101	-0.163**	-0.529***	0.042	-0.156*
	(5.81)	(-1.83)	(0.35)	(-1.12)	(-0.83)	(-0.93)	(-1.48)	(-1.66)	(-2.43)	(-4.90)	(0.32)	(-1.69)
NSW	0.029	0.076	-0.005	0.106	-0.343	0.026	-0.106	-0.030	0.035	-0.003	-0.407**	-0.080
	(0.17)	(0.72)	(-0.08)	(1.12)	(-0.087)	(0.43)	(-1.01)	(-0.39)	(0.41)	(-0.02)	(-2.48)	(-0.68)
CSW	-0.040	0.027	-0.011	-0.018	-0.070	0.017	0.072	-0.010	0.038	-0.074	0.045	-0.048
	(-0.56)	(0.62)	(-0.42)	(-0.45)	(-0.42)	(0.69)	(1.64)	(-0.31)	(1.05)	(-1.20)	(0.64)	(-0.96)
ENT	-0.135	-0.065	-0.039	-0.014	-0.520	0.016	-0.078	-0.054	-0.057	-0.261	-0.123	-0.146
	(-0.57)	(-0.44)	(-0.42)	(-0.11)	(-0.97)	(0.19)	(-0.53)	(-0.50)	(-0.47)	(-1.28)	(-0.55)	(-0.88)
SESW	-0.013	-0.007	0.010	0.067*	-0.181	0.021	-0.087	0.056	0.029	0.044	0.093	-0.038
	(-0.18)	(-0.17)	(0.38)	(1.66)	(-1.09)	(0.82)	(-1.96)	(1.71)	(0.79)	(0.71)	(1.33)	(-0.76)

Note: t-statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

Appendix 10d Short-run parameter for all market pairs of red chilli market integration model 2 (continued)

	WSM	JBI	YOG	BALI	RIAU	SKL	CKL	NSW	CSW	ENT	SESW
WSM		0.173**	-0.009	-0.059	0.047	0.101	0.001	-0.032	-0.254	-0.006	-0.316*
		(2.40)	(-0.09)	(-0.55)	(0.64)	(0.89)	(0.02)	(-0.42)	(-1.34)	(-0.13)	(-1.72)
JBI	0.081		-0.011	-0.113	-0.020	-0.168	0.035	-0.074	-0.160	0.140**	-0.325
	(0.90)		(-0.10)	(-0.94)	(-0.24)	(-1.31)	(0.31)	(-0.86)	(-0.76)	(2.26)	(-1.57)
YOG	0.079	0.030		-0.213**	-0.005	0.042	0.017	-0.075	-0.065	-0.023	-0.098
	(1.35)	(0.57)		(-2.60)	(-0.10)	(0.49)	(0.22)	(-1.27)	(-0.45)	(-0.56)	(-0.69)
BALI	0.145**	0.114**	0.101		0.016	0.053	0.052	0.059	-0.019	-0.018	-0.089
	(2.52)	(2.14)	(1.32)		(0.30)	(0.63)	(0.70)	(1.03)	(-0.14)	(-0.45)	(-0.64)
RIAU	0.197**	0.199**	0.198*	0.144		0.046	0.069	-0.095	-0.311	-0.030	-0.257
	(2.26)	(2.48)	(1.73)	(1.23)		(0.37)	(0.64)	(-1.13)	(-1.49)	(-0.50)	(-1.28)
SKL	0.008	-0.052	0.038	0.054	-0.060		-0.033	-0.163	-0.104	-0.002	-0.215
	(0.15)	(-0.97)	(0.49)	(0.69)	(-1.09)		(-0.46)	(-2.98)	(-0.78)	(-0.07)	(-1.62)
CKL	-0.152**	-0.252	-0.074	-0.031	-0.180***	-0.089		-0.056	-0.491***	-0.016	-0.180
	(-2.32)	(-4.27)	(-0.86)	(-0.36)	(-2.81)	(-0.92)		(-0.88)	(-3.20)	(-0.35)	(-1.17)
NSW	0.007	-0.022	0.055	0.055	0.065	0.246**	0.029		-0.173	-0.026	0.188
	(0.09)	(-0.29)	(0.50)	(0.50)	(0.58)	(2.03)	(0.27)		(-0.85)	(-0.45)	(0.95)
CSW	0.003	-0.034	0.0008	-0.013	-0.009	0.018	-0.061	0.051		-0.046	-0.186**
	(0.10)	(-1.01)	(0.00)	(-0.28)	(-.028)	(0.34)	(-1.37)	(1.52)		-1.82	(-2.29)
ENT	-0.004	-0.052	-0.0001	-0.088	-0.040	-0.145	-0.133	0.021	-0.266		-0.088
	(-0.04)	(-0.48)	(-0.00)	(-0.55)	(-0.36)	(-0.87)	(-0.89)	(0.18)	(-1.00)		(-0.32)
SESW	-0.021	-0.020	-0.074	-0.013	-0.057*	-0.090*	-0.023	-0.011	-0.225***	-0.023	
	(0.58)	(-0.60)	(1.56)	(0.27)	(-1.66)	(-1.74)	(0.51)	(-0.34)	(-2.66)	(-0.93)	

Note: t-statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

Appendix 11a Speed adjustment of market pairs in red chilli market integration model 2

	WJV	NSM	EJV	CJV	SSW	LPG	EKL	BKL	ACH	SSM	WKL	WTN
WJV		-0.193*** (-2.83)	-0.069 (-1.25)	-0.120** (-2.34)	-0.190*** (-3.54)	-0.112** (-2.47)	-0.148*** (-3.12)	-0.279*** (-3.89)	-0.267*** (-3.47)	-0.185*** (-3.10)	-0.147*** (-2.98)	-0.118** (-2.47)
NSM	-0.059 (-0.92)		-0.069 (-1.61)	-0.082* (-1.95)	-0.139*** (-3.21)	-0.084** (-2.10)	-0.130*** (-2.92)	-0.143** (-1.99)	-0.075 (-0.94)	-0.125** (-2.25)	-0.105** (-2.73)	-0.092** (-2.93)
EJV	-0.247*** (-3.37)	-0.245*** (-4.05)		-0.738*** (-7.03)	-0.265*** (-4.49)	-0.366*** (-4.34)	-0.218*** (-4.08)	-0.247*** (-4.30)	-0.297*** (-4.53)	-0.231*** (-4.09)	-0.226*** (-4.11)	-0.244*** (-3.86)
CJV	-0.120** (-2.05)	-0.146*** (-2.88)	0.119 (1.22)		-0.160*** (-3.33)	-0.159*** (-3.25)	-0.143*** (-3.190	-0.154*** (-3.24)	-0.155*** (-2.90)	-0.141*** (-3.06)	-0.143*** (-3.15)	-0.138*** (-2.71)
SSW	-0.053 (-1.35)	-0.042 (-1.26)	-0.028 (-0.86)	-0.041 (-1.36)		-0.046 (-1.58)	-0.110*** (-2.89)	-0.064* (-1.79)	-0.050 (-1.31)	-0.099** (-2.29)	-0.140*** (-3.08)	-0.073* (-1.86)
LPG	-0.108** (-2.29)	-0.127*** (-2.93)	0.020 (0.31)	-0.223** (-2.38)	0.127*** (-3.04)		-0.135*** (-3.11)	-0.126*** (-2.97)	-0.128*** (-2.92)	-0.134*** (-3.22)	-0.125*** (-2.95)	-0.125*** (-2.87)
EKL	-0.103*** (-2.77)	-0.112*** (-2.99)	-0.079** (-2.51)	-0.076** (-2.43)	-0.123*** (-3.00)	-0.079** (-2.46)		-0.124*** (-3.19)	-0.124*** (-3.18)	-0.241*** (-4.51)	-0.212*** (-3.73)	-0.089** (-2.61)
BKl	-0.069 (-0.99)	-0.135* (-1.91)	-0.053 (-1.27)	-0.060 (-1.47)	-0.128*** (-2.74)	-0.066* (-1.70)	-0.118** (-2.46)		-0.136* (-1.93)	-0.188*** (-2.79)	-0.105** (-2.16)	-0.065 (-1.64)
ACH	-0.152** (-2.13)	-0.167** (-2.21)	-0.071 (-1.52)	-0.083* (-1.92)	-0.178*** (-3.71)	-0.084** (-2.12)	-0.134 (-2.96)	-0.168** (-2.48)		-0.158*** (-2.64)	-0.127*** (-2.68)	-0.091** (-2.25)
SSM	-0.021 (-0.52)	-0.024 (-0.65)	-0.028 (-0.98)	-0.028 (-1.05)	-0.106** (-2.60)	-0.032 (-1.20)	-0.083* (-1.78)	-0.037 (-0.78)	-0.050 (-1.12)		-0.120** (-2.27)	-0.037 (-1.20)
WKL	-0.025 (-1.15)	-0.022 (-1.08)	-0.015 (-0.80)	-0.009 (-0.53)	-0.056 (-1.83)	-0.007 (-0.38)	-0.084** (-2.33)	-0.032 (-1.41)	-0.039 (-1.60)	-0.099*** (-2.63)		-0.016 (-0.67)
WTN	-0.196*** (-3.43)	-0.159*** (-3.17)	-0.130** (-2.24)	-0.163*** (-3.00)	-0.241*** (-3.79)	-0.136*** (-2.65)	-0.187*** (-3.50)	-0.191*** (-3.73)	-0.192*** (-3.58)	-0.213*** (-3.86)	-0.259 (-4.41)	

Note: t-statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

High speed adjustment is in red color with coefficient range from: < - 0.200

Moderate speed adjustment in green color with coefficient range from : - 0.100 to 0.200

Low speed adjustment in yellow color with coefficient range form : > - 0.100

Appendix 11b Speed adjustment of market pairs in red chilli market integration model 2

	WSM	JBI	YOG	BALI	RIAU	SKL	CKL	NSW	CSW	ENT	SESW
WJV	-0.239*** (-3.40)	-0.313*** (-4.28)	-0.129 (-1.64)	-0.116** (-2.13)	-0.202*** (-3.33)	-0.215*** (-3.96)	-0.151*** (-3.24)	-0.121*** (-2.92)	-0.187*** (-3.51)	-0.162*** (-3.59)	-0.183*** (-3.13)
NSM	-0.090 (-1.18)	-0.134*** (-2.68)	-0.053 (-1.02)	-0.087* (-1.98)	-0.085 (-1.44)	-0.114** (-2.52)	-0.108** (-2.60)	-0.104*** (-2.69)	-0.119*** (-2.77)	-0.110*** (-2.87)	-0.093** (-2.04)
EJV	-0.244*** (-4.27)	-0.296*** (-4.80)	-0.257*** (-3.44)	-0.408*** (-3.81)	-0.232*** (-4.17)	-0.244*** (-4.35)	-0.225*** (-4.14)	-0.214*** (-4.00)	-0.244*** (-4.34)	-0.258*** (-4.56)	-0.226*** (-4.01)
CJV	-0.150*** (-3.10)	-0.170*** (-3.41)	-0.109* (-1.83)	-0.203** (-2.25)	-0.146*** (-3.19)	-0.150*** (-3.29)	-0.142*** (-3.17)	-0.141*** (-3.12)	-0.152*** (-3.30)	-0.160*** (-3.45)	-0.131*** (-2.83)
SSW	-0.061* (-1.81)	-0.122** (-2.63)	-0.068* (-1.78)	-0.038 (-1.20)	-0.077** (-2.14)	-0.154*** (-3.53)	-0.078*** (-2.21)	-0.048* (-1.66)	-0.222*** (-4.28)	-0.115*** (-2.84)	-0.069* (-1.87)
LPG	-0.128*** (-3.06)	-0.131*** (-3.13)	-0.114** (-2.44)	-0.195*** (-2.81)	-0.127*** (-3.04)	-0.124*** (-3.01)	-0.132*** (-3.10)	-0.131*** (-3.13)	-0.124*** (-2.97)	-0.126*** (-3.03)	-0.124*** (-2.95)
EKL	-0.106*** (-2.79)	-0.134*** (3.12)	-0.090** (-2.57)	-0.078** (-2.46)	-0.165*** (-3.38)	-0.221*** (-4.21)	-0.187*** (-3.95)	-0.072** (-2.19)	-0.147*** (-3.22)	-0.111*** (-2.98)	-0.147*** (-3.47)
BKL	-0.139* (-1.77)	-0.188*** (-3.20)	-0.021 (-0.38)	-0.062 (-1.50)	-0.081 (-1.20)	-0.135** (-2.59)	-0.084* (-1.84)	-0.074* (-1.92)	-0.120** (-2.61)	-0.107** (-2.58)	-0.119** (-2.28)
ACH	-0.144** (-2.16)	-0.231*** (-3.62)	-0.065 (-1.16)	-0.103** (-2.26)	-0.112* (-1.80)	-0.131** (-2.49)	-0.135*** (-2.88)	-0.099** (-2.61)	-0.158*** (-3.32)	-0.135*** (-3.22)	-0.110** (-2.10)
SSM	-0.027 (-0.67)	-0.154*** (-2.82)	-0.024 (-0.67)	-0.029 (-1.05)	-0.0008 (-0.01)	-0.080 (-1.42)	-0.052 (-1.26)	-0.031 (-1.13)	-0.091* (-1.83)	-0.087** (-2.52)	-0.070 (-1.58)
WKL	-0.026 (-1.18)	-0.061** (-2.04)	-0.015 (-0.72)	-0.012 (-0.66)	-0.026 (-0.96)	-0.104** (-2.30)	-0.056* (-1.82)	-0.014 (-0.75)	-0.093** (02.41)	-0.054* (-1.92)	-0.030 (-1.06)
WTN	-0.181*** (-3.55)	-0.291*** (-4.64)	-0.242*** (-3.89)	-0.154** (-2.50)	-0.176*** (-3.32)	-0.257*** (-4.37)	-0.190*** (-3.57)	-0.143*** (-2.92)	-0.291*** (-4.53)	-0.374*** (-5.43)	-0.168*** (-3.17)

Note: t-statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

High speed adjustment is in red color with coefficient range from: < - 0.200

Moderate speed adjustment in green color with coefficient range from : - 0.100 to 0.200

Low speed adjustment in yellow color with coefficient range form : > - 0.100

Appendix 11c Speed adjustment of market pairs in red chilli market integration model 2

	WJV	NSM	EJV	CJV	SSW	LPG	EKL	BKL	ACH	SSM	WKL	WNT
WSM	-0.083 (-1.18)	-0.180** (-2.26)	-0.070 (-1.60)	-0.079* (-1.83)	-0.147*** (-3.19)	-0.081* (-1.95)	-0.159*** (-3.32)	-0.224*** (-2.72)	-0.143* (-1.97)	-0.185*** (-3.08)	-0.136*** (-2.84)	-0.084** (-2.00)
JBI	0.041 (0.66)	-0.006 (-0.14)	-0.004 (-0.11)	-0.020 (-0.55)	-0.133** (-2.50)	-0.033 (-0.96)	-0.095** (-2.07)	-0.051 (-0.95)	-0.000 (-0.00)	-0.075 (-1.12)	-0.124** (-2.38)	-0.056 (-1.27)
YOG	-0.350*** (-3.57	-0.278*** (-4.04)	-0.124* (-1.73)	-0.215*** (-3.24)	-0.284*** (-4.35)	-0.167*** (-2.87)	-0.224*** (-3.97)	-0.369*** (-5.04)	-0.350*** (-4.66)	-0.288*** (-4.22)	-0.255*** (-4.33)	-0.152** (-2.31)
BALI	-0.221*** (-3.24)	-0.205*** (-3.52)	-0.130 (-1.24)	-0.406*** (-4.22)	-0.222*** (-4.08)	-0.259*** (-3.12)	-0.185*** (-3.75)	-0.207*** (-3.82)	-0.221*** (-3.58)	-0.198*** (-3.77)	-0.196*** (-3.79)	-0.236*** (-3.75)
RIAU	-0.165*** (-3.08)	-0.180*** (-3.41)	-0.089*** (-2.41)	-0.090** (-2.55)	-0.136*** (-3.12)	-0.091*** (-2.61)	-0.195*** (-3.64)	-0.213*** (-3.54)	-0.176*** (-3.00)	-0.250*** (-3.75)	-0.157*** (-3.24)	-0.096** (-2.53)
SKL	-0.096** (-2.30)	-0.083** (-2.31)	-0.056* (-1.77)	-0.051* (-1.69)	-0.115** (-2.48)	-0.052* (-1.75)	-0.120** (-2.42)	-0.110*** (-2.65)	-0.117*** (-2.74)	-0.237*** (-3.89)	-0.375*** (-5.71)	-0.073* (-1.97)
CKL	-0.053** (-2.17)	-0.062*** (-2.66)	-0.038* (-1.74)	-0.039* (-1.85)	-0.062** (-2.33)	-0.041** (-1.89)	-0.073** (-2.24)	-0.078*** (-3.09)	-0.081*** (-3.03)	-0.089*** (-2.92)	-0.069** (-2.02)	-0.033 (-1.42)
NSW	-0.116*** (-2.81)	-0.123*** (-2.97)	-0.120*** (-2.96)	-0.124*** (-3.09)	-0.120*** (-2.93)	-0.124*** (-3.09)	-0.130*** (-3.09)	-0.123*** (-3.03)	-0.126*** (-3.04)	-0.127*** (-3.10)	-0.129*** (-3.19)	-0.123*** (-3.07)
CSW	-0.041* (-1.85)	-0.022 (-1.19)	-0.015 (-0.90)	-0.012 (-0.74)	-0.063** (-2.04)	-0.010 (-0.67)	-0.037 (-1.52)	-0.033 (-1.62)	-0.029 (-1.36)	-0.089*** (-2.91)	-0.072** (-2.12)	-0.035 (-1.55)
ENT	-0.147*** (-3.16)	-0.116 (-2.73)	-0.126*** (-2.82)	-0.115*** (-2.68)	-0.273*** (-4.82)	-0.110*** (-2.65)	-0.178*** (-3.62)	-0.133*** (-2.97)	-0.144*** (-3.06)	-0.188*** (-3.63)	-0.286*** (-4.85)	-0.256*** (-4.24)
SESW	-0.100*** (-2.75)	-0.083*** (-2.79)	-0.043* (-1.71)	-0.043* (-1.80)	-0.091*** (-2.97)	-0.041* (-1.72)	-0.070** (-2.15)	-0.097*** (-2.98)	-0.104*** (-3.00)	-0.102** (-2.59)	-0.092** (-2.54)	-0.046* (-1.78)

Note: t-statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

High speed adjustment is in red color with coefficient range from: < - 0.200

Moderate speed adjustment in green color with coefficient range from : - 0.100 to 0.200

Low speed adjustment in yellow color with coefficient range form : > - 0.100

Appendix 11d Speed adjustment of market pairs in red chilli market integration model 2

	WSM	JBI	YOG	BALI	RIAU	SKL	CKL	NSW	CSW	ENT	SESW
WSM		-0.188*** (-3.28)	-0.007 (-0.12)	-0.075* (-1.66)	-0.161** (-2.46)	-0.168*** (-3..32)	-0.133*** (-2.89)	-0.112*** (-2.68)	-0.136*** (-2.96)	-0.125*** (-3.02)	-0.126** (-2.52)
JBI	-0.013 (-0.26)		0.042 (0.81)	-0.015 (-0.40)	-0.060 (-1.14)	-0.155*** (-2.65)	-0.092** (-2.06)	-0.044 (-1.33)	-0.184*** (-3.03)	-0.179*** (-3.76)	0.098* (-1.96)
YOG	-0.363*** (-4.85)	-0.428*** (-5.65)		-0.144** (-2.03)	-0.262*** (-4.05)	-0.282*** (-4.49)	-0.205*** (-3.65)	-0.171*** (-3.35)	-0.269*** (-4.35)	-0.249*** (-4.39)	-0.226*** (-3.70)
BALI	-0.214*** (-3.90)	-0.251*** (-4.34)	-0.244*** (-3.53)		-0.188*** (-3.54)	-0.207*** (-3.93)	-0.185*** (-3.65)	-0.182*** (-3.64)	-0.211*** (-3.97)	-0.234*** (-4.33)	-0.186*** (-3.56)
RIAU	-0.211*** (-3.68)	-0.204*** (-3.78)	-0.128*** (-2.85)	-0.093** (-2.54)		-0.162*** (-2.90)	-0.187*** (-3.57)	-0.092** (-2.56)	-0.130*** (-2.80)	-0.119*** (-3.11)	-0.164*** (-2.92)
SKL	-0.084** (-2.17)	-0.195*** (-3.65)	-0.067* (-1.77)	-0.057* (-1.80)	-0.133*** (-2.73)		-0.140*** (-2.83)	-0.040 (-1.34)	-0.250*** (-4.30)	-0.132*** (-3.10)	-0.151 (-3.06)
CKL	-0.064** (-2.62)	-0.069** (-2.56)	-0.047** (-2.00)	-0.037* (-1.77)	-0.113*** (-3.51)	-0.076** (-2.12)		-0.034 (-1.49)	-0.057** (-2.09)	-0.040 (-1.54)	-0.073** (-2.03)
NSW	-0.124** (-2.92)	-0.123*** (-3.04)	-0.122*** (-3.05)	-0.123*** (-3.07)	-0.134*** (-3.21)	-0.127*** (-3.11)	-0.147*** (-3.38)		0.121*** (-3.03)	-0.123*** (-3.06)	-0.127*** (-3.01)
CSW	-0.025 (-1.35)	-0.096*** (-3.08)	-0.036* (-1.80)	-0.016 (-0.96)	-0.043* (-1.97)	-0.093*** (-2.74)	-0.030 (-1.38)	-0.010 (-0.64)		-0.025 (-0.85)	-0.049** (-2.10)
ENT	-0.120*** (-2.77)	-0.242*** (-4.15)	-0.143*** (-3.09)	-0.128*** (-2.83)	-0.142*** (-3.11)	-0.266*** (-4.66)	-0.187*** (-3.76)	-0.111*** (-2.66)	-0.373*** (-5.47)		-0.163*** (-3.40)
SESW	-0.098*** (-3.21)	-0.118*** (-3.20)	-0.066** (-2.30)	-0.045* (-1.84)	-0.109*** (-2.74)	-0.110 (-2.75)	-0.113*** (-2.80)	-0.059** (-2.35)	-0.054 (-1.57)	-0.049* (-1.77)	

Note: t-statistic in parentheses

**** is significant at 99%, ** is significant at 95% and * is significant at 90%.*

High speed adjustment is in red color with coefficient range from: < - 0.200

Moderate speed adjustment in green color with coefficient range from : - 0.100 to 0.200

Low speed adjustment in yellow color with coefficient range form : > - 0.100

Appendix 12 Description of factors influence market integration model 2

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)		(9)		(10)	(11)	(12)	(13)	(14)	(15)
WJV	NSM	2,120	32	land & sea	Yes	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
WJV	EJV	686	12	land	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
WJV	CJV	373	6.5	land	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
WJV	SSW	1,495	57	land & sea	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
WJV	LPG	374	6	land & sea	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
WJV	EKL	1,734	54	land & sea	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
WJV	BKL	946	15	land & sea	Yes	3,979	62.49	2,913	46.01	2,232	33.96	1,695	31,495	14	139	454	143
WJV	ACH	2,725	41	land & sea	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
WJV	SSM	747	11	land & sea	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
WJV	WKL	944	46	land & sea	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
WJV	WNT	1,251	26	land & sea	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
WJV	WSM	1,492	23.5	land & sea	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
WJV	JBI	1,024	15	land & sea	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
WJV	YOG	397	7.5	land	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
WJV	BALI	1,096	19	land & sea	Yes	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
WJV	RIAU	1,479	22	land & sea	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
WJV	SKL	1,479	22	land & sea	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
WJV	CKL	1,197	44	land & sea	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
WJV	NSW	3,202	84	land & sea	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
WJV	CSW	2,381	71	land & sea	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
WJV	ENT	2,469	84	land & sea	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
WJV	SESW	2,482	72	land & sea	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
NSM	EJV	2,761	42	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
NSM	CJV	2,448	37	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
NSM	SSW	3,570	88	land & sea(2)	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
NSM	LPG	1,750	26	land	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
NSM	EKL	3,809	84	land & sea	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
NSM	BKL	1,387	22	land	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
NSM	ACH	608	9	land	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
NSM	SSM	1,373	21	land	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
NSM	WKL	2,772	75	land & sea(2)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
NSM	WNT	3,326	57	land & sea(2)	No	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
NSM	WSM	752	12.5	land	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
NSM	JBI	1,099	17	land	No	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
NSM	YOG	2,516	39	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
NSM	BALI	3,171	50	land & sea	No	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
NSM	RIAU	660	10	land	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
NSM	SKL	3,466	78	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
NSM	CKL	3,271	75	land & sea(2)	No	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
NSM	NSW	5,277	115	land & sea(2)	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
NSM	CSW	4,455	101	land & sea(2)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
NSM	ENT	4,544	114	land & sea(5)	No	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
NSM	SESW	4,556	103	land & sea(2)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
EJV	WJV	686	12	land	Yes	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
EJV	NSM	2,761	42	land & sea	Yes	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
EJV	CJV	312	5	land	Yes	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
EJV	SSW	824	46	land & sea	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
EJV	LPG	1,013	16.5	land & sea	Yes	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
EJV	EKL	1,063	42	land & sea	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
EJV	BKL	1,585	26	land & sea	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
EJV	ACH	3,364	51	land & sea	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
EJV	SSM	1,386	22	land & sea	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
EJV	WKL	1,172	53	land & sea	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
EJV	WNT	570	15	land & sea(2)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
EJV	WSM	2,130	34	land & sea	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
EJV	JBI	1,663	26	land & sea	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
EJV	YOG	331	6	land	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
EJV	BALI	416	7.5	land & sea	Yes	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
EJV	RIAU	2,118	32	land & sea	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
EJV	SKL	852	37	land & sea	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
EJV	CKL	769	35	land & sea	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
EJV	NSW	2,531	73	land & sea	Yes	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
EJV	CSW	1,709	59	land & sea	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
EJV	ENT	1,789	72	land & sea(6)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
EJV	SESW	1,810	61	land & sea	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
SSW	NSM	3,570	88	land & sea(2)	No	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
SSW	EJV	824	46	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
SSW	CJV	1,122	50	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
SSW	LPG	1,824	62	land & sea(2)	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
SSW	EKL	728	30	land & sea	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
SSW	BKL	2,396	71	land & sea(2)	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
SSW	ACH	4,174	97	land & sea(2)	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
SSW	SSM	2,197	67	land & sea(2)	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
SSW	WKL	2,237	63	land & sea	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
SSW	WNT	821	44	land & sea(2)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
SSW	WSM	2,941	79	land & sea(2)	No	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
SSW	JBI	2,473	71	land & sea(2)	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
SSW	YOG	1,141	51	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
SSW	BALI	846	47	land & sea(2)	No	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
SSW	RIAU	2,929	78	land & sea(2)	No	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
SSW	SKL	766	32	land & sea	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
SSW	CKL	960	35	land & sea	No	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
SSW	NSW	1,713	27	land	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
SSW	CSW	891	14	land	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
SSW	ENT	821	44	land & sea(2)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
SSW	SESW	992	16	land	No	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
CJV	EJV	312	5	land	Yes	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
CJV	SSW	1,122	50	land & sea	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
CJV	LPG	705	11	land & sea	Yes	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
CJV	EKL	1,361	47	land & sea	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
CJV	BKL	1,276	20	land & sea	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
CJV	ACH	3,055	46	land & sea	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
CJV	SSM	1,077	17	land & sea	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
CJV	WKL	865	48	land & sea	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
CJV	WNT	877	20	land & sea(2)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
CJV	WSM	1,822	29	land & sea	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
CJV	JBI	1,354	21	land & sea	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
CJV	YOG	132	3	land	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
CJV	BALI	723	12.5	land & sea	Yes	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
CJV	RIAU	1,809	27	land & sea	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
CJV	SKL	1,019	41	land & sea	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
CJV	CKL	824	38	land & sea	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
CJV	NSW	2,829	78	land & sea	Yes	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
CJV	CSW	2,007	64	land & sea	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
CJV	ENT	2,096	77	land & sea(6)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
CJV	SESW	2,108	66	land & sea	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
LPG	WJV	374	6	land & sea	No	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
LPG	NSM	1,750	26	land	No	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
LPG	EJV	1,013	16.5	land & sea	Yes	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
LPG	CJV	705	11	land & sea	Yes	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
LPG	SSW	1,824	62	land & sea(2)	No	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
LPG	EKL	2,067	58	land & sea(3)	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
LPG	BKL	571	10	land	No	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
LPG	ACH	2,352	35	land	No	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
LPG	SSM	375	6	land	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
LPG	WKL	1,030	49	land & sea(3)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
LPG	WNT	1,583	31	land & sea(3)	No	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
LPG	WSM	1,120	18	land	No	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
LPG	JBI	651	10	land	No	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
LPG	YOG	773	13	land	No	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
LPG	BALI	1,428	24	land & sea(2)	Yes	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
LPG	RIAU	1,107	16.5	land	No	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
LPG	SKL	1,723	52	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
LPG	CKL	1,529	49	land & sea(2)	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
LPG	NSW	3,534	89	land & sea(2)	Yes	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
LPG	CSW	2,713	76	land & sea(2)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
LPG	ENT	2,802	89	land & sea(7)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
LPG	SESW	2,814	77	land & sea(2)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
EKL	EJV	1,063	42	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
EKL	CJV	1,361	47	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
EKL	SSW	728	30	land & sea	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
EKL	LPG	2,067	58	land & sea(3)	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
EKL	BKL	2,634	67	land & sea(3)	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
EKL	ACH	4,413	93	land & sea(3)	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
EKL	SSM	2,435	63	land & sea(3)	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
EKL	WKL	2,014	41	land & sea	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
EKL	WNT	1,628	57	land & sea(4)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
EKL	WSM	3,180	75	land & sea(3)	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
EKL	JBI	2,712	67	land & sea(3)	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
EKL	YOG	1,380	47	land & sea(2)	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
EKL	BALI	1,473	77	land & sea(3)	No	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
EKL	RIAU	3,167	74	land & sea(3)	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
EKL	SKL	606	10	land & sea	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
EKL	CKL	737	12.5	land & sea	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
EKL	NSW	1,403	38	land & sea	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
EKL	CSW	502	23	land & sea	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
EKL	ENT	1,895	83	land & sea(5)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
EKL	SESW	1,247	37	land & sea	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
BKL	NSM	1,387	22	land	Yes	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
BKL	EJV	1,585	26	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
BKL	CJV	1,276	20	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
BKL	SSW	2,396	71	land & sea(2)	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
BKL	LPG	571	10	land	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
BKL	EKL	2,634	67	land & sea(3)	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
BKL	ACH	1,991	31	land & sea	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
BKL	SSM	450	7	land	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
BKL	WKL	1,604	58	land & sea(3)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
BKL	WNT	2,157	40	land & sea(3)	No	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
BKL	WSM	713	11	land	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
BKL	JBI	449	8.5	land	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
BKL	YOG	1,347	22	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
BKL	BALI	2,002	33	land & sea	No	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
BKL	RIAU	758	12.5	land	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
BKL	SKL	2,297	61	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
BKL	CKL	2,103	58	land & sea(2)	No	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
BKL	NSW	4,108	98	land & sea(2)	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
BKL	CSW	3,287	85	land & sea(2)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
BKL	ENT	3,376	98	land & sea(7)	No	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
BKL	SESW	3,388	87	land & sea(2)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
ACH	WJV	2,725	41	land & sea	Yes	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
ACH	NSM	608	9	land	Yes	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
ACH	EJV	3,364	51	land & sea	Yes	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
ACH	CJV	3,055	46	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
ACH	SSW	4,174	97	land & sea(2)	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
ACH	LPG	2,352	35	land	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
ACH	EKL	4,413	93	land & sea(3)	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
ACH	BKL	1,991	31	land & sea	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
ACH	SSM	1,997	30	land	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
ACH	WKL	3,376	83	land & sea(3)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
ACH	WNT	3,929	66	land & sea(3)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
ACH	WSM	1,355	22	land	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
ACH	JBI	1,703	26	land	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
ACH	YOG	3,119	47	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
ACH	BALI	3,775	59	land & sea(2)	Yes	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
ACH	RIAU	1,264	19	land	No	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
ACH	SKL	4,070	87	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
ACH	CKL	3,875	84	land & sea(2)	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
ACH	NSW	5,881	124	land & sea(2)	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
ACH	CSW	5,059	110	land & sea(2)	No	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
ACH	ENT	5,148	123	land & sea(7)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
ACH	SESW	5,160	112	land & sea(2)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
SSM	EJV	1,386	22	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
SSM	CJV	1,077	17	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
SSM	SSW	2,197	67	land & sea(2)	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
SSM	LPG	375	6	land	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
SSM	EKL	2,435	63	land & sea(3)	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
SSM	BKL	450	7	land	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
SSM	ACH	1,997	30	land	No	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
SSM	WKL	1,402	54	land & sea(3)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
SSM	WNT	1,955	37	land & sea(3)	No	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
SSM	WSM	796	12.5	land	No	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
SSM	JBI	278	4	land	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
SSM	YOG	1,146	18	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
SSM	BALI	1,801	29	land & sea(2)	No	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
SSM	RIAU	734	11	land	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
SSM	SKL	2,096	58	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
SSM	CKL	1,901	55	land & sea(2)	No	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
SSM	NSW	3,907	94	land & sea(2)	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
SSM	CSW	3,085	81	land & sea(2)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
SSM	ENT	3,174	94	land & sea(7)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
SSM	SESW	3,186	83	land & sea(2)	No	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
WKL	NSM	2,772	75	land & sea(2)	No	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
WKL	EJV	1,172	53	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
WKL	CJV	865	48	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
WKL	SSW	2,237	63	land & sea	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
WKL	LPG	1,030	49	land & sea(3)	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
WKL	EKL	2,014	41	land & sea	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
WKL	BKL	1,604	58	land & sea(3)	No	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
WKL	ACH	3,376	83	land & sea(3)	No	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
WKL	SSM	1,402	54	land & sea(3)	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
WKL	WNT	1,739	68	land & sea(3)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
WKL	WSM	2,145	66	land & sea(3)	No	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
WKL	JBI	1,677	58	land & sea(3)	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
WKL	YOG	991	51	land & sea	No	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
WKL	BALI	1,584	61	land & sea(2)	No	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
WKL	RIAU	2,132	65	land & sea(3)	No	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
WKL	SKL	1,473	31	land	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
WKL	CKL	1,226	253	land	No	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
WKL	NSW	3,069	576	land & sea(2)	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
WKL	CSW	2,181	393	land & sea(2)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
WKL	ENT	2,725	251	land & sea(7)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
WKL	SESW	3,015	73	land & sea(2)	No	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
WNT	WJV	1,251	26	land & sea	Yes	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
WNT	NSM	3,326	57	land & sea(2)	Yes	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
WNT	EJV	570	15	land & sea(2)	Yes	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
WNT	CJV	877	20	land & sea(2)	Yes	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
WNT	SSW	821	44	land & sea(2)	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
WNT	LPG	1,583	31	land & sea(3)	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
WNT	EKL	1,628	57	land & sea(4)	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
WNT	BKL	2,157	40	land & sea(3)	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
WNT	ACH	3,929	66	land & sea(3)	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
WNT	SSM	1,955	37	land & sea(3)	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
WNT	WKL	1,739	68	land & sea(3)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
WNT	WSM	2,529	295	land & sea(3)	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
WNT	JBI	2,233	40	land & sea(3)	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
WNT	YOG	851	20	land & sea(2)	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
WNT	BALI	164	7.5	land & sea	Yes	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
WNT	RIAU	2,689	47	land & sea(3)	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
WNT	SKL	1,423	51	land & sea(3)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
WNT	CKL	1,340	49	land & sea(3)	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
WNT	NSW	2,534	71	land & sea(2)	Yes	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
WNT	CSW	1,712	58	land & sea(2)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
WNT	ENT	1,358	62	land & sea(5)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
WNT	SESW	1,814	60	land & sea(2)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
WSM	EJV	2,130	34	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
WSM	CJV	1,822	29	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
WSM	SSW	2,941	79	land & sea(2)	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
WSM	LPG	1,120	18	land	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
WSM	EKL	3,180	75	land & sea(3)	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
WSM	BKL	713	11	land	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
WSM	ACH	1,355	22	land	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
WSM	SSM	1,402	54	land & sea(3)	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
WSM	WKL	2,145	66	land & sea(3)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
WSM	WNT	2,529	295	land & sea(3)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
WSM	JBI	528	10	land	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
WSM	YOG	1,885	30	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
WSM	BALI	2,541	41	land & sea	Yes	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
WSM	RIAU	308	5	land	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
WSM	SKL	2,836	70	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
WSM	CKL	2,641	67	land & sea(2)	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
WSM	NSW	4,647	106	land & sea(2)	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
WSM	CSW	2,641	67	land & sea(2)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
WSM	ENT	3,914	106	land & sea(7)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
WSM	SESW	3,926	95	land & sea(2)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
JBI	NSM	1,099	17	land	No	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
JBI	EJV	1,663	26	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
JBI	CJV	1,354	21	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
JBI	SSW	2,473	71	land & sea(2)	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
JBI	LPG	651	10	land	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
JBI	EKL	2,712	67	land & sea(3)	No	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
JBI	BKL	449	8.5	land	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
JBI	ACH	1,703	26	land	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
JBI	SSM	278	4	land	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
JBI	WKL	1,677	58	land & sea(3)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
JBI	WNT	2,233	40	land & sea(3)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
JBI	WSM	528	10	land	No	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
JBI	YOG	1,421	22	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
JBI	BALI	2,076	33	land & sea(2)	No	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
JBI	RIAU	460	7	land	No	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
JBI	SKL	2,371	61	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
JBI	CKL	2,177	59	land & sea(2)	No	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
JBI	NSW	4,182	98	land & sea(2)	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
JBI	CSW	3,361	85	land & sea(2)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
JBI	ENT	3,450	98	land & sea(7)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
JBI	SESW	3,462	87	land & sea(2)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
YOG	WJV	397	7.5	land	Yes	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
YOG	NSM	2,516	39	land & sea	No	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
YOG	EJV	331	6	land	Yes	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
YOG	CJV	132	3	land	Yes	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
YOG	SSW	1,141	51	land & sea	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
YOG	LPG	773	13	land	Yes	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
YOG	EKL	1,380	47	land & sea(2)	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
YOG	BKL	1,347	22	land & sea	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
YOG	ACH	3,119	47	land & sea	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
YOG	SSM	1,146	18	land & sea	No	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
YOG	WKL	991	51	land & sea	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
YOG	WNT	851	20	land & sea(2)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
YOG	WSM	1,885	30	land & sea	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
YOG	JBI	1,421	22	land & sea	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
YOG	BALI	691	13	land & sea	Yes	5,554	78.16	3,534	50.10	1,584	22.15	3,366	12,546	85	111	1362	1482
YOG	RIAU	1,876	29	land & sea	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
YOG	SKL	1,169	42	land & sea	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
YOG	CKL	1,087	40	land & sea	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
YOG	NSW	2,848	78	land & sea	Yes	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
YOG	CSW	2,026	65	land & sea	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
YOG	ENT	2,064	77	land & sea(6)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
YOG	SESW	2,128	67	land & sea	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
BALI	WJV	1,096	19	land & sea	Yes	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
BALI	NSM	3,171	50	land & sea	Yes	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
BALI	EJV	416	7.5	land & sea	Yes	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
BALI	CJV	723	12.5	land & sea	Yes	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
BALI	SSW	846	47	land & sea(2)	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
BALI	LPG	1,428	24	land & sea(2)	Yes	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
BALI	EKL	1,473	77	land & sea(3)	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
BALI	BKL	2,002	33	land & sea	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
BALI	ACH	3,775	59	land & sea(2)	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
BALI	SSM	1,801	29	land & sea(2)	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
BALI	WKL	1,584	61	land & sea(2)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
BALI	WNT	164	7.5	land & sea	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
BALI	WSM	2,541	41	land & sea	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
BALI	JBI	2,076	33	land & sea(2)	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
BALI	YOG	691	13	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
BALI	RIAU	2,527	40	land & sea(2)	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
BALI	SKL	1,262	44	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
BALI	CKL	1,179	42	land & sea(2)	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
BALI	NSW	2,551	74	land & sea(2)	Yes	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
BALI	CSW	1,730	61	land & sea(2)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
BALI	ENT	1,375	65	land & sea(5)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
BALI	SESW	1,831	63	land & sea(2)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
RIAU	WJV	1,479	22	land & sea	Yes	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
RIAU	NSM	660	10	land	Yes	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
RIAU	EJV	2,118	32	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
RIAU	CJV	1,809	27	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
RIAU	SSW	2,929	78	land & sea(2)	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
RIAU	LPG	1,107	16.5	land	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
RIAU	EKL	3,167	74	land & sea(3)	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
RIAU	BKL	758	12.5	land	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
RIAU	ACH	1,264	19	land	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
RIAU	SSM	734	11	land	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
RIAU	WKL	2,132	65	land & sea(3)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
RIAU	WNT	2,689	47	land & sea(3)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
RIAU	WSM	308	5	land	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
RIAU	JBI	460	7	land	Yes	6,882	59.57	6,246	55.39	4,378	38.32	7,493	18,579	51	201	776	130
RIAU	YOG	1,876	29	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
RIAU	BALI	2,527	40	land & sea(2)	No	7,230	38.55	5,715	29.43	6,670	35.90	3,366	12,546	85	111	1362	1482
RIAU	SKL	2,825	68	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
RIAU	CKL	2,630	65	land & sea(2)	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
RIAU	NSW	4,636	105	land & sea(2)	Yes	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
RIAU	CSW	3,814	92	land & sea(2)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
RIAU	ENT	3,903	105	land & sea(7)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
RIAU	SESW	3,915	93	land & sea(2)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
SKL	WJV	1,479	22	land & sea	Yes	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
SKL	NSM	3,466	78	land & sea(2)	No	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
SKL	EJV	852	37	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
SKL	CJV	1,019	41	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
SKL	SSW	766	32	land & sea	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
SKL	LPG	1,723	52	land & sea(2)	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
SKL	EKL	606	10	land & sea	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
SKL	BKL	2,297	61	land & sea(2)	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
SKL	ACH	4,070	87	land & sea(2)	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
SKL	SSM	2,096	58	land & sea(2)	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
SKL	WKL	1,473	31	land	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
SKL	WNT	1,423	51	land & sea(3)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
SKL	WSM	2,836	70	land & sea(2)	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
SKL	JBI	2,371	61	land & sea(2)	No	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
SKL	YOG	1,169	42	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
SKL	BALI	1,262	44	land & sea(2)	No	7,230	38.55	5,715	29.43	6,670	35.90	3,366	12,546	85	111	1362	1482
SKL	RIAU	2,825	68	land & sea(2)	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
SKL	CKL	195	3	land	No	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
SKL	NSW	1,762	43	land & sea(2)	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
SKL	CSW	861	28	land & sea(2)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
SKL	ENT	1,931	85	land & sea(5)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
SKL	SESW	1,606	42	land & sea(2)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
CKL	WJV	1,197	44	land & sea	No	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
CKL	NSM	3,271	75	land & sea(2)	No	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
CKL	EJV	769	35	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
CKL	CJV	824	38	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
CKL	SSW	960	35	land & sea	No	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
CKL	LPG	1,529	49	land & sea(2)	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
CKL	EKL	737	12.5	land & sea	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
CKL	BKL	2,103	58	land & sea(2)	No	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
CKL	ACH	3,875	84	land & sea(2)	No	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
CKL	SSM	1,901	55	land & sea(2)	No	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
CKL	WKL	1,226	253	land	No	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
CKL	WNT	1,340	49	land & sea(3)	No	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
CKL	WSM	2,641	67	land & sea(2)	No	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
CKL	JBI	2,177	59	land & sea(2)	No	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
CKL	YOG	1,087	40	land & sea	No	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
CKL	BALI	1,179	42	land & sea(2)	No	7,230	38.55	5,715	29.43	6,670	35.90	3,366	12,546	85	111	1362	1482
CKL	RIAU	2,630	65	land & sea(2)	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
CKL	SKL	195	3	land	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
CKL	NSW	1,894	46	land & sea(2)	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
CKL	CSW	993	31	land & sea(2)	No	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
CKL	ENT	2,124	88	land & sea(5)	No	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
CKL	SESW	1,738	45	land & sea(2)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
NSW	WJV	3,202	84	land & sea	No	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
NSW	NSM	5,277	115	land & sea(2)	Yes	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
NSW	EJV	2,531	73	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
NSW	CJV	2,829	78	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
NSW	SSW	1,713	27	land	No	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
NSW	LPG	3,534	89	land & sea(2)	Yes	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
NSW	EKL	1,403	38	land & sea	No	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
NSW	BKL	4,108	98	land & sea(2)	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
NSW	ACH	5,881	124	land & sea(2)	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
NSW	SSM	3,907	94	land & sea(2)	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
NSW	WKL	3,069	576	land & sea(2)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
NSW	WNT	2,534	71	land & sea(2)	No	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
NSW	WSM	4,647	106	land & sea(2)	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
NSW	JBI	4,182	98	land & sea(2)	No	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
NSW	YOG	2,848	78	land & sea	No	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
NSW	BALI	2,551	74	land & sea(2)	No	7,230	38.55	5,715	29.43	6,670	35.90	3,366	12,546	85	111	1362	1482
NSW	RIAU	4,636	105	land & sea(2)	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
NSW	SKL	1,762	43	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
NSW	CKL	1,894	46	land & sea(2)	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
NSW	CSW	953	16	land	No	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
NSW	ENT	2,883	80	land & sea(4)	No	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
NSW	SESW	1,612	28	land	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
CSW	WJV	2,381	71	land & sea	No	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
CSW	NSM	4,455	101	land & sea(2)	No	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
CSW	EJV	1,709	59	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
CSW	CJV	2,007	64	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
CSW	SSW	891	14	land	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
CSW	LPG	2,713	76	land & sea(2)	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
CSW	EKL	502	23	land & sea	No	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
CSW	BKL	3,287	85	land & sea(2)	No	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
CSW	ACH	5,059	110	land & sea(2)	No	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
CSW	SSM	3,085	81	land & sea(2)	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
CSW	WKL	2,181	393	land & sea(2)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
CSW	WNT	1,712	58	land & sea(2)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
CSW	WSM	2,641	67	land & sea(2)	No	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
CSW	JBI	3,361	85	land & sea(2)	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
CSW	YOG	2,026	65	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
CSW	BALI	1,730	61	land & sea(2)	No	7,230	38.55	5,715	29.43	6,670	35.90	3,366	12,546	85	111	1362	1482
CSW	RIAU	3,814	92	land & sea(2)	No	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
CSW	SKL	861	28	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
CSW	CKL	993	31	land & sea(2)	No	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
CSW	NSW	953	16	land	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
CSW	ENT	2,059	67	land & sea(4)	Yes	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200
CSW	SESW	788	15	land	No	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
ENT	WJV	2,469	84	land & sea	Yes	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
ENT	NSM	4,544	114	land & sea(5)	No	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
ENT	EJV	1,789	72	land & sea(6)	Yes	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
ENT	CJV	2,096	77	land & sea(6)	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
ENT	SSW	821	44	land & sea(2)	Yes	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
ENT	LPG	2,802	89	land & sea(7)	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
ENT	EKL	1,895	83	land & sea(5)	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
ENT	BKL	3,376	98	land & sea(7)	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
ENT	ACH	5,148	123	land & sea(7)	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
ENT	SSM	3,174	94	land & sea(7)	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
ENT	WKL	2,725	251	land & sea(7)	Yes	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
ENT	WNT	1,358	62	land & sea(5)	Yes	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
ENT	WSM	3,914	106	land & sea(7)	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
ENT	JBI	3,450	98	land & sea(7)	Yes	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
ENT	YOG	1,421	22	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
ENT	BALI	1,375	65	land & sea(5)	Yes	7,230	38.55	5,715	29.43	6,670	35.90	3,366	12,546	85	111	1362	1482
ENT	RIAU	3,903	105	land & sea(7)	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
ENT	SKL	1,931	85	land & sea(5)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
ENT	CKL	2,124	88	land & sea(5)	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
ENT	NSW	2,883	80	land & sea(4)	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
ENT	CSW	2,059	67	land & sea(4)	Yes	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
ENT	SESW	2,160	69	land & sea(4)	Yes	4,014	48.88	3,370	40.54	2,982	35.64	8,598	1,600	34	125	234	179

provinces		distance		Transportation	cointegration (Yes/No)	The length of asphalted road		Quality of road condition				populations (thousand people)	production (ton)	Economic facilities			
		(km)	(hours)			(km)	(% of total)	Good (km)	(% of total)	Damaged (km)	(% of total)			Super-market	Traditional market	Restaurant	Hotel
SESW	WJV	2,482	72	land & sea	Yes	19,492	76.62	9,124	35.87	2,828	34.08	38,479	179,136	355	870	6028	1056
SESW	NSM	4,556	103	land & sea(2)	No	16,976	49.85	7,047	34.62	13,245	38.78	12,692	115,076	134	916	1838	399
SESW	EJV	1,810	61	land & sea	No	29,021	81.32	19,329	52.30	8,420	22.69	35,944	12,546	315	1118	3855	695
SESW	CJV	2,108	66	land & sea	No	21,080	75.06	12,502	44.52	7,396	26.28	32,999	14,255	236	1006	3026	1149
SESW	SSW	992	16	land	No	15,954	53.98	12,735	42.55	11,098	37.29	2,020	19,312	93	252	681	236
SESW	LPG	2,814	77	land & sea(2)	No	8,248	54.10	5,698	37.21	5,255	34.89	7,269	16,224	30	199	948	135
SESW	EKL	1,247	37	land & sea	Yes	7,246	41.53	4,301	39.11	3,320	30.86	2,750	5,369	106	419	651	232
SESW	BKL	3,388	87	land & sea(2)	Yes	3,979	62.49	2,913	46.01	2,105	31.81	1,695	31,495	14	139	454	143
SESW	ACH	5,160	112	land & sea(2)	Yes	9,182	51.39	7,047	39.46	5,694	30.72	4,330	28,304	86	416	668	113
SESW	SSM	3,186	83	land & sea(2)	Yes	6,875	48.84	3,925	29.08	3,963	28.06	2,658	15,704	35	596	1186	181
SESW	WKL	3,015	73	land & sea(2)	No	5,526	45.37	4,056	33.32	5,628	47.01	4,355	3,143	66	117	656	139
SESW	WNT	1,814	60	land & sea(2)	No	4,443	60.38	2,851	38.85	2,828	38.36	4,329	7,197	29	163	620	196
SESW	WSM	3,926	95	land & sea(2)	Yes	10,152	57.63	7,485	41.66	7,444	39.86	4,570	32,703	88	365	2107	208
SESW	JBI	3,462	87	land & sea(2)	No	6,882	59.57	6,246	55.39	5,047	43.16	7,493	18,579	51	201	776	130
SESW	YOG	2,128	67	land & sea	Yes	3,980	68.31	2,563	42.62	1,100	20.31	3,206	14,255	92	79	750	319
SESW	BALI	1,831	63	land & sea(2)	No	7,230	38.55	5,715	29.43	6,670	35.90	3,366	12,546	85	111	1362	1482
SESW	RIAU	3,915	93	land & sea(2)	Yes	7,230	38.55	5,715	29.43	6,670	35.90	5,497	6,660	126	321	1448	144
SESW	SKL	1,606	42	land & sea(2)	Yes	6,045	63.33	4,164	43.99	2,784	27.89	3,215	3,726	28	597	452	172
SESW	CKL	1,738	45	land & sea(2)	Yes	4,029	35.60	3,333	29.40	5,392	49.20	2,045	1,659	29	343	229	116
SESW	NSW	1,612	28	land	No	4,835	65.15	2,715	36.73	2,871	37.85	2,125	2,943	39	89	690	224
SESW	CSW	788	15	land	No	7,058	55.55	5,328	41.66	4,565	31.47	2,366	2,475	25	103	156	78
SESW	ENT	2,160	69	land & sea(4)	No	8,180	42.86	6,964	36.47	6,578	34.54	4,172	2,204	27	245	259	200

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