The Dynamic Analysis of Inflation Rate and Farmers' Welfare for Rural Poverty Reduction in Indonesia

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Jayadi

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Members of the Examining Committee:

Prof. Dr. Michael Grimm (Supervisor)
Prof. Dr. Peter van Bergeijk (Reader)

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Disclaimer:

Inquiries:

Postal address:

Institute of Social Studies
P.O. Box 29776
2502 LT The Hague
The Netherlands

Location:

Kortenaerkade 12
2518 AX The Hague
The Netherlands

Telephone: +31 70 426 0460
Fax: +31 70 426 0799

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List of Acronyms

ADF	Augmented Dickey Fuller
AIC	Akaike Information Criterion
Bappenas	Badan Perencanaan Pembangunan Nasional (National Development Planning Agency of Indonesia)
BI	Bank Indonesia (Central Bank of Indonesia)
BPS	Badan Pusat Statistik (Central Statistics Agency of Indonesia)
CPI	Consumer Price Index
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
IFS	International Financial Statistics
IMF	International Monetary Fund
IPA	Importance Performance Analysis
IRF	Impulse Response Function
ISS	Institute of Social Studies
MDGs	Millenium Development Goals
MoA	Ministry of Agriculture
NTP	Nilai Tukar Petani (Index of Farmer Term of Trade)
PPP	Purchasing Power Parity
Renstra	Rencana Strategis Kementerian Pertanian (Strategic Plan of Ministry of Agriculture in Indonesia)
RPJMN	Rencana Pembangunan Jangka Menengah Nasional (National Medium Term Development Plan of Indonesia)
VAR	Vector Auto-regression
VECM	Vector Error Correction Model

Abstract

This study aims to first analyse the relationship between inflation rate and farmers' welfare improvement using VAR (Vector Auto-regression) model analysis based on quarterly data in the period 2000 – 2011. Second, it is to investigate the role of farmer well-being on rural poverty using the quadrant analysis based on quarterly data in the period 2008 – 2011. More precisely, we will use the data based on the NTP (Nilai Tukar Petani) index and on rural poverty rate to run this latter analysis.

The result of our dynamic analysis using VAR model shows that inflation rate affects Indonesian farmers' welfare significantly in the long run but not in the short run. This is in line with the characteristic of inflation rate in Indonesia as the long-term inflation rate that can stimulate the structural-macroeconomic conditions. Therefore, the synergy of monetary instruments and real-sector-development policy on determining expected inflation rate is needed to improve the further farmers' welfare in Indonesia. Moreover, we also find that domestic and international economic shocks, such as share of agriculture sector in GDP's growth or real exchange rate, do influence the NTP index significantly. More precisely, the agriculture output growth and the inflation rate are positively influencing the farmer well-being while a depreciation of real exchange rate significantly reduces it. Therefore, our analysis stresses the fact that in order to improve further the farmers' welfare in Indonesia, not only the inflation rate needs to be considered but also other monetary instruments and real-sector-development policies.

Additionally, based on the quadrant analysis done for the period 2008-2011, we can see that there is an increase over time of the number of agriculture-based provinces (with high NTP index and low rural poverty rate) in Indonesia. The number of provinces in this particular quadrant had generally increased because of raise in the average of NTP index. This corresponds to provinces going from low NTP index and low poverty rate (quadrant II) to high NTP index and low poverty rate (quadrant I). Nevertheless, the rural poverty in Indonesia remained stable in 2011 with many provinces located in the normative quadrant (with high poverty rate and low NTP index) or in the transition provinces (with high poverty rate and high NTP index). To summarize, we find in our analysis that inflation rate influences significantly and positively the NTP index in the long run and the NTP index cannot affect poverty rate in the short run, or that beyond other factors of the farmers' welfare are at play to reduce rural poverty rate.

Relevance to Development Studies

The analysis about the role of inflation rate and farmers' welfare for rural poverty reduction in Indonesia is interesting. Indonesia is a significant country for development studies since it has many involvements in the agricultural sector development for a long time. These involvements and practices had caused dynamic deviations on the social-economic system especially in the rural poverty problem. The Indonesian government's policy in the improve-

ment of farmers' welfare has played an important role on the development of agricultural sector. Hence, farmers' welfare needs to be seen comprehensively for all stakeholders participating. The macro-level research through inflation rate mechanism of monetary policy in this study will give new perspectives about how the quality of famers' welfare in Indonesia will be developed. Then, we can understand the significant role of agriculture sector on increasing farmers' welfare for rural poverty reduction based on monetary framework in Indonesia.

Keywords

Agriculture sector development, inflation rate, farmers' welfare, rural poverty reduction, VAR, VECM, quadrant analysis, Indonesia

Chapter 1
Introduction

1.1 Background

Agriculture becomes a potential sector for developing countries in the economic development and rural poverty reduction process (Dubey 1963, Ershad A. 2010, and Norton et al. 2006). Dercon (2009) said that steady increase of agriculture share in the GDP and population share involved in the agriculture sector are well recognized to positively influence economic growth and rural poverty alleviation. The World Development Report 2008 (2007: 1) also stated that in the 21st century, agriculture sector production becomes an essential mechanism of MDGs 2015 for sustainable development and rural poverty reduction process. It is clearly reported in the statement as follows:

> "Three of every four poor people in developing countries live in the rural areas. 2.1 billion living on less than $ 2 a day and 880 million on less than $1 a day and most depend on agriculture for their livelihoods. Given where they are and what they do best, promoting agriculture is imperative for meeting the Millennium Development Goal of halving poverty and hunger by 2015 and continuing to reduce poverty and hunger for several decades thereafter. Agriculture alone will not be enough to massively reduce poverty, but it has proven to be uniquely powerful for that task".

In Indonesia, the agriculture sector is acknowledged by the government to have a strategic role in the national economy, such as improving people welfare, accelerating economic growth, and reducing poverty rate (Kementerian Pertanian 2009). According to some policies in the history of economic development in Indonesia, the important role of agriculture sector on improvement of farmers' welfare also becomes a critical point in rural poverty reduction process (Bappenas 2010a). Therefore, Sudaryatno and Rusastra (2006: 121) indicated that the ability of agriculture sector to increase economic production and rural poverty reduction depends on its ability to overcome obstacles faced by farmers in the agriculture sector. In particular, raising the purchasing power of farmers is one way to reduce poverty in rural areas.

The new report from the MoA of Indonesia shows that over the period 2005-2008 the aggregated agricultural development in Indonesia had been quite important. The agriculture share of GDP had continuously grown to reach 5.16% in 2008. The agricultural trade was in surplus condition of 17.97 billion USD in 2008 exceeding the government's target of 13.13 billion USD. Finally, the agriculture labour force covered more than 40 million people every year during 2005-2009. This figure indicates that agriculture sector has given an important role in national employment. Unfortunately, during the period 2005-2008, the average of NTP index[1], as one of important measurements in farmers' welfare in Indonesia, had been closed to the value of 100 (break event

[1] The NTP or the index of Farmer Term of Trade is as a measure in the exchange ability of agriculture goods (products) produced by farmers for other goods/services in domestic consumption and agriculture production demand.

point). It indicates that Indonesian farmers actually need subsistence to spend more than what they earn. Therefore, farmers' welfare will be a crucial issue in the further agriculture sector development (Kementerian Pertanian 2009: 6).

In addition, the new report from the MoA of Indonesia also presents that the average of farmers' income per capita is only about 4.69 million rupiah per year in 2009. The MoA expects that the average of farmers' income per capita can be increased up to 7.93 million rupiah per year in 2014. It means that the agriculture sector should pursue about 11.1 % increases in agriculture revenue every year (ibid: 60). Therefore, the program of revitalizing agriculture sector and improvement of farmers' welfare will be the main agenda in the national development planning, such as RPJMN 2010-2014 and Renstra 2010-2014. Indonesian government in MDGs framework is also continuing to improve food security at the local level through increase of agriculture productivity, improvement of agriculture distribution system, and correction of agriculture issues. It is based on local resources systems in order to solve rural poverty problem. Moreover, the World Bank (2006) has also claimed that rural poverty problem in Indonesia can be solved by enhancing the role of economic growth, social services, and government spending for poor people. One of important points in the role of economic growth is by revitalizing agriculture sector through improvement of farmers' welfare.

Furthermore, the use of farmers' welfare as an indicator of agriculture sector performance and rural poverty reduction has been considered to have relationship with inflation rate mechanism by some researchers. Norton et al. (2006: 353), for instance, stated that monetary policy on maintaining inflation rate instrument would be possible for designing further agriculture-economic development, where it tends to stimulate better agriculture share of GDP performance as well as better prices of inputs and outputs agriculture for farmer. Tangermann (1973: 131) also claimed that the effect of inflation rate could give a significant influence for 'the terms of trade' in agriculture sector that has tight dependency in intermediate input of other sectors. Moreover, Richards and Timothy (2009) argued that inflation rate can stimulate not only the change of cost-share in agriculture input price but also the change of agriculture market competition between wholesalers and retailers in their 'strategic pricing' of agriculture products. Inflation rate is also considered to have role on stimulating the quality of farmers' welfare through their income of agriculture-economic activities. Therefore, the agriculture development in farmers' welfare will need a more comprehensive approach as claimed by Chaudhry (2007), Gaiha (1989), and Travers and Ma (1994). They said that the agriculture intensification process through technological revolution and better internal management to increase output production is not the only factor to reduce rural poverty rate. Other monetary factors beyond the agriculture sector may play an important role. They claimed that macroeconomic stability due to better monetary policy on maintaining inflation rate is considered as significant factor on determining the quality index of household consumer/producer prices. A stable inflation rate has been proved to have a strategic role on improving farmers' welfare and reducing rural poverty rate.

Additionally, some theoretical and empirical review has also indicated that farmers' welfare had a critical role for rural poverty reduction in Indonesia. This nexus can be affected by inflation rate in monetary policy, or vice versa. The deregulation of Indonesian monetary policy in 1988 has given administrative simplicity in the establishment of private banks. It has stimulated a huge growth of new private banks and has made the weakness condition of Indonesian banking system (Sidiq 1999). The condition has encouraged to decrease the Return on Assets (ROA) and increase non-performing loans, in turn, it can affect the low performance of agriculture sector when the presence of currency crisis (Hayati 2006: 6). The Indonesian economic crisis in the mid-1997 had affected the depreciation of rupiah currency and it had driven capital outflow, whereas characteristic of agriculture sector at that time was 'footloose agricultural industry' with a higher dependency in imported-input goods (Lena 2007: 1). Then, Lena argued that this condition had triggered increase of inflation rate and caused price of good consumption is too high for farmers, in turn, it had stimulated decrease in farmers' welfare and increase in rural poverty rate. Therefore, Indonesian economic crisis in the mid-1997 caused a sudden increase in the number of poor people in rural area from 24.59 million in 1996 people to 31.90 million (64.40% of total poor people in Indonesia) in 1998 (Sudaryanto and I. W. Rusastra 2006: 116). Furthermore, Isdijoso (1992) and Simatupang and Mardianto (1996) also claimed that inflation rate that leads to increase price of input/output agriculture production cannot be ignored in the analysis of agriculture sector development in Indonesia. On the other hand, Atmadja (1999) also said that inflation rate in Indonesia, tends to be 'cosh push inflation'. The characteristic of inflation rate is stimulated by structural phenomena of economic shock from crop failure, falling terms of trade, foreign debt, exchange rates depreciation, and price fluctuations in the domestic market. Therefore, he said that 'the structural bottlenecks' as cause of long-term problem in inflation rate need to be solved in comprehensive plan between monetary instruments and real-sector-development policy to improve farmers' welfare.

The previously mentioned literature and historical policies of Indonesian government in agriculture sector have shown the potential relationship between inflation rate and farmers' welfare development on the reduction of rural poverty in Indonesia. The structural and simultaneous econometrical model for time series and panel data have been used extensively and exclusively in these studies. Nevertheless, given the reverse causality issue existing between inflation rate and purchasing power of farmers, such methodologies generate biased coefficients. (Gujarati 2004: 848 and Krisharianto 2007: 63). Therefore, it is quite difficult to determine the proper quantitative approach for dynamic analysis of inflation rate and farmers' welfare variables based on the principles of Economics accurately. Then, VAR model that has been offered by Sims in 1980 is as better resolution to the endogeneity problem through a non-structural model in dynamic analysis (Gujarati 2004: 848). In order to overcome the endogeneity issue, we plan to use the VAR model combined with the quadrant analysis in our dynamic analysis. On the one hand, in the dynamic analysis, we are not only able to define relationship between inflation rate and farmers' welfare in uni-directional (one direction), but also we are able to know their relationship in bi-directional (two directions). Furthermore, we can also predict the short-run and long-run dynamic relationship in VAR model for both of variables. On the other hand, in the quadrant analysis, we will also know about the transition process amongst Indonesian provinces on reducing rural poverty rate based on the effect of farmers' welfare. Therefore, we aim here to study the relation between inflation rate and farmers' welfare and its role for rural poverty reduction in Indonesia. The macro-level research through inflation rate mechanism of monetary policy in this study will give new perspectives about how the quality of farmers' welfare in Indonesia could be developed. Then, we can know about the significant role of agriculture sector on increasing farmers' welfare and rural poverty reduction based on monetary framework in Indonesia.

1.2 Research Questions

The involvements of new Indonesian monetary policy in agriculture development and the dynamic relationship between agriculture development and rural poverty reduction have generated some interesting questions. In this study we will focus on the following research question.

The main question:

In Indonesia, since the 2000s, has inflation had a significant impact on rural poverty? If so, was this effect channelled via farmer's incomes?

Sub Questions:

1. How can the relationship between inflation rate and farmers' welfare be characterized in the short and long run?
2. How does inflation via farmers' income affect rural poverty?

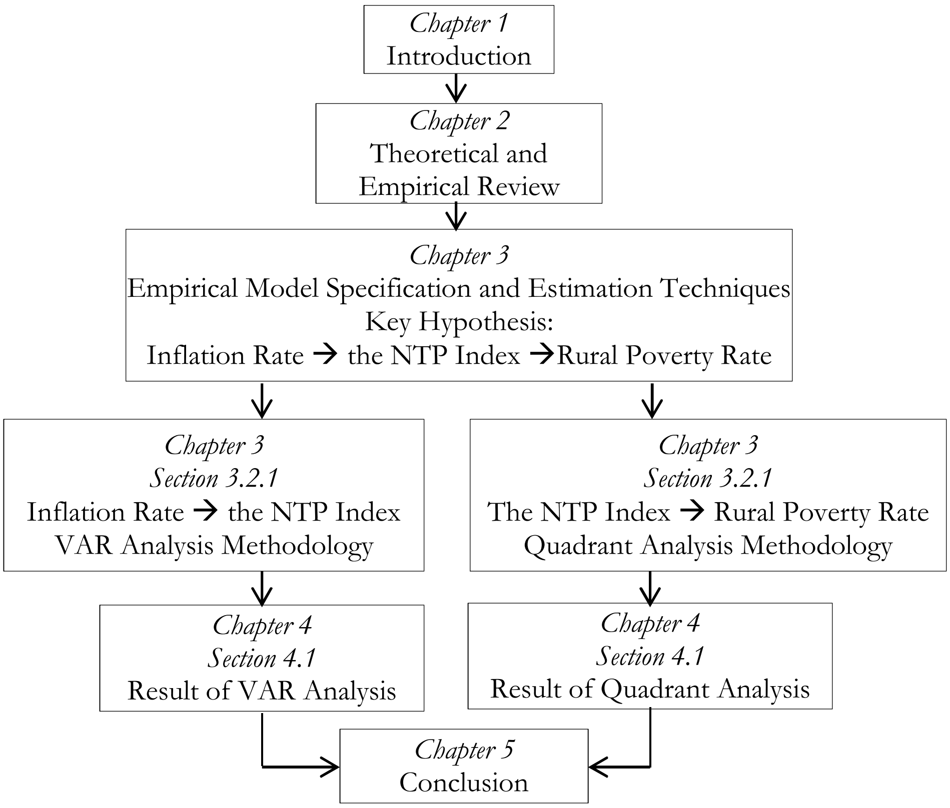
1.3 Hypothesis and Objectives of Study

The hypothesis to be tested in this study is the significant causal influence of inflation rate on farmers' welfare and the subsequent influence of farmer well-being in the rural poverty reduction in Indonesia in the period 2000-2011. The objective of the study is to analyse the relationship between the inflation rate and farmers' welfare development and its role for rural poverty reduction in Indonesia.

1.4 Organization of Study

There are five chapters in this study. Chapter one is an introduction which contains the background, research questions, hypothesis and objectives of the study, along with the organization of the paper. Chapter two presents the theoretical and empirical literature review regarding relationship between inflation rate and farmers' welfare development and its impact on rural poverty reduction. The third chapter describes the empirical methodology that will be used, and chapter four delivers the empirical results and analysis. Chapter five concludes.

Figure 1.1
Organization of Study



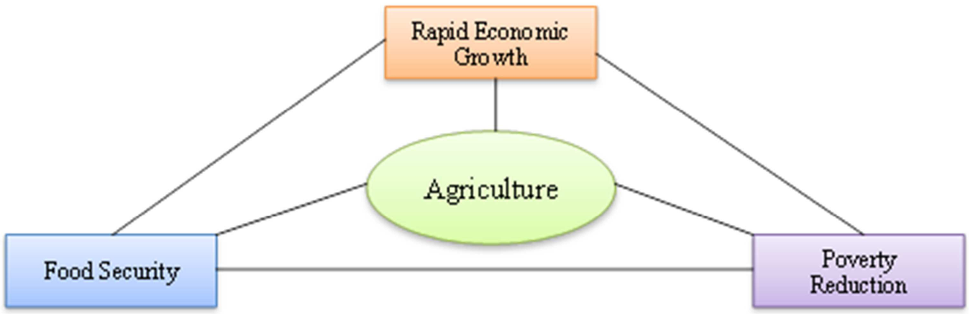
Chapter 2
Inflation Rate, Farmers' Welfare and Rural Poverty: A Review of Theoretical Approaches and the Empirical Evidence

2.1 The Nexus between Inflation Rate and Farmers' Welfare for Rural Poverty Reduction

Poverty is as a low-level living standard in terms of material deficiency compared to the general living standard prevailing in the society (Hudaya 2009: 6). Coudouel et al. (2002: 29) had given similar definition about poverty as a condition in which the households or individuals have not enough resources or capabilities to meet their needs. Thus, the poverty can be concluded as a bad condition where people have problem with their basic materials or their needs in the life. Coudouel et al. also mentioned that there are three essential factors on calculating poverty rate, namely (1) well-being indicators, (2) poverty line, and (3) poverty measure. First, well-being indicators are monetary aspects (income factor and consumption level) and non-monetary aspects (health, nutrition, education, and insecurity level). Second, the poverty line is related to 'cut-off points' that can be used on determining poor people and non-poor people. For example, the World Bank categorizes as below poverty line in Indonesia for people living with less than one or two U.S. dollars per day. On the other hand, the BPS has used the minimum amount of calories that must be met by each person in a day to measure a poverty rate in Indonesia. As a result, it proposed that each person must meet minimum 2100 calories per day. Therefore, 2100 calories is the benchmark of the poverty line set by BPS with consideration in other non-food needs, such as housing, fuel, electricity, clean water, and services. Finally, the poverty measure is a statistical function to determine the aggregate number of poor people in the population living below the poverty line mentioned above.

Some researches in development study, agriculture is claimed as a potential sector for developing countries in the economic development and poverty reduction process (Dubey 1963, Ershad A. 2010, and Norton et al. 2006). The agriculture sector is also entrusted for providing services such as food production, environmental quality protection, and employment opportunities for many people, as well as maintaining the macroeconomic stability (Ali, E. and Dayal, T. 2010: 372). Dercon (2009) stated that the most of poor people in the world are 'living and working in the rural areas as a farmer'. Therefore, the role of agriculture sector is considered important on reducing rural poverty rate. The relationship between agriculture sector development and rural poverty reduction can be clearly seen in Figure 2.1 about the concept of 'the development trilogy' introduced by Akiyama and Larson (2004). The concept is about revitalizing the role of agriculture sector development in three economic achievements, namely 'rapid economic growth', 'poverty reduction', and 'food 'security'. It has put an emphasis on the growth of agriculture sector, which is as an important aspect to overcome various basic problems for better rural development. It is also in line with a statement from Chaudry (2007: 250) argued that most of developing countries have rural development strategies in poverty alleviation concentrated in the agriculture sector development. The agriculture productivity and improving 'the income-earning potential' of population in rural area will be the trigger of agriculture sector development. Hence, the agriculture sector development is not only about programs to reduce rural poverty, but also it is interpreted as the machine of economic growth in rural area.

Figure 2.1
The Development Trilogy on Three Areas of Development Activities in the Agriculture



Source: Akiyama and Larson, 2004.

In term of economic perspective and based on analysis of relationship between agriculture sector and rural poverty reduction, the agriculture activities can also be viewed as having a value-added in agriculture productivity for famer's welfare. Hanafie (2010: 3) said that the technical efficiency and price efficiency as agriculture productivity are very important factors on creating farmers' welfare. The availability of input production, infrastructure distribution, and market in the technical efficiency do not guarantee farmers' welfare. However, farmers' welfare is also about the price efficiency issues in the monetary policy framework. Norton et al. (2006: 353) stated that the monetary policy instruments are possible for designing further agricultural productivity. They tend to generate deviations such as 'overvalued exchange rates, heavily subsidized interest rates, and inflationary monetary policy' that can in turn affect the quality of farmer's welfare through the price efficiency. Another illustration has given by Bardan and Udry (1999). They argued that the living conditions of rural communities, in poor or developing countries, are largely constrained by various aspects of economic condition in agriculture sector, like capital and investment problems. Both of them are related to the price efficiency condition in a country as implication of monetary policy instruments to farmer's welfare.

Furthermore, the price efficiency in the agriculture productivity is related to the inflation rate as one of monetary policy instruments. Mishkin (2004: 411) has mentioned that there are six basic goals of monetary policy, that is to say (1) to increase employment rate, (2) to stimulate high economic growth, (3) to maintain price stability, (4) to keep interest-rate stability, (5) to stabilize financial markets, and (6) to get stability in foreign exchange markets. Then, Lena (2007: 27), drawing upon Mishkin, further added that in order to achieve the six basic goals, monetary policies should be targeting exchange rate, money supply, interest rate, and inflation rate. The inflation rate targeting in the monetary policy is referring to a percentage change in the price level, for instance in the price of consumer goods (Sachs, J. D. and F.B. Larrain 1993: 327). Some economists define the inflation rate as a rise in the general level of prices in the economic condition (Mankiw 2004: 13). According to Samuelson and Nordhaus (1998: 579), the calculation of inflation rate follows the formula:

$$The\ inflation\ rate_t = \frac{Price\ level_t - Price\ level_{t-1}}{Price\ level_{t-1}}\ x\ 100 \quad (1)$$

By concept, the determination of price level is measured as a weighted average of goods and services in economy by making the price index.

Atmadja (1999), Canavese (1982), and Lim (1987) said that there are at least four fundamental theories of inflation rate, (1) quantity theory, (2) Keynesian theory, (3) mark-up theory, and (4) structural theory. First, quantity theory is the oldest theory of inflation that known as 'monetarist model', where inflation is not only explained as stimulated by additional volume of money supply, but also determined by public expectations regarding future increase of price. Second, Keynesian theory defined that inflation occurs in economic activities because people want to live beyond their economic capacity. Hence, there is inflationary gap in macroeconomic condition, because the aggregate demand exceeds the aggregate supply. Limited number of inventory items (aggregate supply) is due to the production capacity in the short term, which cannot be developed to offset the increase of aggregate demand. Third, the rationale of mark-up theory is determined by two components, cost of production and profit margin. The relation between these components and price change can be formulated as follows:

$$Price\ = Cost +\ Profit\ Margin \quad (2)$$

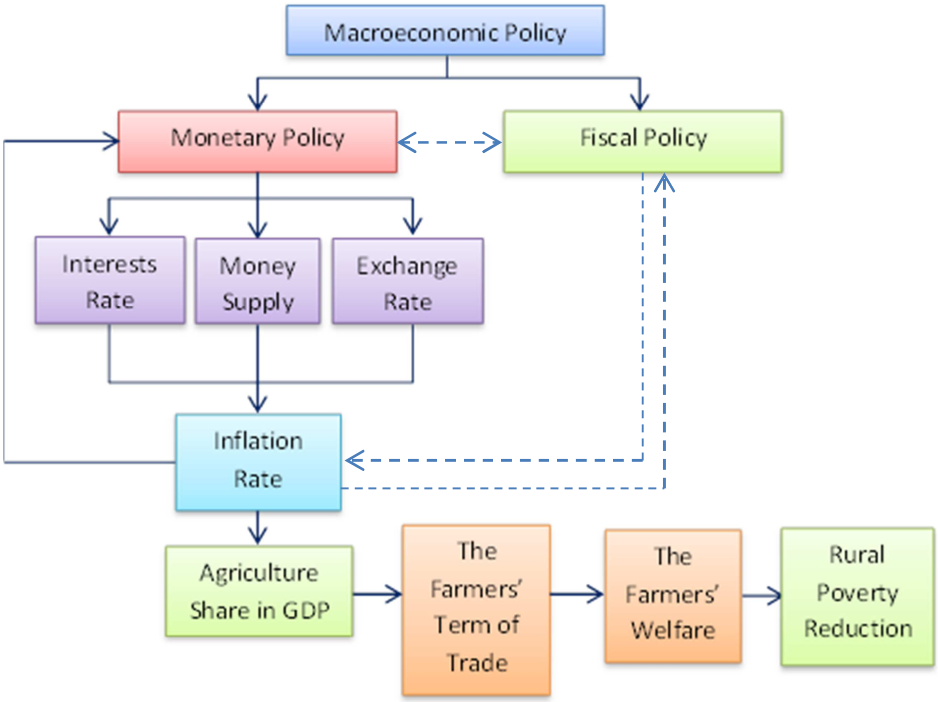
In equation (2), we can see that the large profit margin is usually defined as a certain percentage $(\beta\ \%)$ of the total cost of production, and then the formula can be translated into:

$$Price\ = Cost + (\beta\ \%\ x\ Cost) \quad (3)$$

Thus, in case of commodity price increase, it will also lead to raise the profit margin through the make up of the costs of production. Lastly, structural theory is related to inflation in some developing countries. Inflation is not only about monetary phenomena, but also it is related to structural phenomena or cost push inflation. Hence, the economic shocks that come from domestic and abroad will stimulate to inflation rate.

In addition, Samuelson and Nordhaus (1998: 581-591) have categorized the inflation by degree into three types of inflation, (1) moderate inflation (one digit inflation per year), (2) galloping inflation (two digits inflation per year), and (3) hyperinflation (more two digits inflation per year). Based on the source, inflation also can be divided into four types, (1) inertial inflation, (2) demand-pull inflation, (3) cost-push inflation, and (4) expectations-inertial inflation. First, the inertial inflation will grow at a similar rate until there are economic occasions that can make it change on a relatively long-term period. Second, the demand-pull inflation is caused by change of aggregate demand based on the amount of money in the liquidity process. Third, the cost-push inflation (the supply-shock inflation) is affected by supply shocks when the prices and income have begun to rise before achieving full employment. Lastly, expectations-inertial inflation is relatively similar to inertial inflation, but it is influenced by the motives/expectations of businesses and workers on improving inflation rate into decision-making in the price and income level. Likewise, Atmadja (1999: 59) has classified inflation by origin into two types, (1) domestic inflation, and (2) imported inflation. Domestic inflation is entirely due to the mismanagement of economy in the real and/or monetary sector by local economic actors, whereas imported inflation is caused by an increase of commodity prices abroad in countries through change on exchange rate and price of imported/exported goods.

Figure 2.2
The Framework of the Relationship between Monetary Policy and Agriculture Development for Rural Poverty Reduction



Source: Base on the Major Connection between Macroeconomic Policy and Agriculture Policy (Norton et al., 2006: 355)

In the monetary policy, the inflation rate tends to influence the farmers' welfare and rural poverty reduction through the price efficiency. Tangermann (1973) claimed that the effects of inflation rate could give a significant impact to agriculture sector on maintaining output demand, input supply, technological restriction, and government policy as response of increasing prices. The benefit of inflation targeting is to focus the monetary authority, such as the central bank, on achieving good domestic economic conditions. This strategy also tends to be more understandable and transparent for public attention, and will capable to reduce the price shock in the agriculture market. In Addition, Norton et al. (2006: 355) have also stated maintaining inflation rate can manage the distribution of total income (GDP) among wage, interest, rent, and profit. Therefore, the GDP analysis will be relevant to understand the impact of inflation rate on the farmers' welfare analysis related to the prices of goods and services. Figure 2.2 outlines the impact of monetary policy through inflation rate for rural poverty reduction. The monetary policy generally tends to maintain the economic condition using instruments of interest rate, money supply, and exchange rate. Then, this policy, affecting inflation rate, may in turn stimulate the GDP performance as well. The agriculture sector as a part of GDP in supply side[2] is being affected by inflation rate in the prices of agriculture inputs and outputs. The inflation rate is also encouraged by changes in the foreign exchange rate, and then it can change the performance of agricultural export/import. Finally, the price efficiency condition of agriculture productivity can stimulate change of farmers' welfare and rural poverty reduction.

Some researchers have given an interesting depiction regarding the impact of inflation rate on farmer's welfare. Schuh (1974) and Timer (1984) are two economists that have studied the relationship between inflation rate and farmers' welfare development. They stated that interaction between monetary policy and agriculture sector for increasing farmers' welfare could be affected by inflation rate and intensive export-import of agriculture. McFall Lamn (1980) has built the simultaneous-econometrical model to see the relationship between inflation rate and farmers' welfare. He said that inflation rate is a transition medium for monetary policy on determining farmers' welfare in the agriculture sector development. Tangermann (1973: 131) also claimed that the inflation rate may lead to a negative impact for 'the terms of trade' in agriculture sector when this sector dependent to intermediate input of other sectors. Richards and Timothy on their study about 'commodity prices and food inflation' (2009) argued that inflation rate can stimulate not only on change of cost share in agriculture input price but also in agriculture market competition between wholesalers and retailers in their 'strategic pricing' of agriculture products.

Moreover, other researchers claimed that income factors related to inflation rate become important to maintain farmers' income and rural poverty rate. Price-stabilization policies may be crucial to preserve the quality of input-output agriculture and offer potential advantages on raising farmers' welfare. Travers and Ma (1994) claimed that a subsidizing policy in the production of agricultural inputs (fertilizer price, new seed price, informal credit) and a stabilizing policy for agricultural outputs (agriculture good price) are more comprehensive approach than a stimulating policy driving agriculture productivity using only technologies. Gaiha (1989) with his study about the impact of consumer prices and an agriculture production related to the poverty reduction in India in the period 1956-1977, argued for the importance of inflation rate in price stabilization for maintaining farmers' welfare in rural area. 'The trickle-down effect' of agriculture sector production for rural poverty reduction is either frail or sometimes vague in the real condition. Then he stated that the consequences of price fluctuation factor in rural area are steady and it will be crucial to determine the living condition of farmers. Unanticipated inflation rate in the index of household consumer prices can worsen rural poverty condition. It can be said that rural destitution amongst 'low-income households' could be caused by their inadequate capability to purchase the basic needs. As a result, the 'consumer price stabilization' in rural areas may be a key point in decreasing rural poverty rate by diminishing the risks associated to higher prices in consumption goods.

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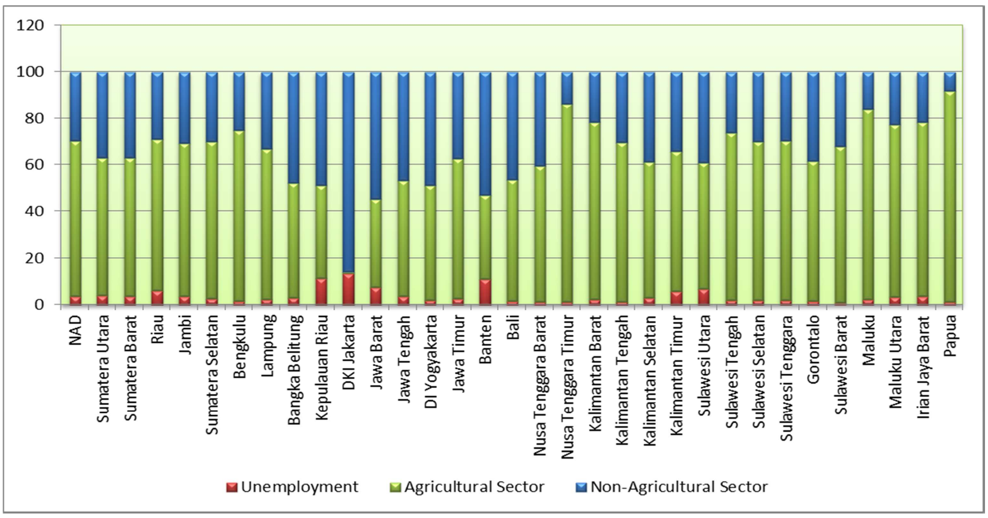
[2] The GDP can be derived from three analyses, (1) demand side (*consumption + private investment + government expenditure + export – import*), (2) supply side (*agriculture production + industrial production+ production of services + government production*), and (3) income side (*wages + interest + rents + profits*).

In this position, we can see that the agriculture development on increasing farmer's welfare will need a more comprehensive approach, as claimed by Chaudhry (2007), Gaiha (1989), Travers and Ma (1994). They stated that the agriculture intensification process through technological revolution and better internal management to increase output production is not the only factor to reduce rural poverty rate. Other monetary factors beyond the agriculture sector may play an important role. They claimed that macroeconomic stability due to better monetary policy on maintaining inflation rate could be considered as significant factor on determining the quality index of household consumer/producer prices. Indeed, the factor has been proved to have a strategic role on improving farmers' welfare and reducing rural poverty rate.

2.2 Inflation Rate and Farmers' Welfare for Rural Poverty Reduction in Indonesia

Based on the Renstra 2010-2014, agricultural sector development has a strategic role in Indonesian economy in terms of real formation of capital, labour absorption, foreign exchange source, revenue sources, and environmental conservation. In the RPJMN 2010-2014, revitalizing agriculture sector is expected to improve farmers' welfare, to increase non-oil exports, to reduce poverty, and to stimulate higher national employment. Therefore, the agriculture sector will be the key factor in analysing rural poverty reduction, as Indonesia's countryside is dominated by farming activities. Poverty data in District/City of Indonesia in 2009 (BPS 2010a: 95-126) as shown by Figure 2.3, illustrates the fact that the percentage of poverty is higher in agriculture sector (about 60.99 %) compared to other non-agriculture sectors (about 32.54 %). Sudaryanto and Rusastra (2006: 116-117) also stated that most of farmers, dominant population in rural area, are still facing poverty problem. They are still having low income, low education level, and malnutrition condition. They are also generally living in marginal areas with limited infrastructure support and low level of advanced technology adoption.

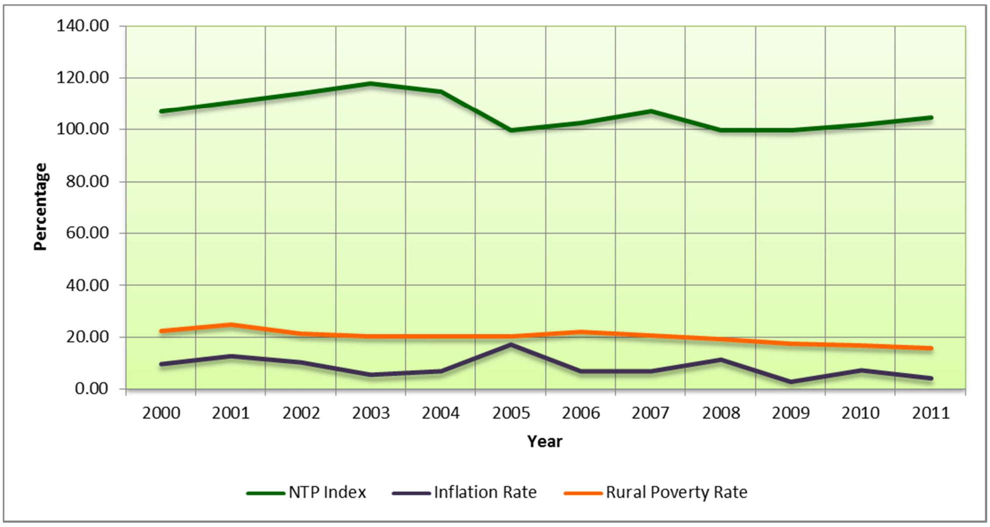
Figure 2.3
Percentage of Poverty by Sector in Indonesia in 2009



Source: Indonesia Statistics of Centre Statistics Agency (BPS), 2010.

In addition, based on Indonesia Statistics in Figure 2.4, rural poverty rate in Indonesia is relatively high in the period 2000-2011. The last percentage of poor people in rural area in 2011 was 15.72%, whereas the performance of farmers' welfare based on the NTP index in the last decade relatively remained stable about 106 %. On the other hand, the average of inflation rate in the period 2000 – 2011 was fluctuated around 8.19 %. This condition can give a signal that Indonesia is unlikely to achieve the MDGs'[3] target of 7.5% in the program poverty alleviation in 2015. Therefore, Indonesian government needs to reduce half of existing rural-poor people within four years with accelerating rural development process. According to the achievement report of MDGs in Indonesia 2010 (Bappenas 2010b), it is stated that poverty rate in rural area is significantly more than in urban areas, so it also needs to increase rural development process. One of the policies that will continue to be taken by Indonesian government in MDGs framework is continuing to improve food security at the local level through increased agriculture productivity, agriculture distribution system improvements, and solving agriculture problems based on local resources systems. It shows that the role of agriculture sector development is expected to reduce rural poverty in Indonesia.

Figure 2.4
The Relationship amongst Inflation Rate, Farmers' Welfare and the Percentage of Rural-Poor People in Indonesia in the Period 2000 - 2011



Source: Indonesia Statistics of Centre Statistics Agency (BPS), 2011.

In line with the MDGs report, the World Bank (2006) also claimed that poverty problem in Indonesia can be solved by enhancing the role of agriculture development. In the new era of poverty reduction, the effective poverty reduction strategy for Indonesia consists of three components, economic

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[3] MDGs is the Millennium Development Goals as an agreement of the heads of state and representatives from 189 countries in the court of the United Nations – New York in September 2000. They have confirmed the main concern in achieving the MDGs by 2015. The MDGs emphasize human development as the main focus of its activities to achieve the human welfare. The poverty and hunger alleviation in Indonesia is one of the eight MDGs target's, in which its target has to reduce half proportion of the poor people with the income on less than US$ 1.00 (PPP) per day period 1990-2015 (Bappenas 2010b).

growth, social services, and government spending for poor people. One of the important points in economic growth is by revitalizing the role of agriculture sector and increasing agriculture productivity. Then, the World Bank also said that nearly two-thirds of poor households in Indonesia are still working in agriculture sector. They are still facing problem in meeting their basic needs. Hence, agriculture in Indonesia is not well developed. The growth of total factor productivity in the agriculture sector has been proved negative since the early 1990s, from the positive growth of 2.5 % per year in the period 1968-1992 to a contraction of 0.1 % per year in the period 1993-2000.

Furthermore, the important of agriculture sector development in Indonesia has been also displayed in the history of Indonesian agriculture since hundred years ago, from the colonial era to the reformation era. Many interesting issues are related to Indonesian government policies in terms of agriculture land, farmers' welfare, quality of human resources, lack of capital, distribution and market factors, agriculture information and technology, and farmer organizations. Based on historical policy of Indonesian government in agriculture sector, farmers' welfare has been weakened and marginalized by several social-economic policies. Bappenas (2010a: 11) has given some indication of deterioration of farmers' welfare in Indonesia. The history of Indonesian agriculture displayed that farmers' welfare has been frequently neglected. In pre-colonial, the king was the absolute owner of the land, thus the living of farmer depended on the local nobility. In the Dutch colonial period, farmers were forced to follow slavery of land cultivation and had experience in the tragedy of hunger in 1940s. In the post-colonial, land ownership imbalances between rich agriculture businessmen and peasantry had also remained unchanged. Likewise, in the reformation era, the implementation of floating exchange rate system in Indonesia since 1998, the 'expansionary monetary policy' of money supply from the central bank will be significant to attract the FDI from agriculture export performance (Asnawi 2005: 69). Nonetheless, the FDI liberalization in Indonesia can only stimulate the excessive investment in 'downstream (wholesalers, second-stage processors, retailers, consumers)' for agricultural food processing, agricultural good retail, and industrial-food services. Hence, the returns to FDI in the industrial-food production are usually much higher than in the primary production (small farmers and first-stage processors) (Reardon, T. and C.P. Timmer 2007: 2827).

Moreover, some theoretical and empirical review has also indicated that farmers' welfare had a critical role in rural poverty reduction. This nexus can be affected by inflation rate in monetary policy, or vice versa. Lena (2007: 94-100), in her time series research in the period 1984 – 2005, stated that the performance of agriculture sector on rural poverty reduction in Indonesia as related to the increasing of farmers' welfare, is affected by four indicators, namely agriculture share of GDP, agriculture investment, agriculture commodity export, and labour force in agriculture sector. One instrument of monetary policy, the inflation rate, can stimulate the indicators of farmers' welfare. Isdijoso (1992) has built a model of relationship between monetary policy and agriculture sector development in Indonesia. He claimed that the important variables in the monetary policy for affecting the agriculture sector performance are credit, government consumption, export, import, and inflation rate. On the other hand, Atmadja (1999) said that inflation rate in Indonesia, as an agriculture-developing country, tends to be 'cosh push inflation'. The characteristic inflation rate in agriculture-developing country is related to structural phenomena of economic shock from crop failure, falling terms of trade, foreign debt, exchange rates depreciation, and price fluctuations in the domestic market. Therefore, 'the structural bottlenecks' as causes of long-term problem in inflation rate need to be solved in comprehensive plan between monetary instruments and real-sector-development policy to improve farmers' welfare and to reduce rural poverty in Indonesia.

In Indonesian new agriculture policy, the government tried to revitalize agriculture sector on rural poverty reduction through Law No.16/2006 about Extension System for Agriculture, Livestock and Forestry. It has been followed up with the Minister of Agriculture Regulation No.273/2007 related to the elaboration of Institutional Development of Farmers. Both of them take as focus of their concern on increasing the productivity of agriculture commodities as well as farmers' welfare. Based on the macro data from MoA in the period 2005-2008, development of agriculture has been claimed as performing properly. The agriculture share of GDP had continued to grow and had reached 5.16% in 2008. The agricultural trade balance had been recorded a surplus of 17.97 billion USD in 2008, exceeding the government target about 13.13 billion USD. Then, the agriculture labour was more than 40 million people every year during 2005-2009. This figure indicates that the agricultural sector development has contributed on increasing the amount of labour force. Unfortunately, in the period 2005-2008, the average of NTP index had been closed to the value of 100 (break event point). The NTP index closed to the break event point indicates that those farmers are still spending more their income than they earn. Hence, the farmers' welfare will be a crucial issue in the further agriculture sector development (Kementerian Pertanian 2009: 6).

Additionally, Bappenas (2010a: 14-15) stated that one of main targets in agriculture development is reducing rural poverty rate through improving farmers' welfare. An important factor influencing the level of farmers' welfare is income level, related in turn to inflation rate. An increase of farmer income is also directly associated to the main tasks and functions of the MoA. As a result, one of main priorities in the Renstra 2010-2014 is to raise farmer income. The average farmer income per capita in 2009 was around 4.69 million rupiah per year. The MoA expects that per capita income can be increased to 7.93 million rupiah per year in 2014. It means that the agriculture revenues should pursue about 11.1 % increases per annum (Kementerian Pertanian 2009: 60). On the other hand, the Renstra 2010-2014 stated that income value for farmers can be acquired from agriculture and non-agriculture sector. The income value in agriculture will be obtained from the difference between the sale value of farming production and the purchase value of household consumption. The sale value will be determined by volume of production as well as the selling price. An increased production of agriculture cannot be guaranteed to get higher income for farmer, if there is not price stability of inflation rate.

Chapter 3
Research Methodology

3.1 Data

This study uses two forms of data, time series and panel data. Time series data are used to the dynamic analysis in the VAR model, which are composed of six variables in the form of quarterly data in the period 2000 – 2011 (264 observations). They are (1) the NTP index based on CPI in 2007, (2) growth of agriculture share in GDP based on constant price in 2000, (3) inflation rate, (4) interest rate, (5) money supply in billion Indonesian Rupiah period average, and (6) real exchange rate of national currency of Indonesia Rupiah per U.S. Dollar in the period average.

The NTP index or the index of Farmer Term of Trade is one of most important farmers' welfare measurements in Indonesia (BPS 2007). It is generated from an assessment approach of earnings by farmers in the production and consumption process. The NTP index is claimed by BPS as an index that can be used to know the level of competitiveness of agriculture products produced by farmers compared to other products. Furthermore, the NTP index is conceptually a measure in the exchange ability of agriculture commodities produced by farmers for other goods/services needed in a domestic consumption or agriculture production demand. The index of prices received by farmers ($\mathrm{I_t}$), as the producer price index, is the index of various commodities prices in the agriculture production (farm gate price). Whereas, the index of prices paid by farmers ($\mathrm{I_b}$), as the consumer price index, is the index of goods/services prices consumed by farmers and the index of production costs issued by the farmer on producing agriculture products (retail price). Quantitatively, the NTP index is the ratio of index of $\mathrm{I_t}$ to index of $\mathrm{I_b}$ (BPS. 2012a). The calculation in value of $\mathrm{I_t}$ and $\mathrm{I_b}$ is using the modified Laspeyres index[4] method as follows:

$$I_n = \frac{\sum_{i=1}^{m} \frac{P_{ni}}{P_{(n-1)i}} P_{(n-1)i} Q_{oi}}{\sum_{i=1}^{m} P_{oi} Q_{oi}} \; x \; 100 \qquad (4)$$

Where:

I_n : Price index of the n[th] month for I_t and I_b
P_{ni} : Price of the n[th] month for goods i
$P_{(n-1)i}$: Price of the (n-1)[th] month for goods i
P_{oi} : Prices in the base year for goods i
Q_{oi} : Quantity in the base year for goods i
m : Many types of goods, included in the commodity package

[4] Laspeyres index is one basic formula that is introduced by Etienne Laspeyres (1834–1913) to calculate the relative value of price indices (P_L) in two periods (base period = 0, and computed period = t) , where increases of good price (P) are weighted by the quantities of good (Q) in the base year as follows:

$P_L = \frac{\sum_{i=1}^{n} P_i^t \; x \; Q_i^0}{\sum_{i=1}^{n} P_i^0 \; x \; Q_i^0}$ (Hill 2004: 3)

NTP is formulated as follows:

$The\ index\ of\ NTP = \frac{I_t}{I_b}\ x\ 100$ (5)

Based on formula (5), the value of NTP has three possibilities, i.e.:

(1) NTP = 100 : farmers have a break-even point or a break-even price received for the same price paid.
(2) NTP > 100 : farmers have a surplus because the price received is greater than the price paid.
(3) NTP < 100 : farmers have a deficit because the price received is less than the price paid.

In addition, the growth of agriculture share in GDP data are based on various economic activities producing value added from forestry, hunting, and fishing as well as cultivation of crops and livestock production processes (BPS 2007). The inflation data from IFS-IMF are a percentage change in the price level and it is accounted as the rise of consumer price. The exchange rate data from IFS-IMF are the real exchange rate as a relative price of the currencies between national currencies of Indonesia Rupiah per U.S. Dollar in the period average (IMF. 2012). The interest rate data from BI are provided by state bank for working capital. Whereas, the money supply data are the amount of billion Indonesian Rupiah supplied by BI, which has permitted authority to supply money in the economic activities in Indonesia (BI. 2012).

Furthermore, panel data from BPS (2012b) are used in the quadrant analysis. The data consist of two variables, (1) the NTP index by province based on CPI in 2007, and (2) the percentage of rural poverty rate by province. The number of provinces (i) is 32 provinces (without DKI Jakarta as a capital city of Indonesia which is non-agricultural provinces), whereas the number of time series (t) is 4 years (in the period 2008 – 2011). The use of NTP data analysis by province in the period 2008 - 2011 is based on the availability of data that has a similar value in price changes. The NTP index is based on CPI in 2007and it is better to use in the comparison aspect of quadrant analysis. Whereas, the use of rural poverty data by province in the period 2008 - 2011 is based on the data availability for all provinces (32 provinces) in Indonesia because the poverty data are not complete for all provinces in the previous year. It has been affected by the presence of some new autonomous provinces resulted from the post-implementation of the decentralization and local autonomy policy in Indonesia in the period 1999-2004.

3.2 Analysis

The analysis in this study deploys the VAR analysis and the quadrant analysis. The VAR analysis is used to test the relationship between inflation rate and farmers' welfare in the short and long run. The quadrant analysis is used to map interrelated conditions between farmers' welfare and rural poverty rate. It aims to indicate the effect of farmers' welfare based on the NTP index for rural poverty reduction in 32 provinces of Indonesia.

3.2.1 VAR Analysis

The procedures of structural econometrical method in the simultaneous equations often apply economic theory in order to express the relationship amongst economic variables. However, the estimation process in the simultaneous model will be more complicated and will generate the endogeneity problem on each side of equation (between dependent and independent variables). Therefore, it is quite difficult to determine the proper quantitative approach for dynamic analysis between monetary and agricultural variables based on the principles in Economics accurately. Then, VAR model that has been offered by Sims in 1980 provides a better resolution to the endogeneity problem through a non-structural model (Gujarati 2004: 848). It is a general procedure for dynamic analysis in some variables used in the quantitative economic study.

In this study, the VAR analysis uses six variables from monetary policy instruments and agriculture sector aspects. The variables are consist of the NTP index (NTP), the growth of agriculture value added share in GDP (AG), the percentage of inflation rate (IF), the interest rate (in percent) (IR), the logarithm of money supply (M2), and the logarithm of real Rupiah/USD exchange rate (EX). They can be written as follows:

$$X_t = \beta_0 + \beta_n X_{t-n} + e_t \quad (6)$$

Where:

X_t : The vector elements of variables (NTP, AG, IF, IR, M2, and EX)
β_0 : The constantan vector of $n\,x\,1$
β_n : The coefficient of X_t
n : The length of lag
e_t : The vector of variable shock

In the primitive system as 'common econometrical model', the model for this research can be derived as:

$$\mathrm{NTP_t} = \alpha_{10} - \alpha_{11}\mathrm{AG_t} - \alpha_{12}\mathrm{IF_t} - \alpha_{13}\mathrm{IR_t} - \alpha_{14}\mathrm{M2_t} - \alpha_{15}\mathrm{EX_t} + \beta_{11}\mathrm{NTP_{t-1}} + \delta_{11}\mathrm{AG_{t-1}} + \gamma_{11}\mathrm{IF_{t-1}} + \rho_{11}\mathrm{IR_{t-1}} + \tau_{11}\mathrm{M2_{t-1}} + \omega_{11}\mathrm{EX_{t-1}} + \varepsilon\mathrm{NTP}_t$$

$$\mathrm{AG_t} = \alpha_{20} - \alpha_{21}\mathrm{NTP_t} - \alpha_{22}\mathrm{IF_t} - \alpha_{23}\mathrm{IR_t} - \alpha_{24}\mathrm{M2_t} - \alpha_{25}\mathrm{EX_t} + \beta_{21}\mathrm{NTP_{t-1}} + \delta_{21}\mathrm{AG_{t-1}} + \gamma_{21}\mathrm{IF_{t-1}} + \rho_{21}\mathrm{IR_{t-1}} + \tau_{21}\mathrm{M2_{t-1}} + \omega_{21}\mathrm{EX_{t-1}} + \varepsilon\mathrm{AG}_t$$

$$\mathrm{IF_t} = \alpha_{30} - \alpha_{31}\mathrm{NTP_t} - \alpha_{32}\mathrm{AG_t} - \alpha_{33}\mathrm{IR_t} - \alpha_{34}\mathrm{M2_t} - \alpha_{35}\mathrm{EX_t} + \beta_{31}\mathrm{NTP_{t-1}} + \delta_{31}\mathrm{AG_{t-1}} + \gamma_{31}\mathrm{IF_{t-1}} + \rho_{31}\mathrm{IR_{t-1}} + \tau_{31}\mathrm{M2_{t-1}} + \omega_{31}\mathrm{EX_{t-1}} + \varepsilon\mathrm{IF}_t$$

$$\mathrm{IR_t} = \alpha_{40} - \alpha_{41}\mathrm{NTP_t} - \alpha_{42}\mathrm{AG_t} - \alpha_{43}\mathrm{IF_t} - \alpha_{44}\mathrm{M2_t} - \alpha_{45}\mathrm{EX_t} + \beta_{41}\mathrm{NTP_{t-1}} + \delta_{41}\mathrm{AG_{t-1}} + \gamma_{41}\mathrm{IF_{t-1}} + \rho_{41}\mathrm{IR_{t-1}} + \tau_{41}\mathrm{M2_{t-1}} + \omega_{41}\mathrm{EX_{t-1}} + \varepsilon\mathrm{IR}_t$$

$$\mathrm{M2_t} = \alpha_{50} - \alpha_{51}\mathrm{NTP_t} - \alpha_{52}\mathrm{AG_t} - \alpha_{53}\mathrm{IF_t} - \alpha_{54}\mathrm{IR_t} - \alpha_{55}\mathrm{EX_t} + \beta_{51}\mathrm{NTP_{t-1}} + \delta_{51}\mathrm{AG_{t-1}} + \gamma_{51}\mathrm{IF_{t-1}} + \rho_{51}\mathrm{IR_{t-1}} + \tau_{51}\mathrm{M2_{t-1}} + \omega_{51}\mathrm{EX_{t-1}} + \varepsilon\mathrm{M2}_t$$

$$\mathrm{EX_t} = \alpha_{60} - \alpha_{61}\mathrm{NTP_t} - \alpha_{62}\mathrm{AG_t} - \alpha_{63}\mathrm{IF_t} - \alpha_{64}\mathrm{IR_t} - \alpha_{65}\mathrm{M2_t} + \beta_{61}\mathrm{NTP_{t-1}} + \delta_{61}\mathrm{AG_{t-1}} + \gamma_{61}\mathrm{IF_{t-1}} + \rho_{61}\mathrm{IR_{t-1}} + \tau_{61}\mathrm{M2_{t-1}} + \omega_{61}\mathrm{EX_{t-1}} + \varepsilon\mathrm{EX}_t$$

(7)

Then, the primitive-system model (7) needs to be converted in the form of matrix algebra for getting the standard VAR model:

$$\begin{bmatrix} 1 & \alpha_{11} & \alpha_{12} & \alpha_{13} & \alpha_{14} & \alpha_{15} \\ \alpha_{21} & 1 & \alpha_{22} & \alpha_{23} & \alpha_{24} & \alpha_{25} \\ \alpha_{31} & \alpha_{32} & 1 & \alpha_{33} & \alpha_{34} & \alpha_{35} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & 1 & \alpha_{44} & \alpha_{45} \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & 1 & \alpha_{55} \\ \alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & 1 \end{bmatrix} \begin{bmatrix} NTP_t \\ AG \\ IF_t \\ IR_t \\ M2_t \\ EX_t \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \\ \alpha_{30} \\ \alpha_{40} \\ \alpha_{50} \\ \alpha_{60} \end{bmatrix} + \begin{bmatrix} \beta_{11} & \delta_{11} & \gamma_{11} & \rho_{11} & \tau_{11} & \omega_{11} \\ \beta_{21} & \delta_{21} & \gamma_{21} & \rho_{21} & \tau_{21} & \omega_{21} \\ \beta_{31} & \delta_{31} & \gamma_{31} & \rho_{31} & \tau_{31} & \omega_{31} \\ \beta_{41} & \delta_{41} & \gamma_{41} & \rho_{41} & \tau_{41} & \omega_{41} \\ \beta_{51} & \delta_{51} & \gamma_{51} & \rho_{51} & \tau_{51} & \omega_{51} \\ \beta_{61} & \delta_{61} & \gamma_{61} & \rho_{61} & \tau_{61} & \omega_{61} \end{bmatrix} \begin{bmatrix} NTP_{t-1} \\ AG_{t-1} \\ IF_{t-1} \\ IR_{t-1} \\ M2_{t-1} \\ EX_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon NTP_t \\ \varepsilon AG_t \\ \varepsilon IF_t \\ \varepsilon IR_t \\ \varepsilon M2_t \\ \varepsilon EX_t \end{bmatrix} \quad (8)$$

The matrix algebra of the standard VAR model (8) can be simplified to the simple form:

If $B = \begin{bmatrix} 1 & \alpha_{11} & \alpha_{12} & \alpha_{13} & \alpha_{14} & \alpha_{15} \\ \alpha_{21} & 1 & \alpha_{22} & \alpha_{23} & \alpha_{24} & \alpha_{25} \\ \alpha_{31} & \alpha_{32} & 1 & \alpha_{33} & \alpha_{34} & \alpha_{35} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & 1 & \alpha_{44} & \alpha_{45} \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & 1 & \alpha_{55} \\ \alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & 1 \end{bmatrix}; X_t = \begin{bmatrix} NTP_t \\ AG \\ IF_t \\ IR_t \\ M2_t \\ EX_t \end{bmatrix}; \Gamma_0 = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \\ \alpha_{30} \\ \alpha_{40} \\ \alpha_{50} \\ \alpha_{60} \end{bmatrix}; \Gamma_1 =$
$\begin{bmatrix} \beta_{11} & \delta_{11} & \gamma_{11} & \rho_{11} & \tau_{11} & \omega_{11} \\ \beta_{21} & \delta_{21} & \gamma_{21} & \rho_{21} & \tau_{21} & \omega_{21} \\ \beta_{31} & \delta_{31} & \gamma_{31} & \rho_{31} & \tau_{31} & \omega_{31} \\ \beta_{41} & \delta_{41} & \gamma_{41} & \rho_{41} & \tau_{41} & \omega_{41} \\ \beta_{51} & \delta_{51} & \gamma_{51} & \rho_{51} & \tau_{51} & \omega_{51} \\ \beta_{61} & \delta_{61} & \gamma_{61} & \rho_{61} & \tau_{61} & \omega_{61} \end{bmatrix}; X_{t-1} = \begin{bmatrix} NTP_{t-1} \\ AG_{t-1} \\ IF_{t-1} \\ IR_{t-1} \\ M2_{t-1} \\ EX_{t-1} \end{bmatrix}; and\ \varepsilon_t = \begin{bmatrix} \varepsilon NTP_t \\ \varepsilon AG_t \\ \varepsilon IF_t \\ \varepsilon IR_t \\ \varepsilon M2_t \\ \varepsilon EX_t \end{bmatrix}$

$BX_t = \Gamma_0 + \Gamma_1 X_{t-1} + \varepsilon_t$ (9)

Then, all equations in the simple form (9) are multiplied by the inverse matrix B (B^{-1}) to attain the standard VAR model:

$X_t = B^{-1}\Gamma_0 + B^{-1}\Gamma_1 X_{t-1} + B^{-1}\varepsilon_t$

If $A_0 = B^{-1}\Gamma_0,\ A_1 = B^{-1}\Gamma_1, and\ e_t = B^{-1}\varepsilon_t$

$X_t = A_0 + A_1 X_{t-1} + e_t$ or $X_t = \alpha_{i0} + \alpha_{ij} X_{t-1} + e_{it}$ (10)

Finally, based on the VAR system, the basic equation/the standard VAR model (10) in this study can be rewritten:

$NTP_t = \alpha_{10} + \alpha_{11}NTP_{t-1} + \alpha_{12}AG_{t-1} + \alpha_{13}IF_{t-1} + \alpha_{14}IR_{t-1} + \alpha_{15}M2_{t-1} + \alpha_{16}EX_{t-1} + e_{1t}$

$AG_t = \alpha_{20} + \alpha_{21}AG_{t-1} + \alpha_{22}NTP_{t-1} + \alpha_{23}IF_{t-1} + \alpha_{24}IR_{t-1} + \alpha_{25}M2_{t-1} + \alpha_{26}EX_{t-1} + e_{2t}$

$IF_t = \alpha_{30} + \alpha_{31}IF_{t-1} + \alpha_{32}NTP_{t-1} + \alpha_{33}AG_{t-1} + \alpha_{34}IR_{t-1} + \alpha_{35}M2_{t-1} + \alpha_{36}EX_{t-1} + e_{3t}$

$IR_t = \alpha_{40} + \alpha_{41}IR_{t-1} + \alpha_{42}NTP_{t-1} + \alpha_{43}AG_{t-1} + \alpha_{44}IF_{t-1} + \alpha_{45}M2_{t-1} + \alpha_{46}EX_{t-1} + e_{4t}$

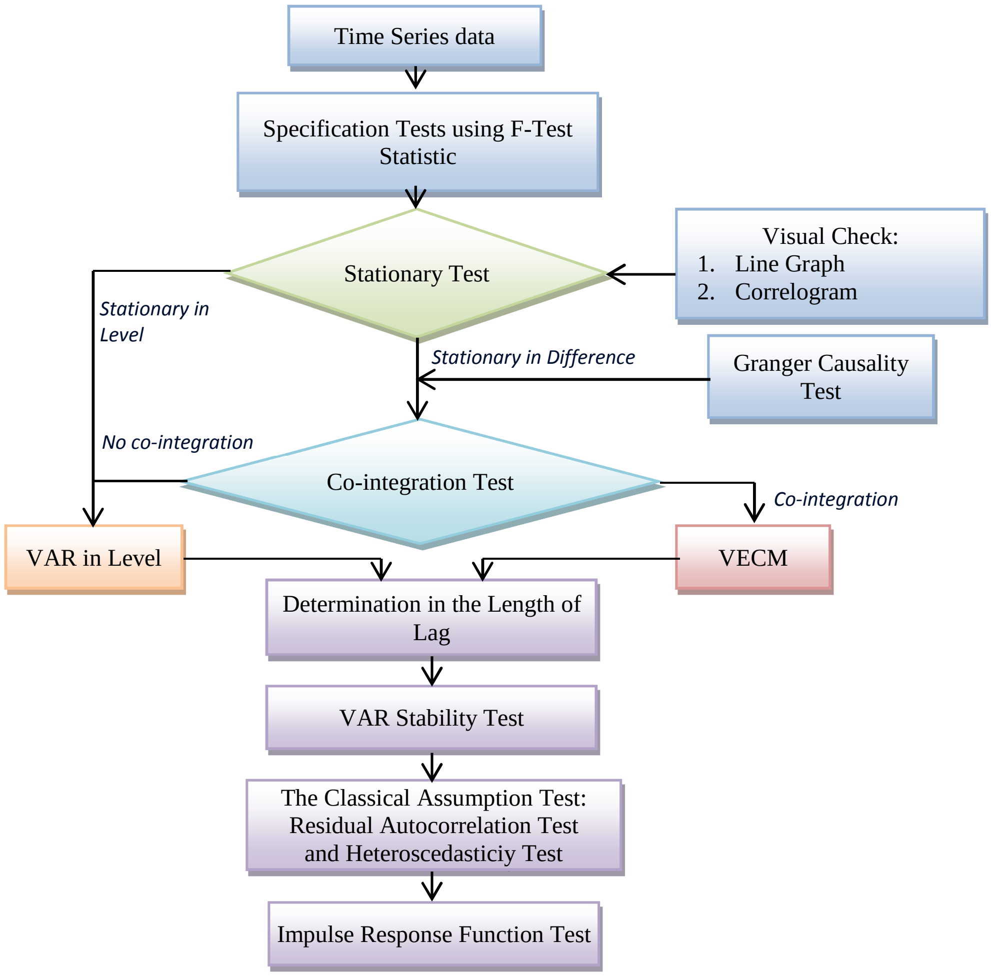
$M2_t = \alpha_{50} + \alpha_{51}M2_{t-1} + \alpha_{52}NTP_{t-1} + \alpha_{53}AG_{t-1} + \alpha_{54}IF_{t-1} + \alpha_{55}IR_{t-1} + \alpha_{56}EX_{t-1} + e_{5t}$

$$\mathrm{EX_t} = \alpha_{60} + \alpha_{61}\mathrm{EX_{t-1}} + \alpha_{62}\mathrm{NTP_{t-1}} + \alpha_{63}\mathrm{AG_{t-1}} + \alpha_{64}\mathrm{IF_{t-1}} + \alpha_{65}\mathrm{IR_{t-1}} + \alpha_{66}\mathrm{M2_{t-1}} + e_{6t} \quad (11)$$

Where:

NTP	: The NTP index
AG	: The growth of agriculture value added share in GDP
IF	: The percentage of inflation rate
IR	: The percentage of interest rate
M2	: The logarithm of money supply
EX	: The logarithm of real Rupiah/ USD exchange rate
$\alpha_{10}, \alpha_{20}, \dots, \alpha_{40}$	: Constantan
$\alpha_{11}, \alpha_{12}, \dots, \alpha_{44}$	: Coefficient of regression
$e_{1t}, e_{2t}, \dots, e_{4t}$	: White noise

Figure 3.1
The Flowchart of Estimation Procedure in VAR Model/VECM



Source: Widarjono (2007: 374) and Krisharianto (2007: 64)

In the VAR model, there are some statistical processes used in the dynamic analysis for all variables. Figure 3.1 displays the estimation procedure in the VAR model. The procedure starts from the test on determining the accurate specification for the Augmented Dickey Fuller Test (ADF Test) until investigating the variable response to other variable shocks in the impulse response function (IRF). The first step in the VAR analysis conducts the stationary test. It is the unit root test in the ADF Test, where it assumes that error term (ε_t) has correlation. The estimation regression of all variables in the model follows the equations below:

$$\Delta NTP_t = \beta_1 + \beta_2 t + \delta NTP_{t-1} + \alpha_i \sum_{i=t}^{n} \Delta \mathrm{NTP}_{t-i} + \varepsilon_t$$

$$\Delta AG_t = \beta_1 + \beta_2 t + \delta AG_{t-1} + \alpha_i \sum_{i=t}^{n} \Delta \mathrm{AG}_{t-i} + \varepsilon_t$$

$$\Delta IF_t = \beta_1 + \beta_2 t + \delta IF_{t-1} + \alpha_i \sum_{i=t}^{n} \Delta \mathrm{IF}_{t-i} + \varepsilon_t$$

$$\Delta IR_t = \beta_1 + \beta_2 t + \delta IR_{t-1} + \alpha_i \sum_{i=t}^{n} \Delta \mathrm{IR}_{t-i} + \varepsilon_t$$

$$\Delta M2_t = \beta_1 + \beta_2 t + \delta M2_{t-1} + \alpha_i \sum_{i=t}^{n} \Delta \mathrm{M2}_{t-i} + \varepsilon_t$$

$$\Delta EX_t = \beta_1 + \beta_2 t + \delta EX_{t-1} + \alpha_i \sum_{i=t}^{n} \Delta \mathrm{EX}_{t-i} + \varepsilon_t \qquad (12)$$

Furthermore, the next stage is the Granger Causality Test on determining the causality of all variables in the relationship model. Based on the Granger concept, the causality of independent variable affecting dependent variable is the value of independent variable in the past time that can increase the prediction value of dependent variable (Gujarati 2004: 696-697). One variable is described by one variable or many variables in the model (13). Therefore, there is an interrelationship amongst variables in the Granger Causality model. The model to define the causality of relationship amongst all variables as follows:

$$\mathrm{NTP}_t = \sum_{i=t}^{n} \alpha1_i \mathrm{NTP}_{t-i} + \sum_{i=t}^{n} \alpha2_i \mathrm{AG}_{t-i} + \sum_{i=t}^{n} \alpha3_i \mathrm{IF}_{t-i} + \sum_{i=t}^{n} \alpha4_i \mathrm{IR}_{t-i} + \sum_{i=t}^{n} \alpha5_i \mathrm{M2}_{t-i} + \sum_{i=t}^{n} \alpha6_i \mathrm{EX}_{t-i} + \varepsilon_{1t}$$

$$\mathrm{AG}_t = \sum_{i=t}^{n} \beta1_i \mathrm{NTP}_{t-i} + \sum_{i=t}^{n} \beta2_i \mathrm{AG}_{t-i} + \sum_{i=t}^{n} \beta3_i \mathrm{IF}_{t-i} + \sum_{i=t}^{n} \beta4_i \mathrm{IR}_{t-i} + \sum_{i=t}^{n} \beta5_i \mathrm{M2}_{t-i} + \sum_{i=t}^{n} \beta6_i \mathrm{EX}_{t-i} + \varepsilon_{2t}$$

$$\mathrm{IF}_t = \sum_{i=t}^{n} \gamma1_i \mathrm{NTP}_{t-i} + \sum_{i=t}^{n} \gamma2_i \mathrm{AG}_{t-i} + \sum_{i=t}^{n} \gamma3_i \mathrm{IF}_{t-i} + \sum_{i=t}^{n} \gamma4_i \mathrm{IR}_{t-i} + \sum_{i=t}^{n} \gamma5_i \mathrm{M2}_{t-i} + \sum_{i=t}^{n} \gamma6_i \mathrm{EX}_{t-i} + \varepsilon_{3t}$$

$$\mathrm{IR}_t = \sum_{i=t}^{n} \delta1_i \mathrm{NTP}_{t-i} + \sum_{i=t}^{n} \delta2_i \mathrm{AG}_{t-i} + \sum_{i=t}^{n} \delta3_i \mathrm{IF}_{t-i} + \sum_{i=t}^{n} \delta4_i \mathrm{IR}_{t-i} + \sum_{i=t}^{n} \delta5_i \mathrm{M2}_{t-i} + \sum_{i=t}^{n} \delta6_i \mathrm{EX}_{t-i} + \varepsilon_{4t}$$

$$\mathrm{M2}_t = \sum_{i=t}^{n} \theta1_i \mathrm{NTP}_{t-i} + \sum_{i=t}^{n} \theta2_i \mathrm{AG}_{t-i} + \sum_{i=t}^{n} \theta3_i \mathrm{IF}_{t-i} + \sum_{i=t}^{n} \theta4_i \mathrm{IR}_{t-i} + \sum_{i=t}^{n} \theta5_i \mathrm{M2}_{t-i} + \sum_{i=t}^{n} \theta6_i \mathrm{EX}_{t-i} + \varepsilon_{5t}$$

$$\mathrm{EX}_t = \sum_{i=t}^{n} \tau1_i \mathrm{NTP}_{t-i} + \sum_{i=t}^{n} \tau2_i \mathrm{AG}_{t-i} + \sum_{i=t}^{n} \tau3_i \mathrm{IF}_{t-i} + \sum_{i=t}^{n} \tau4_i \mathrm{IR}_{t-i} + \sum_{i=t}^{n} \tau5_i \mathrm{M2}_{t-i} + \sum_{i=t}^{n} \tau6_i \mathrm{EX}_{t-i} + \varepsilon_{6t}$$

(13)

Afterward, the determination in the length of lag is significant aspect in the VAR model. In this study, it uses the Akaike Information Criterion (AIC) on determining the length of lag as follows: $\mathrm{AIC} = \mathrm{T\ Log}\,|\Sigma| + 2\mathrm{N}$ (14)

From equation (14), the value of $|\Sigma|$ is the determinant of variance/covariance residual matrix and the value of N is the total number of estimated parameters in all equations. Every equation has VAR variable (n), length of lag (p), and intercept, where the number of all variables (N) as follows: $\mathrm{N} = \mathrm{n}^2\mathrm{p} + \mathrm{n}$ (15)

Hence, the lowest value of AIC is gained from several VAR assessment results with different length of lag. Then, it shows that its length of lag is ideal used in the VAR model (Krisharianto 2007: 73).

Furthermore, this study has to conduct co-integration test in the Augmented Engle-Granger test in error term (ε_t). The co-integration test was generated by Engle and Granger (1987) and further was enhanced by Johansen (1988). It is important to decide the model using specification in VAR or VECM as follow the equation:

$Y_t = \beta_{10} + \beta_{11}Z_t + \varepsilon_{1t}$ or $Z_t = \beta_{20} + \beta_{21}Y_t + \varepsilon_{2t}$ (16)

In equation (16), we can see that if the value of Y_t or Z_t has unit root in the error term (ε_t). They will be non-stationary, where the error term as lows $\varepsilon_t = Y_t - \beta_{10} + \beta_{11}Z_t$. Contrary, if stationary test in the error term gives a stationary result, they will have the co-integration (Gujarati 2004: 822).

After generating some quantitative test to determine better specification of data to be used in the model, then we can create the VAR model. The model treats all variables symmetrically, because it cannot determine the real exogenous variables in the model. The right side of regression equation in the VAR model is the lagged value of dependent variable (autoregressive) and the vector of VAR model is containing more than two variables. After that, we can also generate the several tests to define better quality of model, such as VAR stability test, residual autocorrelation test, and heteroscedasticiy test. First, the VAR stability is used to define characteristic roots in the VAR model, where the results of VAR stability are determined by modulus value of all roots in the unit circle. The test is important to decide the validity result of VAR estimation. Second, the residual autocorrelation test will describe the autocorrelation problem in the VAR model, which is related to better quality coefficient estimator. The assumption in this test uses the null hypothesis (H_0): no serial correlation in the variables based on the probability of LM-Statistic. Finally, the heteroscedasticity test is to delineate a variable condition where its variance of each error term is constant, and/or not constant. The impact of heteroscedasticity is inefficient estimation process, while the own estimate remains consistent and unbiased. The presence of heteroscedasticity problem will lead to the result of t-statistic and F-test that can be useless in the model.

The final test for VECM analysis is IRF used to define the response of one variable to shock of variable itself and/or to shock of other variables. In the IRF, each column variable describes the dynamic response of each row variable to one standard deviation shock in the future. Enders (2004: 305) has shown one simple model of IRF interpretation in the two variables, for example NTP and IF, as follows:

$$NTP_t = \alpha_{10} + \alpha_{11}NTP_{t-1} + \alpha_{12}IF_{t-1} + e_{1\mathrm{t}}$$
$$IF_t = \alpha_{20} + \alpha_{21}NTP_{t-1} + \alpha_{22}IF_{t-1} + e_{2\mathrm{t}}$$
(17)

Then, Ender has changed equations (17) into the matrix from:

$$\begin{bmatrix} NTP_t \\ IF_t \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \end{bmatrix} \begin{bmatrix} NTP_{t-1} \\ IF_{t-1} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \quad (18)$$

After the iteration process, the final equation becomes:

$$\begin{bmatrix} NTP_t \\ IF_t \end{bmatrix} = \begin{bmatrix} \overline{NTP}_t \\ \overline{IF}_t \end{bmatrix} + \sum_{i=0}^{\infty} \begin{bmatrix} \phi_{11}(i) & \phi_{12}(i) \\ \phi_{21}(i) & \phi_{22}(i) \end{bmatrix} \begin{bmatrix} \varepsilon_{1t-i} \\ \varepsilon_{2t-i} \end{bmatrix} \quad (19)$$

In equation (19) shows that the coefficient from the value of ϕ can be used on getting the dynamic response from the shocks effect of error term variables (εNTP_t *and* εIF_t) on all time dimension of NTP_t and IF_t. Hence, four elements from ϕ_{ik} have multiplier impact amongst variables in the VECM model. For example, ϕ_{11} is the dynamic response of εNTP_{t-1} to one standard deviation shock of NTP_t.

3.2.2 Quadrant Analysis

The quadrant analysis is related to the Importance Performance Analysis (IPA) as a descriptive analysis technique introduced by John A. Martilla and John C. James in 1977. IPA was originally an analytical technique used to identify the important performance factors in the grid system for investigating the satisfaction's users of company's services. The technique considers the attributes of relative importance and relative performance that can affect the further development of marketing strategies (Martilla, J. A. and J. C. James 1977). This method was initially only for use in the field of marketing researches and consumer behaviour studies. However, on further development, this method has been used in other socio-economic researchers.

The quadrant analysis is technically used to map an object on two interrelated conditions. Thus, it can determine a relative condition of objects to other objects in their relationship (Bappenas 2010a: 21). Meanwhile, to make a quadrant analysis, each object is mapped in a Cartesian diagram. There are two components in quadrant analysis, namely (1) the cut line between the X-axis and Y-axis, (2) the four quadrants resulted from intersection point of X-axis and Y-axis. The intersection point is determined by the average value of X and Y ($\bar{X}$ or $\bar{Y}$) for all observations (1, ..., j), as follows:

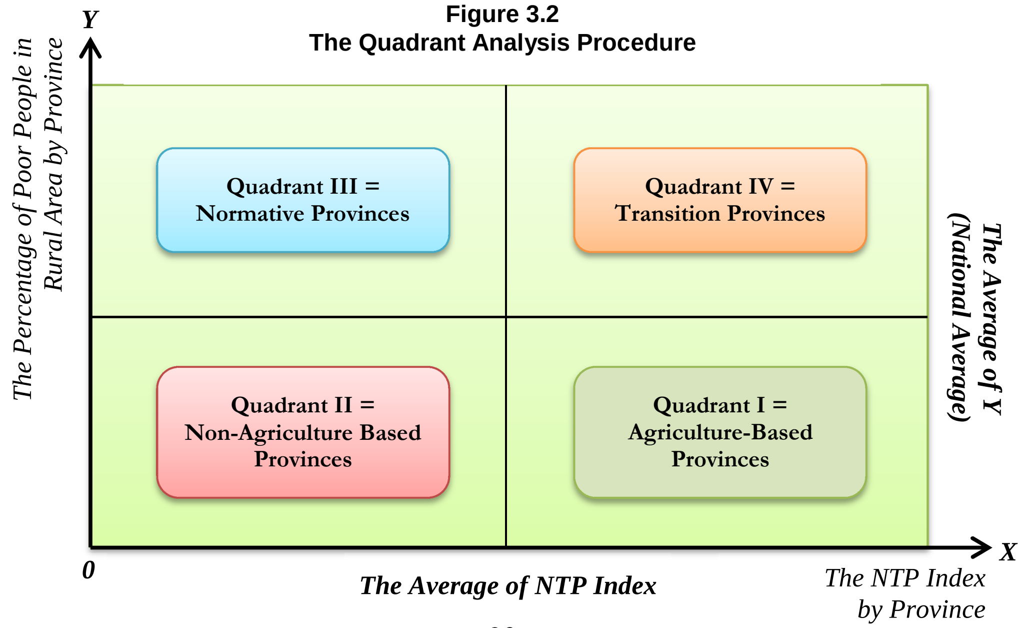
$$\bar{X} = \frac{\sum_{j=1}^{n} X_j}{j} \text{ or } \bar{Y} = \frac{\sum_{j=1}^{n} Y_j}{j} \quad (20)$$

The quadrant analysis is based on some theoretical and empirical review said that farmers' welfare has been indicated as one of important factor in agriculture sector for rural poverty reduction. The significant role of farmers' welfare can be seen in the share of farmer labour in the total of rural population and the agriculture sector share of poverty rate. The total of farmers about 41.49 million people in 2000 (34.78 % of rural population) is relatively significant compared to the total of rural population which is about 119.32 million people. Whereas, the percentage of poverty is higher in agriculture sector (about 60.99 %) compared to other non-agriculture sectors (about 32.54 %) in Indonesia (BPS 2010a: 95-126). Therefore, the NTP index as one proxy in measurement of farmers' welfare in Indonesia is related to the ability of agricultural household to finance their needs (Rachmat 2000). Then, Coudouel et al. (2002) said that one of essential factors on calculating a poverty rate are well-being indicators, where the dimensions of the latter include monetary instrument of inflation rate, in relation with income factor and consumption level. Therefore, the analysis of the relationship between the NTP index (income factor/consumption level) and rural poverty rate in the quadrant analysis is used to indicate the extent in which farmers' welfare can affect rural poverty reduction.

Figure 3.2 displays that there are two important components of the quadrant analysis in this study: (1) X-axis (the NTP index per province) and Y-axis (the percentage of poor people in rural area), and (2) the four quadrants resulted from the intersection point between the average of NTP index of X values and the average of poor-people percentage in rural area of Y values (national average). The basic assumption in this analysis is that increased farmers' welfare can stimulate a decrease of rural poverty rate. Hence, the increase of farmers' welfare is correlated to the increase of the number of agriculture-based provinces and the decrease of the number of normative provinces and transition provinces as explained below concerning the four categories of provinces (four quadrants) in the quadrant analysis.

1. **Quadrant I (Agriculture-Based Provinces)**: the provinces have *high* value of NTP index and *low* percentage of poor people in rural area.
2. **Quadrant II (Non-Agriculture Based Provinces)**: the provinces have *low* value of NTP index and *low* percentage of poor people in rural area.
3. **Quadrant III (Normative Provinces)**: The normative provinces are normal condition of provinces that have high rural-poverty rate based on low farmers' welfare. The assumption is according to some researches, Lena (2007), Isdijoso (1992), Simatupang and Mardianto (1996), and Atmadja (1999), claimed that rural poverty reduction in Indonesia can be affected by the improvement of farmers' welfare. In other words, the characteristic of these provinces have *low* value of NTP index and *high* percentage of poor people in rural area.
4. **Quadrant IV (Transition Provinces)**: the provinces have *high* value of NTP index and *high* percentage of poor people in rural area.

Figure 3.2
The Quadrant Analysis Procedure



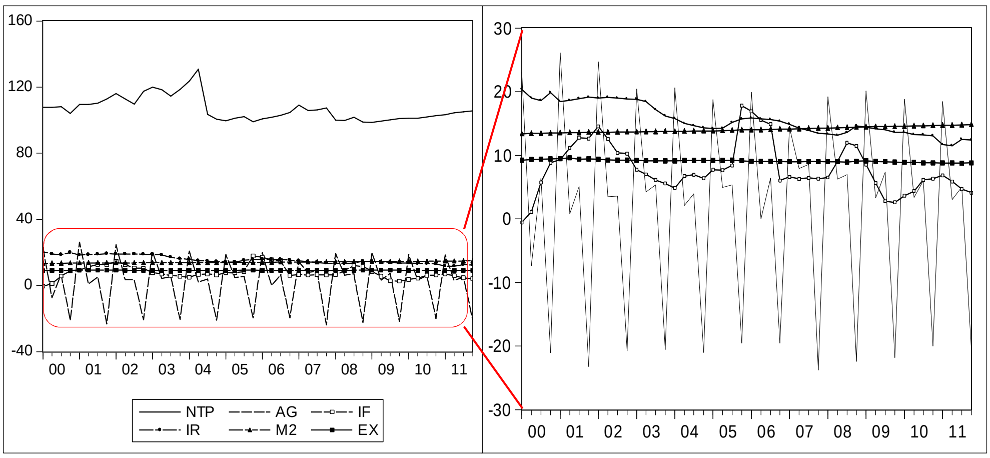
Chapter 4
Analysis of Empirical Results

4.1 Vector Auto-regression (VAR) Model Analysis

4.1.1 Stationary Test

In the VAR model, the condition of non-stationary data is important to define a spurious estimation or non-sense regression. The spurious estimation tends to give biased interpretation in the regression model (Gujarati 2004: 792). The regression result, of all variables, can often give a high value of R^2 (goodness of fit), but it cannot actually explain the real relationship amongst all variables in the model. Figure 4.1 shows that some variables in the model tended to go down for the NTP index (NTP), interest rate (IR), and real exchange rate (EX), whereas variable of money supply (M2) tended to go up. On the contrary, the variables of growth of agriculture output (AG) and inflation rate (IF) generally fluctuated in the period 2000-2011. This condition shows that some variables are not noticeable for determining their trends on stochastic trend, and/or deterministic trend. Gujarati (2004: 797) stated that the stochastic process of stationary data is an identical value from the average, variance, and covariance of all variable lags in the VAR model. All variables in the level tend to change and fluctuate together. Therefore, it can be concluded visually that no variables are stationary. It is due to increase in the average of all variables over time (no mean reversion) and the different covariance in all variable lags.

Figure 4.1
The Distribution of Variables NTP, AG, IF, IR, M2 and EX in the Level in the Period 2000 – 2011



Additionally, the Correlogram[5] generally displays that all variables are also not stationary based on the ACF (autocorrelation function) value. It defines that the first order of autocorrelation function in all variables is close to one

[5] See Figure A.1 in Appendices.

and decreases gradually with the number of lags. Likewise, the first order of the PACF (partial autocorrelation function) value is also close to one but goes down to zero quickly as long as the lag length of variable goes up. Consequently, we can conclude normally that all variables have single unit root and it means that the data are not stationary.

Moreover, determination of data stationary for all variables has to use the unit root test quantitatively. In this study, the F-test statistic is used to define correct specification of all variables for the stationary test. In the F-test statistic, the model defines the null hypothesis (H_0) that the constant term and coefficient value on all time variables and lagged variables of NTP, AG, IF, IR, M2 and EX are simultaneously equal to zero ($H_0: \beta_1 = \beta_2 = \delta = 0$). For the example to determine correct specification of NTP variable using the equation as follows:

$$\Delta NTP_t = \beta_1 + \beta_2 t + \delta NTP_{t-1} + \alpha_i \sum_{i=t}^{n} \Delta \mathrm{NTP}_{t-i} + \varepsilon_t \quad (21)$$

From Table 4.1, we can clearly see that all variables in the model are significant to have a correct random walk specification with drift and time trend for stationary test because the value of F-test statistic is significantly larger than the critical value. We can reject the null hypothesis at significant level 1 % and 5 %. It means that the constant term (β_1) and coefficient value on all time variables and lagged variables (β_2 and δ) are not simultaneously equal to zero ($H_a: \beta_1 \neq 0, \beta_2 \neq 0$, and $\delta \neq 0$).

Table 4.1
The Result of F-Test Statistic in Correct Specification Determination of All Variables for Stationary Test

Variables	F-Test Statistic	Probability
NTP	2.83	0.0492**
AG	48.14	0.0000***
IF	3.96	0.0138**
IR	3.29	0.0294**
M2	33.33	0.0000***
EX	4.62	0.0068***

**** Significant level 1%, ** significant level 5 %*

Furthermore, stationary test in this study generates the unit root test in the Augmented Dickey Fuller Test (ADF Test). The test is to decide the optimal lag length of all variables. Table 4.2 shows that all of variables in the model are generally not stationary in the level when using intercept and trend. The results have trace-statistic value smaller than critical value at 1 % and 5%. Consequently, we can fail to reject the null hypothesis (H_0) that all variables have unit root ($H_0: \delta = 0 \rightarrow \rho = 1$). It means that no variables are stationary on the level (Lag 0). Nonetheless, in the first difference, all of variables become stationary based on the stationary test. Hence, trace-statistic value will be larger than critical value, and it means that no variables have unit root ($H_a: \delta \neq 0 \rightarrow \rho \neq 1$).

Table 4.2
The Result of Stationary Test in the ADF Test on the Level and the Difference

Variables	Intercept and Trend			
	t-Stat	Critical Value 5 %	Prob.	Result
NTP	-2.228205	-3.513075	0.4630	Not Stationary
△NTP	-6.836080	-3.513075	0.0000***	Stationary
AG	-3.149373	-3.523623	0.1089	Not Stationary
△AG	-3.875434	-3.529758	0.0228**	Stationary
IF	-2.994063	-3.518090	0.1456	Not Stationary
△IF	-4.792604	-3.518090	0.0019***	Stationary
IR	-2.400735	-3.510740	0.3744	Not stationary
△IR	-6.048810	-3.510740	0.0000***	Stationary
M2	-1.082908	-3.508508	0.9212	Not stationary
△M2	-5.991862	-3.513075	0.0001***	Stationary
EX	-3.432777	-3.508508	0.0592	Not Stationary
△EX	-6.800986	-3.510740	0.0000***	Stationary

△ Means the first difference, ****significant level 1%, ** significant level 5 %*

4.1.2 Granger Causality Test

The granger causality test generally defines that there is important information for investigating the interrelationship between one variable and other variables. The design of granger causality test is implemented by the F-test statistic. We can conclude that there is uni-directional (one direction) or bi-directional (two directions) amongst all variables in the test with the assumption that the result of F-test statistic value is larger than the critical F value (F table), or it means that we can reject the null hypothesis (H_0) in the model.

Table 4.3
The Summary of Granger Causality Result

Null Hypothesis	F-Stat	Prob.	Explanation	
			Result	Interpretation
AG does not Granger Cause NTP	0.58338	0.4491	Not Rejected H_0	No relationship
NTP does not Granger Cause AG	0.34817	0.5582	Not Rejected H_0	No relationship
IF does not Granger Cause NTP	0.15914	0.6919	Not Rejected H_0	No relationship
NTP does not Granger Cause IF	0.01875	0.8917	Not Rejected H_0	No relationship
IR does not Granger Cause NTP	4.17666	0.0470**	**Rejected H_0**	Uni-directional rela-
NTP does not Granger Cause IR	1.85673	0.1799	Not Rejected H_0	tionship (one direction) from IR to NTP
M2 does not Granger Cause NTP	1.37720	0.2469	Not Rejected H_0	No relationship
NTP does not Granger Cause M2	1.45178	0.2347	Not Rejected H_0	No relationship
EX does not Granger Cause NTP	0.61491	0.4371	Not Rejected H_0	No relationship
NTP does not Granger Cause EX	0.51561	0.4765	Not Rejected H_0	No relationship
IF does not Granger Cause AG	0.04800	0.8276	Not Rejected H_0	No relationship
AG does not Granger Cause IF	0.03412	0.8543	Not Rejected H_0	No relationship
IR does not Granger Cause AG	0.03049	0.8622	Not Rejected H_0	No relationship
AG does not Granger Cause IR	0.25973	0.6129	Not Rejected H_0	No relationship
M2 does not Granger Cause AG	0.02425	0.8770	Not Rejected H_0	Uni-directional rela-
AG does not Granger Cause M2	6.88299	0.0119**	**Rejected H_0**	tionship (one direction) from AG to M2
EX does not Granger Cause AG	0.13263	0.7175	Not Rejected H_0	No relationship
AG does not Granger Cause EX	0.83488	0.3658	Not Rejected H_0	No relationship
IR does not Granger Cause IF	1.08076	0.3042	Not Rejected H_0	Uni-directional rela-
IF does not Granger Cause IR	6.18606	0.0167**	**Rejected H_0**	tionship (one direction) from IF to IR
M2 does not Granger Cause IF	3.89566	0.0547**	**Rejected H_0**	Uni-directional rela-
IF does not Granger Cause M2	0.00644	0.9364	Not Rejected H_0	tionship (one direction) from M2 to IF
EX does not Granger Cause IF	6.06101	0.0178**	**Rejected H_0**	Uni-directional rela-

IF does not Granger Cause EX	2.43990	0.1254	Not Rejected H_0	tionship (one direction) from EX to IF
M2 does not Granger Cause IR	1.88651	0.1766	Not Rejected H_0	No relationship
IR does not Granger Cause M2	0.81844	0.3706	Not Rejected H_0	No relationship
EX does not Granger Cause IR	11.7194	0.0013**	**Rejected H_0**	Uni-directional rela-
IR does not Granger Cause EX	1.46188	0.2331	Not Rejected H_0	tionship (one direction) from EX to IR
EX does not Granger Cause M2	1.31298	0.2580	Not Rejected H_0	Uni-directional rela-
M2 does not Granger Cause EX	9.73024	0.0032**	**Rejected H_0**	tionship (one direction) from M2 to EX

****significant level 1%, ** significant level 5 %, * significant level 10 %*

The result of granger causality test in Table 4.3 shows that there is only uni-directional relationship amongst variables in the VAR model. The variable of IR can affect the NTP index significantly. This result indicates that monetary policy in Indonesia through interest rate mechanism can considerably affect the change of farmers' welfare in the short run, whereas the growth of agriculture sector significantly stimulates the change of money supply. In addition, there are causal relationships amongst monetary instruments in the short run. On the one side, interest rate is influenced by inflation rate and real exchange rate. On the other hand, money supply and real exchange rate can induce inflation rate, while real exchange rate itself is affected by money supply.

4.1.3 Determination in the Length of Lag

Determination of optimal lag for VAR analysis is conducted in choosing a lag with the smallest value based on the Akaike Information Criterion (AIC). The result of VAR lag order selection in Table 4.4 shows that lag 4 with the smallest value about 6.61 is the optimal lag used in the VAR model.

Table 4.4
The Result of VAR Lag Order Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-470.9412	-	104.7870	21.67914	21.92244	21.76937
1	-215.6733	429.3141	0.004999	11.71242	13.41551	12.34401
2	-180.0527	50.19268	0.005579	11.72967	14.89255	12.90262
3	-56.70943	140.1628	0.000136	7.759520	12.38219*	9.473830
4	4.540542	52.89770*	0.0000752*	**6.611794***	12.69426	8.867465*

** indicates lag order selected by the criterion*
LR: sequential modified LR test statistic (each test at significant level 5%)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4.1.4 Co-integration Test

A co-integration in the VAR model shows a long-term relationship (equilibrium) between one non-stationary variable and other non-stationary variables. The Johannes co-integration test in Table 4.5 indicates that there are five co-integrating equations in the lag 4. All of co-integrating vectors have the trace statistic that is greater than the critical value. Hence, the null hypothesis is rejected and it means there is co-integration in the model. Then, we can conclude that the model is better to use the VECM analysis.

Table 4.5
The Result of Johansen Co-integration Test in Lag 4

Hypothesis		Eigenvalue	Trace Statistic 5 %	Critical Value	Prob.
H_0	Ha				
r = 0*	r > 0	0.817421	214.1620	95.75366	0.0000***
r ≤ 1*	r > 1	0.678895	139.3368	69.81889	0.0000***
r ≤ 2*	r > 2	0.646221	89.35337	47.85613	0.0000***
r ≤ 3*	r > 3	0.420669	43.63372	29.79707	0.0007***
r ≤ 4*	r > 4	0.348457	19.61494	15.49471	0.0113***
r ≤ 5	r > 5	0.017232	0.764817	3.841466	0.3818

Trace test indicates 5 co-integrating equations at significant level 1 %
** denotes rejection of the hypothesis at significant level 1 %*

4.1.5 VECM Analysis

The VECM is a form of the restricted VAR owing to the presence of non-stationary and co-integrated data in the dynamic analysis. The information of co-integrated restriction in the VECM specification will restrict for the long-run relationship amongst endogenous variables into its co-integrated relationship, but it is still approving the short-run relationship. Actually, the term of co-integration is also identified as the error term in the model, where deviation of the long-run equilibrium is adjusted regularly with the short-run partial adjustment mechanism. In this study, the VECM at lag 4 for all variables is defined as follows:

$$\Delta Y_t = \omega + \alpha\beta' Y_{t-1} + \Gamma_1 \Delta Y_{t-1} + \varepsilon_t \quad (22)$$

Where:

Y_t : Predicted variables = $\begin{bmatrix} NTP \\ AG \\ IF \\ IR \\ M2 \\ EX \end{bmatrix}$

ω : 6 x 1 vector of drift terms
α : 6 x 1 vector of the speed of adjustment terms
β : 6 x 1 co-integrating vector of the long-run equilibrium relationship amongst the Y_t variables
Γ_1 : 6 x 6 matrices of the short-run parameters

Table 4.6
The General Result of the VECM at Lag 4

Component	ΔNTP_t	ΔAG_t	ΔIF_t	ΔIR_t	$\Delta M2_t$	ΔEX_t
R-squared	0.718879	0.997468	0.726557	0.636502	0.902717	0.672460
S.E. equation	4.162392	1.960731	1.850289	0.455824	0.010105	0.047170
F-statistic	2.223644	342.5681	2.310490	1.522648	8.068959	1.785275

The general result of VECM in Table 4.6 indicates that the determinant coefficient of all variables is significant on defining relationship amongst variables. It is based on the high value of R^2 (goodness of fit) about more than 60 % for all variables. Nachrowi and Usman (2008: 21) explained that the goodness of fit in the econometrical model is used to define the capability of some regressors (independent variables) to estimate the econometrical relationship with another regressand (dependent variable). Therefore, we can conclude that all variables in the VECM model with high value of R^2 can generally be estimated.

Table 4.7
The Short-Run Co-integrating Relationship with Rank 5 in the VECM at Lag 4

Γ_1	ΔNTP_t	ΔAG_t	ΔIF_t	ΔIR_t	$\Delta M2_t$	ΔEX_t
	0.426129	-0.093204	0.072459	0.028350	0.002004	0.002024
ΔNTP_{t-1}	(0.22479)	(0.10589)	(0.09992)	(0.02462)	(0.00055)	(0.00255)
	[1.89568]*	[-0.88021]	[0.72514]	[1.15167]	[3.67185]***	[0.79446]
	-0.030519	-0.024098	0.050230	-0.003418	0.001585	0.001137
ΔNTP_{t-2}	(0.19892)	(0.09371)	(0.08843)	(0.02178)	(0.00048)	(0.00225)
	[-0.15342]	[-0.25717]	[0.56804]	[-0.15690]	[3.28123]***	[0.50441]
	0.018484	-0.111978	0.072908	-0.000372	0.000852	-0.001484
ΔNTP_{t-3}	(0.19238)	(0.09062)	(0.08552)	(0.02107)	(0.00047)	(0.00218)
	[0.09608]	[-1.23568]	[0.85256]	[-0.01764]	[1.82381]*	[-0.68080]
	-2.420618	1.521822	-0.577349	0.005085	0.000488	0.003848
ΔAG_{t-1}	(1.18855)	(0.55988)	(0.52834)	(0.13016)	(0.00289)	(0.01347)
	[-2.03661]**	[2.71814]***	[-1.09276]	[0.03906]	[0.16905]	[0.28572]
	-1.735568	0.745263	-0.354924	0.011122	0.000729	0.003151
ΔAG_{t-2}	(0.80335)	(0.37843)	(0.35711)	(0.08798)	(0.00195)	(0.00910)
	[-2.16040]**	[1.96937]*	[-0.99388]	[0.12643]	[0.37362]	[0.34613]
	-0.877535	-0.082088	-0.177755	0.006472	0.000630	0.001702
ΔAG_{t-3}	(0.42526)	(0.20032)	(0.18904)	(0.04657)	(0.00103)	(0.00482)
	[-2.06353]**	[-0.40978]	[-0.94031]	[0.13898]	[0.60985]	[0.35327]
	-0.080832	0.463175	0.312995	-0.013464	3.21E-05	-0.002543
ΔIF_{t-1}	(0.33591)	(0.15823)	(0.14932)	(0.03679)	(0.00082)	(0.00381)
	[-0.24064]	[2.92717]***	[2.09613]**	[-0.36603]	[0.03932]	[-0.66813]
	-0.097656	-0.089230	0.123668	0.017930	0.000601	0.005484
ΔIF_{t-2}	(0.35602)	(0.16771)	(0.15826)	(0.03899)	(0.00086)	(0.00403)
	[-0.27430]	[-0.53206]	[0.78142]	[0.45989]	[0.69503]	[1.35914]
	0.322693	-0.158048	0.350204	-0.019684	-0.001507	-0.000918
ΔIF_{t-3}	(0.36112)	(0.17011)	(0.16053)	(0.03955)	(0.00088)	(0.00409)
	[0.89358]	[-0.92909]	[2.18158]**	[-0.49773]	[-1.71847]*	[-0.22437]
	-3.761020	-0.742403	2.358741	0.091352	-0.004412	-0.041143
ΔIR_{t-1}	(1.89429)	(0.89232)	(0.84206)	(0.20744)	(0.00460)	(0.02147)
	[-1.98545]*	[-0.83199]	[2.80116]***	[0.44037]	[-0.95950]	[-1.91657]*
	-6.004537	1.636593	1.283618	-0.003005	0.005741	0.023271
ΔIR_{t-2}	(2.06318)	(0.97188)	(0.91714)	(0.22594)	(0.00501)	(0.02338)
	[-2.91033]***	[1.68395]*	[1.39960]	[-0.01330]	[1.14617]	[0.99528]
	-1.384310	0.001194	0.177360	0.011252	-0.019593	-0.073720
ΔIR_{t-3}	(2.49960)	(1.17746)	(1.11114)	(0.27373)	(0.00607)	(0.02833)
	[-0.55381]	[0.00101]	[0.15962]	[0.04111]	[-3.22884]***	[-2.60249]**
	16.76243	24.33776	57.38865	-5.259557	-0.659506	-1.120682
$\Delta M2_{t-1}$	(67.5643)	(31.8267)	(30.0340)	(7.39897)	(0.16402)	(0.76567)
	[0.24810]	[0.76470]	[1.91079]*	[-0.71085]	[-4.02092]***	[-1.46366]
	-101.8502	83.36628	65.28496	-2.424874	-0.315776	-0.091384
$\Delta M2_{t-2}$	(71.0743)	(33.4802)	(31.5943)	(7.78335)	(0.17254)	(0.80545)
	[-1.43301]	[2.49002]**	[2.06635]**	[-0.31155]	[-1.83017]*	[-0.11346]
	-52.85997	66.11677	31.25518	-4.336443	-0.389936	-0.984577
$\Delta M2_{t-3}$	(79.0734)	(37.2482)	(35.1501)	(8.65933)	(0.19196)	(0.89610)
	[-0.66849]	[1.77503]*	[0.88919]	[-0.50078]	[-2.03136]**	[-1.09874]
	3.303321	6.467600	-16.50544	-2.253653	0.211884	0.439416
ΔEX_{t-1}	(21.2379)	(10.0043)	(9.44077)	(2.32576)	(0.05156)	(0.24068)
	[0.15554]	[0.64648]	[-1.74832]*	[-0.96900]	[4.10971]***	[1.82574]*
	27.38937	-16.40540	-25.73293	-1.294501	0.041332	0.010247
ΔEX_{t-2}	(20.6627)	(9.73334)	(9.18509)	(2.26277)	(0.05016)	(0.23416)
	[1.32555]	[-1.68549]**	[-2.80160]***	[-0.57209]	[0.82400]	[0.04376]
	12.63045	-12.90421	-9.488986	-2.507057	0.170266	0.384608
ΔEX_{t-3}	(22.9053)	(10.7897)	(10.1820)	(2.50836)	(0.05560)	(0.25957)
	[0.55142]	[-1.19597]	[-0.93194]	[-0.99948]	[3.06208]***	[1.48169]

Standard errors in ( ) and t-statistics in [ ]
**** Significant at t-statistic > 1 % critical value with df 40 [2.704]*
*** Significant at t-statistic > 5 % critical value with df 40 [2.021]*
** Significant at t-statistic > 10 % critical value with df 40 [1.684]*

The result of short-run relationship in Table 4.7 displays that the variables of AG and IR can affect the further change of NTP index in several lags. The variable of AG now can affect the NTP index on several next periods significantly, where the coefficient value of its variable is gradually decreasing over time. The increase 1 % of current AG will significantly affect decrease of NTP about 2.42 %, 1.74 %, and 0.88 % for one, two, and three next periods respectively. This result indicates that the farmers' welfare has negative relationship on agriculture output growth in the short run. The decrease of the NTP index due to increase of agriculture output growth is based on the three reasons, demand factor, market structure, and technological development (Rachmat 2000).

In the demand factor, the characteristic of agriculture products is inelastic based on the Engel Law[6]. The increase of agriculture output cannot increase farmer's income automatically in the short run, as long as people can meet their basic needs from agriculture products. Therefore, the imbalance of agriculture cost production and earned income for farmer can affect decrease of the NTP index. In the market structure of commodity, the volatility of the NTP index can be stimulated by the difference between agriculture and manufacture products. The market of agriculture commodity is generally perfect competition, where the market force determines the price level. In contrary, the market of manufacture commodity tends to imperfect competition or monopoly. Hence, this condition can relatively affect decrease of the price level of agriculture products compared to the price level of manufacture products in the market. Moreover, agriculture prices are fragile, where the characteristics of agriculture commodities are seasonal and perishable. Additionally, in the technological development, the adoption of new technology in agriculture sector has been followed the dependency of agriculture sector to non-agriculture sector and it can decrease the role of land factor in agriculture production (Rachmat 2000: 31). Therefore, the new technology can increase aggregate supply of agriculture product. In turn, it can decrease of price level based on the price elasticity of supply[7] in the short run. Then, the low performance of value added of agriculture price can also reduce the NTP index.

Furthermore, IR is only monetary instrument variable that significantly stimulates further change of the NTP index in the short run. The determination of interest rate for working capital from the central bank of Indonesia can induce significant decrease of the NTP index. The increase 1 % of current IR will meaningfully lead to decrease of the NTP index about 3.76 % and 6 % for one and two next periods respectively. This condition indicates that the effect of high interest rate can encourage investment process in agriculture sector. Afterwards, it may influence increase of agriculture cost production in the short run. It means that the index of prices paid by farmers (I_b) is larger than the index of prices received by farmers (I_t), therefore this condition can affect decrease of the NTP index.

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[6] The Engel law is introduced by Ernst Engel (1821–1896), which it states that people in spending their food consumption (primary goods) are not change due to increase of their income.

[7] Mankiw (2004: 109) stated that supply is more inelastic in the short run than the long run in the most markets, especially for agriculture product. When the new advance technology in agriculture sector can raise the agriculture supply, the price of agriculture products will be fall.

Moreover, the variable of IF is not significant to influence the NTP index in the short run. It can only affect AG for one next period. Conversely, IF is significantly stimulated by some other monetary instruments, IR, M2, and EX. Money supply instrument can give larger impact to increase inflation rate than other monetary instruments. Based on the theory of liquidity preference[8], the quantity of money supply from the monetary policy of the central bank is stable in the balance system and it cannot be determined on other economic factors. The central bank can independently use the monetary authority on determining the amount of money to achieve expected low inflation rate and sustainable economic growth (Mankiw 2004: 453). This authority tends to be not optimal if there are close relationship amongst money supply, economic factors, and high inflation rate. In this study, the increase 1 % of current M2 will considerably drive to rise of IF about 57.39 % and 65.28 % for one and two next periods respectively. Therefore, money supply instrument in Indonesia is not good policy to maintain low inflation rate in the short run. This fact also indicates that inflation rate in Indonesia is based on structural theory, where inflation is not only about monetary phenomena, but also it is related to structural phenomena. Hence, the economic shocks that come from domestic and abroad will also stimulate the inflation rate.

In addition, the type of inflation in Indonesia is also as cost-push inflation[9] resulted from a major force, for example, increase of domestic oil prices to stimulate higher production cost of agriculture sector (Atmadja 1999). Fortunately, the three times of adjustment policies for domestic oil price in Indonesia in the period 2000-2011 were not able to affect the stability of economic conditions. Indonesian government had maintained the purchasing power of vulnerable people in their basic consumption through inflation rate control in commodities supply and social-community programs. For example, the success of oil-fuel-to-gas conversion program on decreasing the dependence of Indonesian households to consume oil, in turn, it can maintain basic consumption of vulnerable people (Abdini, et al. 2012). The multiplier effect in better consumption of vulnerable people working in agriculture sector can maintain good performance of farmers' welfare. It indicates that the average of moderate inflation rate in the period 2000 – 2001 could be still accepted from agriculture sector production, and Indonesian government had maintained the expected inflation rate for economic stability. Therefore, the fluctuation of inflation rate cannot be significant to affect performance of farmers' welfare in the short run.

[8] It is one part of Keynes's theory that states that the interest rate adjusts to drive the money supply and the money demand into the balance system.
[9] Samuelson and Nordhaus (1998: 581-591) said that the cost-push inflation (the supply-shock inflation) is the inflation occurred due to the large increase in production costs in the supply-side.

Table 4.8
The Long-Run Co-integrating Relationship in the VECM at Lag 4 with Johansen Normalization

ΔNTP_t	ΔAG_t	ΔIF_t	ΔIR_t	$\Delta M2_t$	ΔEX_t
1	-3.916007 (0.81405) [-4.81051]***	-1.871178 (0.28617) [-6.53875]***	-0.707430 (0.56914) [-1.24298]	-1.541645 (4.24815) [-0.36290]	26.55805 (7.72461) [3.43811]***

Standard errors in ( ) and t-statistics in [ ]
**** Significant at t-statistic > 1 % critical value with df 40 [2.704]*

The result of long-run relationship in Table 4.8 presents that interpretation procedure is reverse with the short-run relationship, where the negative coefficient is interpreted as a positive effect for normalised variables based on the NTP index in the equation:

$$1NTP - 3.92AG - 1.87IF - 0.71IR - 1.54M2 + 26.56EX = 0$$

$$NTP = 3.92AG^{***} + 1.87IF^{***} + 0.71IR + 1.54M2 - 26.56EX^{***} \qquad (23)$$

**** Significant at 1 % critical value*

The result of long-run co-integrating relationship in equation (23) shows that the NTP index is positively related to the variables of AG and IF, but it has a negative relationship with variable of EX significantly. The variables of AG, IF, and EX are significant to influence the NTP index based on significant level 1 %. The coefficient for variable of AG indicates that every 1 % increase in the growth of agriculture output will significantly increase the NTP index by 3.92 % in the long run. It means that since the growth of agriculture output plays an important role in Indonesian economy, an increase in agriculture sector output will cause the farmers' welfare to be higher.

On the one side, the monetary instruments of EX are negatively significant to affect change of the NTP index in the long run. Every 1 % increase variable of EX will expressively decrease the NTP index about 26.56 %. This means that a depreciation of Indonesian rupiah tends to decrease the NTP index significantly. Sipayung (2000: 25) stated that the real exchange rate of rupiah could indirectly be related to generate price level in Indonesia. Then, he claimed that the exchange rate of rupiah in Indonesia is generally over valued compared with the official exchange rate[10]. The over-valued rupiah can give the subsidy of import exchange rate and impose the tax of export exchange rate. It can affect the performance of export-import products. In turn, the depreciation of exchange rate can stimulate the higher price for agriculture household consumption and the lower farmers' income for agriculture household production. Hence, the depreciation of exchange rate compared to other monetary variables is not good for increasing the NTP index in the long run.

On the other side, inflation rate can positively drive a significant effect on the NTP index in the long run. The 1 % increase of IF can raise the NTP index about only 1.87 %. It indicates that the inflation rate can considerably raise the index of prices received by farmers (I_t) than the index of prices paid by farmers (I_b). Inflation rate is actually needed to increase the farmers' welfare in the long run through better quality of price selling in economic stability.

[10] The real value of exchange rate in the country.

Atmadja (1999) said that the characteristic of inflation rate in Indonesia is not 'the short-term phenomenon' and incidental situation. It is as the long-term inflation rate that can stimulate the structural-macroeconomic conditions. Therefore, the synergy of monetary instruments and real-sector-development policy on determining expected inflation rate is needed to improve the further farmers' welfare in Indonesia.

4.1.6 Validity Test of VECM Estimation Result

In this study, there are three tests used to check validity of VECM estimation result, the stability test, the residual autocorrelation test, and the heteroscedasticity test. The VECM stability test investigates the characteristic roots of the autoregressive (AR) polynomial model. This test uses the assumption that the validity of VAR estimation has the characteristic roots inside the unit circle. Based on the result of stability condition test[11], all roots have modulus value less than one and they are generally inside the unit circle. Therefore, we can conclude that the result of VECM estimation is stable and valid. Furthermore, the residual autocorrelation test using Lagrange-multiplier test is to determine whether there is a correlation amongst variables. The assumption in this test uses the null hypothesis (H_0): no serial correlation in the variables. The results of this test from lag 1 to lag 4 in Table 4.9 shows failing to reject the null hypothesis (H_0) at significant level 5 %. It is based on the probability for some lag length is more than the value of LM-Stat, and it indicates that there is not any serial correlation amongst variables in the model.

Table 4.9
The Result of Autocorrelation Test

Lags	LM-Stat (Chi^2)	Prob.
1	44.08123	0.1669
2	34.64027	0.5332
3	48.18604	0.0843
4	32.21451	0.6493

Prob. from chi-square with 36 df

Another assumption used in the validity test is heteroscedasticity. The estimators are still containing the heteroscedasticy, which will create 'misleading' in the interpretation of VECM result. The heteroscedasticity test is to define a variable condition where its variance of each error term is not constant and its estimator remains consistent and unbiased. The presence of heteroscedasticity problem will lead to the result of t-statistic and F-test that can be useless in the model. Therefore, the assumption in absence of heteroscedasticity (homoscedasticity) aspect needs to be fulfilled in the model. In the result of heteroscedasticity test[12], the probability of Chi-square values is not significant for the joint test and the individual components test. Therefore, all of individual components fail to reject the null hypothesis (H_0), which it means that the estimators in the model are homoscedasticy.

[11] See Figure A.2 and Table A.1 in Appendices.
[12] See Table A.2 in Appendices.

4.1.7 Impulse Respond Function

The IRF traces the effects of a one-time shock on the endogenous variables in the future. It is used to define the response of one variable to shock of variable itself or to shock of other variables. In the IRF, each column variable describes dynamic response of row variables to one standard deviation shock. The result of IRF[13] displays that there is direct positive impact from response of NTP index to shock of AG and IF. Furthermore, the dynamic responses of NTP index to one standard deviation shock of IR, M2, and EX are fluctuated.

The large positive-dynamic response of NTP index to one standard deviation shock of AG will occur from the first period to the second periods, then it considerably decrease in small positive-dynamic response until the fourth period. Then, the response of NTP index to one standard deviation shock of AG gradually increases until in the tenth period. Likewise, the response of NTP index to one standard deviation shock of IF from the first period to the fourth period will be stable. Afterwards, the response will impressively increase on the sixth period and then it will be positively fluctuated until the tenth period. Furthermore, the larger positive response of NTP index is to one standard deviation shock of IR, where it considerably rises from the third period to the sixth period. Then, it will be positively fluctuated in higher percentage of response to one standard deviation shock of IR until the tenth period. In contrary, there is slightly fluctuated-dynamic response of NTP index to one standard deviation shock of M2 from the first period to the tenth period about 1%, whereas the response of NTP index to one standard deviation shock of EX negatively fluctuates from the first period to the sixth period. Then, its response will be positively fluctuated until the tenth period. Based on the result, we can conclude that response of NTP index to inflation rate and other monetary variable shocks will continue over time, and it tends to difficult to reach the equilibrium condition for a long time. Hence, the inflation rate and the performance of agriculture output growth in Indonesia will be significant to affect the change of NTP index in the future.

4.2. Quadrant Analysis

The result of quadrant analysis in Figure 4.2 displays that many provinces in Indonesia are non-agriculture based provinces (quadrant II). Sumatera Utara, Bangka Belitung, Jambi, Kepulauan Riau, Jawa Barat, Banten, Kalimantan Timur, Kalimantan Tengah, Kalimantan Barat, Sulawesi Utara, and Maluku Utara can be considered as belonging to the quadrant II. The provinces have low value of NTP index and low percentage of poor people in rural area. The provinces from the western part of Indonesia (Sumatra, Java, and Kalimantan) are dominant on this quadrant. In fact, agricultural productivity in some provinces in the quadrant II is quite high. Three provinces of quadrant II have the important commodities on a national scale, such as rubber and oil palm in Sumatra Utara, plywood in Kalimantan Timur, and rice in Jawa Barat (Hendayana 2003). However, the lower labour absorption, the higher land conversion, and land ownership inequality in agriculture sector are still becoming important

[13] See Figure A.3 in Appendices.

factors on causing the low level of farmers' welfare in these provinces (E. M. Lokollo, et al. 2007).

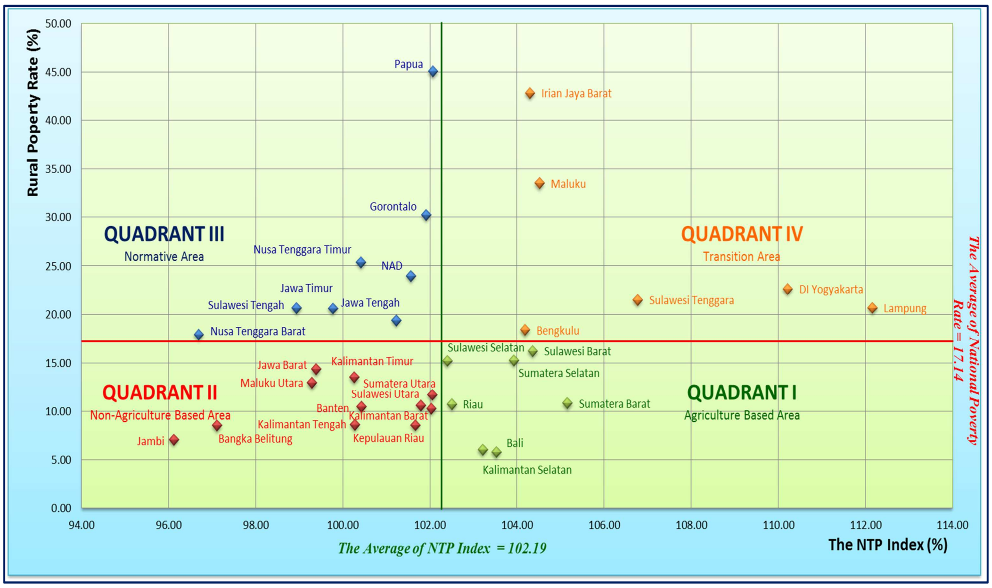
In addition, employment share of agriculture sector in the provinces of quadrant II was still low about 0.02% - 3.01%, where the dominant proportion of population aged 15 years and over working in agricultural sector in the period 2004-2009 was only smaller than 50%. It indicates that the agriculture structure in Sumatra, Java, and Kalimantan is still dominated by small number of farmers. Moreover, manufacturing industries sector, service sector, trade sector, finance sector, and mining/quarrying sector have rapidly grown and caused high land conversion from agriculture to non-agriculture sector in these provinces (BPS 2010b). In the period 1993 – 2003, total of land conversion of provinces in this quadrant is considerably high about 1.65 million hectare or about 9.35 % of total of agriculture land in 1993 (Bappenas 2010a). Furthermore, Lokollo (2007: 9) stated that in four census periods, three decades: 1973-2003, the Gini ratio of agricultural land distribution in Sumatra, Java, and Kalimantan was increased from 0.5481 in 1973 to 0.7171 in 2003. It means that land ownership inequality is high (Gini ratio > 0.50), where the average of agriculture land owned by each household is only 0.10 hectares. Hence, it is difficult to pursue high agriculture productivity without adequate availability of agricultural land. Whereas, the policy intervention from Indonesian government on agriculture-intensification process (advanced technology, good management, efficient production, and high competitiveness products) in these provinces is not optimal (Kasryno 1996). Hence, it indicates that these provinces may have not been able to increase the performance of agriculture sector development, because they are still considering the non-agriculture based sectors as key sector on increasing farmer's welfare and reducing rural poverty rate.

The second dominant provinces are normative provinces (quadrant III). They are NAD, Jawa Timur, Jawa Tengah, Sulawesi Tengah, Gorontalo, Nusa Tenggara Timur, Nusa Tenggara Barat, and Papua. On the one side, agriculture productivity in food crops and fishery for some provinces, such as NAD, Sulawesi Tengah, Gorontalo, Nusa Tenggara Timur, Nusa Tenggara Barat, and Papua have low multiplier effect to increase the farmers' welfare and reduce poverty rate. This condition is caused by the low agriculture production and low employment share of agriculture sector. The employment share in these provinces, in the period 2004 – 2009, was only about 0.10% - 4.18% (Bappenas 2010a). On the other side, some provinces in this quadrant, Jawa Timur and Jawa Tengah, have been known as the best of food crops-production provinces in Indonesia. In the period 2007 – 2010, Jawa Tengah had produced rice about 9,360,239 tons (15.16% of total of national production). Meanwhile, Jawa Timur had also produced rice about 10,594,698 tons (17.16% of total of national production), maize about 4,953,872 tons (30.37% of total of national production), and soybeans about 307.240 tons (37.58% of total of national production). The paddy field in Jawa Tengah and Jawa Timur in 2005 was the widest in Indonesia, which is about more than one million hectare (BPS 2006). This fact shows that high agriculture output do not guarantee the high farmer's welfare and low rural poverty rate. This condition is more caused by lack of ownership in the agricultural productive assets by small farmers, poor economic-agricultural policies, and weak agricultural institutions on supporting the high marketability of agricultural products in order to increase farmers' income (Kasryno 2000). Moreover, Malian et al. (2004) also claimed that low-income farmer and unskilled-agriculture farmer indicates less attractive of agriculture sector for productive labours and high-educated people. Indonesian government has to determine better policy on increasing of agricultural productivity in order to raise farmers' income, in turn; it can affect rural poverty reduction process in Indonesia.

Furthermore, seven provinces could be depicted as agriculture-based provinces (quadrant I), Sumatera Barat, Sumatera Selatan, Riau, Bali, Kalimantan Selatan, Sulawesi Barat, and Sulawesi Selatan. These provinces have a good level of agricultural production and farmers' welfare from the sectors food crops and estate crops. It could be indicated that the provinces in this area have been able to increase the performance of agriculture sector development for reducing rural poverty rate. The competitive agriculture products in these provinces are rice, maize, sweet potatoes, peanuts, green beans for food crops production, while oil palm, coconut, rubber, pepper, coffee, and cocoa for estate crops production. Indeed, some provinces in this quadrant have agricultural products on a national scale, such as palm oil in Riau and cocoa in Sulawesi Barat (Hendayana 2003). Some provinces in this quadrant were also in the best provinces of Indonesia with the high employment share about 4.18%. - 5.12% in food-estate-crops agriculture sector in the period 2004-2009. While, the proportion of people aged 15 years and over working in agricultural sector was also relatively large about 60-69% (Bappenas 2010a).

Lastly, the minority of provinces in Indonesia are transition provinces (quadrant IV), namely Bengkulu, Lampung, Daerah Istimewa Yogyakarta, Sulawesi Tenggara, Maluku, and Irian Jaya Barat. The level of farmers' welfare in these provinces is quite high, but they are still having problem in the high rural poverty rate. In general, the agricultural sector in this province comes from fisheries and food crops, with the competitive commodities of rice, sweet potatoes, maize, cassava, and peanuts (Hendayana 2003). Food crops agriculture is competitive commodities in Lampung, Bengkulu, Daerah Istimewa Yogyakarta, and Sulawesi Tenggara, while fishery is an important sector in Maluku and Irian Jaya Barat. Food crops and fishery sectors in some provinces, such as rice in Lampung and fishery in Irian Jaya Barat, become important commodities in the national scale, but both of sectors are still not significant on reducing poverty rate in all these provinces. Services sector, manufacturing industries sector, trade sector, and mining /quarrying sector has contributed on high GRDP growth and high labour absorption in these provinces (BPS 2010a). On the other hand, the proportion of people aged 15 years and over working in agricultural sector in the period 2004-2009 was quite large, about 70-90% although the employment share of agriculture sector in these provinces was quite low, about 0.02 - 1.50% (Bappenas 2010a). The results indicate that there is still potential agriculture sector to be developed in these provinces. One the one side, these provinces require a change on determining economic sector policy to increase more agriculture sector productivity for rural poverty reduction. On the other side, they also need to consider the transformation policy based on comparative advantage analysis in determining the best sector for rural poverty reduction between agriculture sector and non-agriculture sector development.

Figure 4.2
The Result of Quadrant Analysis between the Average of Poor-People Percentage in Rural Area and the Average of NTP Index by Province in the Period 2008 - 2011



In Table 4.10, the result of quadrant analysis[14] indicates a significant increase of the number of agriculture-based provinces in Indonesia alongside an increase of farmers' welfare in these provinces. The number of provinces in this quadrant analysis had generally increased from 5 to 9 provinces because of a raise in the average of NTP index, from 100.98 to 104.19 in the period 2009-2011. This corresponds to provinces going from low NTP index and low poverty rate (quadrant II) to high NTP index and low poverty rate (quadrant I). There was considerably decrease in the number of non-agriculture based provinces from 13 to 9 provinces in the period 2009-2011. This condition indicates that some provinces in Indonesia have been able to increase the farmers' welfare and they have considered that the agriculture sectors as key factor for reducing rural poverty rate. However, the rural poverty in Indonesia remained stable in 2011 with many provinces located in the normative quadrant (with high poverty rate and low NTP index) or in the transition provinces (with high poverty rate and high NTP index). It indicates that these provinces require a change on determining economic sector policy to increase farmers' welfare development. The presence of provinces in the latter quadrant provides evidence that NTP index may not affect poverty rate in the short term, or that beyond the other factors of farmers' welfare are at play to reduce rural poverty rate. This fact also shows that the rural poverty alleviation in Indonesia can be affected by all other factors beyond the criteria of farmers' welfare based on only the NTP index.

[14] The complete quadrant analysis can see Figure A.4 – Figure A.7 in Appendices.

Table 4.10
The Result of Quadrant Analysis between Farmers' Welfare and Rural Poverty Reduction by Province in the Period 2008 - 2011

Year	The Average of NTP Index	The Number of Provinces			
		Quadrant I (Agriculture-Based Provinces) = High NTP & Low Rural Poor-People Percentage	Quadrant II (Non-Agriculture Based Provinces) = Low NTP & Low Rural Poor-People Percentage	Quadrant III (Normative Provinces) = Low NTP & High Rural Poor-People Percentage	Quadrant IV (Transition Provinces) = High NTP & High Rural Poor-People Percentage
2008	101.02	9	9	5	9
2009	100.98	5	13	6	8
2010	102.57	7	11	6	8
2011	104.19	9	9	8	6
Average**	102.19	7	11	8	6

** *The average of NTP index and the average of rural-poor-people percentage by province in the period 2008-2011*

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Chapter 5
Conclusion

In Indonesia, the agriculture sector has a strategic role in the national economy for improving farmers' welfare, accelerating economic growth, and reducing poverty rate. Hence, the objective of revitalizing agriculture and improving farmers' welfare has become the main agenda in the strategic program of MDGs 2015 framework and the national development planning in Indonesia. According to RPJMN 2010-2014 and Renstra 2010-2014, the role of agriculture sector development program is expected to reduce rural poverty rate through improvement of farmers' welfare in Indonesia.

However, agriculture development needs a more comprehensive approach, as inflation rate-induced fluctuation of farmers' welfare indicates. The agriculture intensification process through technological advancement and better internal management in order to increase output production is not the only factor for rural poverty reduction. Other factors beyond the agriculture sector, such as maintaining inflation rate, had proven to have a strategic role on improving the farmers' welfare and rural poverty reduction.

The study attempts to first analyse the relationship between inflation rate and farmers' welfare improvement using VAR model analysis based on quarterly data in the period 2000 – 2011. Second, it is to investigate the role of farmer well-being on rural poverty using the quadrant analysis based on quarterly data in the period 2008 – 2011. More precisely, we will use the data on the NTP index and on rural poverty rate to run this latter analysis. The dynamic analysis using the VAR model is useful to test the relationship between inflation rate and farmers' welfare in the short and long run. Additionally, quadrant analysis is used to analyse interrelated conditions between farmers' welfare and rural poverty rate. It is simple, but it can give better depiction about the related conditions between the NTP index and the average of rural poverty rate across provinces in Indonesia.

The result of our dynamic analysis using VAR model shows that inflation rate affects Indonesian farmers' welfare significantly in the long run but not in the short run. This is in line with the theoretical findings from the structural theory of inflation, where the inflation rate is related to structural phenomena. The characteristic of inflation rate in Indonesia is not 'the short-term phenomenon' and incidental situation. It is the long-term inflation rate that can stimulate the structural-macroeconomic conditions. Moreover, it has also been found that domestic and international economic shocks, such as share of agriculture sector in GDP's growth or real exchange rate, do influence the NTP index significantly. More precisely, the agriculture output growth and the inflation rate are positively affecting the farmer well-being while a depreciation of Indonesian rupiah significantly reduces it. Therefore, our analysis stresses the fact that in order to improve further the farmers' welfare in Indonesia, not only the inflation rate needs to be considered but also other monetary instruments and real-sector-development policies.

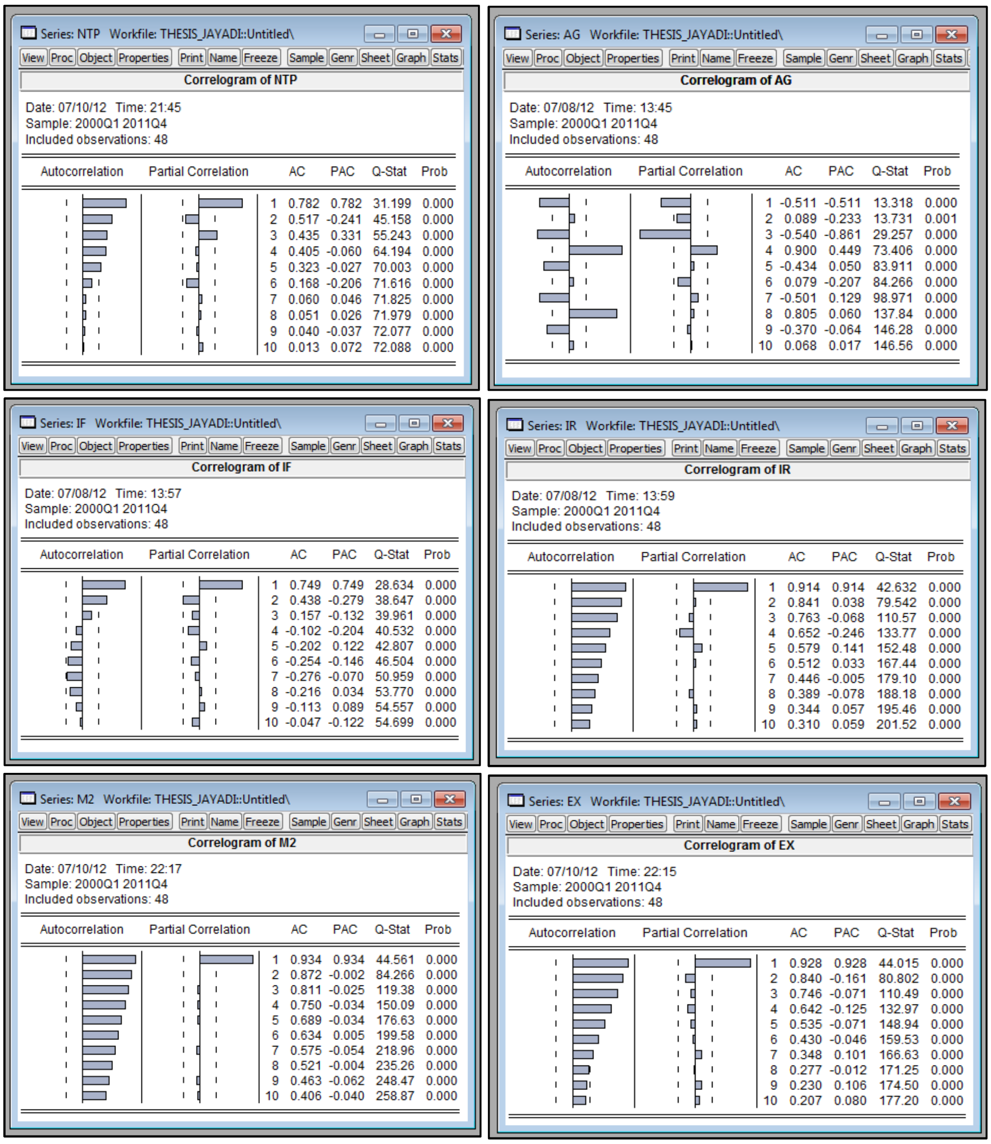
Finally, based on the quadrant analysis done for the years 2008-2011, an increase over time of the number of agriculture-based provinces (with high

NTP index and low rural poverty rate) can be observed. The number of provinces in this quadrant analysis had increased from 5 to 9 provinces. This increase is due to the raise in the average of NTP index from 100.98 to 104.19. This corresponds to provinces going from low NTP index and low poverty rate (quadrant II) to high NTP index and low poverty rate (quadrant I). Nevertheless, the rural poverty in Indonesia remained stable in 2011 with many provinces located in the normative quadrant (with low NTP index and high poverty rate) or in the transition provinces (with high NTP index and high poverty rate). To conclude, we find in our analysis that inflation rate influences significantly and positively the NTP index in the long run. In turn, we find evidence that an increase in the farmers' income through NTP index cannot affect poverty rate in the short term, or that beyond other factors of the farmers' welfare are at play to reduce rural poverty rate in Indonesia.

The results of this study also point to some important factors of policy interventions on reducing rural poverty rate through increasing the farmers' welfare. The farmers' welfare is affected by some factors from monetary instruments and real-sector-development policies. The farmers' welfare problem highlights the need for policy interventions to induce many different stakeholders, which should be involved in agriculture sector. Only a comprehensive and global approach could efficiently improve the farmers' welfare in Indonesia.

Appendices

Figure A.1
The Correlogram of Variables NTP, AG, IF, IR, M2 and EX in the Level in the period 2000 – 2011



Series: NTP Workfile: THESIS_JAYADI::Untitled\

Correlogram of NTP

Date: 07/10/12 Time: 21:45
Sample: 2000Q1 2011Q4
Included observations: 48

	AC	PAC	Q-Stat	Prob
1	0.782	0.782	31.199	0.000
2	0.517	-0.241	45.158	0.000
3	0.435	0.331	55.243	0.000
4	0.405	-0.060	64.194	0.000
5	0.323	-0.027	70.003	0.000
6	0.168	-0.206	71.616	0.000
7	0.060	0.046	71.825	0.000
8	0.051	0.026	71.979	0.000
9	0.040	-0.037	72.077	0.000
10	0.013	0.072	72.088	0.000

Series: AG Workfile: THESIS_JAYADI::Untitled\

Correlogram of AG

Date: 07/08/12 Time: 13:45
Sample: 2000Q1 2011Q4
Included observations: 48

	AC	PAC	Q-Stat	Prob
1	-0.511	-0.511	13.318	0.000
2	0.089	-0.233	13.731	0.001
3	-0.540	-0.861	29.257	0.000
4	0.900	0.449	73.406	0.000
5	-0.434	0.050	83.911	0.000
6	0.079	-0.207	84.266	0.000
7	-0.501	0.129	98.971	0.000
8	0.805	0.060	137.84	0.000
9	-0.370	-0.064	146.28	0.000
10	0.068	0.017	146.56	0.000

Series: IF Workfile: THESIS_JAYADI::Untitled\

Correlogram of IF

Date: 07/08/12 Time: 13:57
Sample: 2000Q1 2011Q4
Included observations: 48

	AC	PAC	Q-Stat	Prob
1	0.749	0.749	28.634	0.000
2	0.438	-0.279	38.647	0.000
3	0.157	-0.132	39.961	0.000
4	-0.102	-0.204	40.532	0.000
5	-0.202	0.122	42.807	0.000
6	-0.254	-0.146	46.504	0.000
7	-0.276	-0.070	50.959	0.000
8	-0.216	0.034	53.770	0.000
9	-0.113	0.089	54.557	0.000
10	-0.047	-0.122	54.699	0.000

Series: IR Workfile: THESIS_JAYADI::Untitled\

Correlogram of IR

Date: 07/08/12 Time: 13:59
Sample: 2000Q1 2011Q4
Included observations: 48

	AC	PAC	Q-Stat	Prob
1	0.914	0.914	42.632	0.000
2	0.841	0.038	79.542	0.000
3	0.763	-0.068	110.57	0.000
4	0.652	-0.246	133.77	0.000
5	0.579	0.141	152.48	0.000
6	0.512	0.033	167.44	0.000
7	0.446	-0.005	179.10	0.000
8	0.389	-0.078	188.18	0.000
9	0.344	0.057	195.46	0.000
10	0.310	0.059	201.52	0.000

Series: M2 Workfile: THESIS_JAYADI::Untitled\

Correlogram of M2

Date: 07/10/12 Time: 22:17
Sample: 2000Q1 2011Q4
Included observations: 48

	AC	PAC	Q-Stat	Prob
1	0.934	0.934	44.561	0.000
2	0.872	-0.002	84.266	0.000
3	0.811	-0.025	119.38	0.000
4	0.750	-0.034	150.09	0.000
5	0.689	-0.034	176.63	0.000
6	0.634	0.005	199.58	0.000
7	0.575	-0.054	218.96	0.000
8	0.521	-0.004	235.26	0.000
9	0.463	-0.062	248.47	0.000
10	0.406	-0.040	258.87	0.000

Series: EX Workfile: THESIS_JAYADI::Untitled\

Correlogram of EX

Date: 07/10/12 Time: 22:15
Sample: 2000Q1 2011Q4
Included observations: 48

	AC	PAC	Q-Stat	Prob
1	0.928	0.928	44.015	0.000
2	0.840	-0.161	80.802	0.000
3	0.746	-0.071	110.49	0.000
4	0.642	-0.125	132.97	0.000
5	0.535	-0.071	148.94	0.000
6	0.430	-0.046	159.53	0.000
7	0.348	0.101	166.63	0.000
8	0.277	-0.012	171.25	0.000
9	0.230	0.106	174.50	0.000
10	0.207	0.080	177.20	0.000

Figure A.2
The Inverse Roots of AR Characteristic Polynomial in the VECM at Lag 4

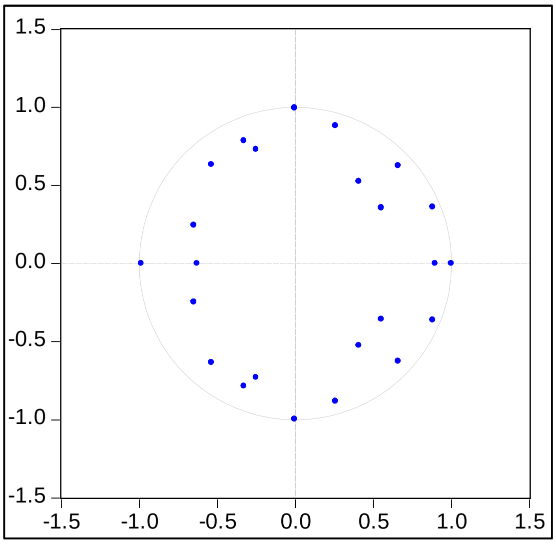


Table A.1
The Result of VECM Stability Condition Check at Lag 4

Root	Modulus
1.000000	1.000000
-0.003040 + 0.996470i	0.996475
-0.003040 - 0.996470i	0.996475
-0.986111	0.986111
0.880571 - 0.360982i	0.951689
0.880571 + 0.360982i	0.951689
0.257573 - 0.882286i	0.919115
0.257573 + 0.882286i	0.919115
0.659415 - 0.625318i	0.908763
0.659415 + 0.625318i	0.908763
0.897480	0.897480
-0.328825 + 0.785375i	0.851434
-0.328825 - 0.785375i	0.851434
-0.537737 + 0.632697i	0.830342
-0.537737 - 0.632697i	0.830342
-0.250384 - 0.730389i	0.772114
-0.250384 + 0.730389i	0.772114
-0.648667 + 0.246117i	0.693788
-0.648667 - 0.246117i	0.693788
0.408877 + 0.524832i	0.665304
0.408877 - 0.524832i	0.665304
0.551619 + 0.356876i	0.656996
0.551619 - 0.356876i	0.656996
-0.629860	0.629860

Table A.2
The Result of Heteroscedasticity Test

Joint test:

Chi-sq	df	Prob.
802.4786	798	0.4488

Individual components:

Dependent	R-squared	F(38,5)	Prob.	Chi-sq(38)	Prob.
res1*res1	0.975094	5.151506	0.0371	42.90415	0.2690
res2*res2	0.920839	1.530598	0.3392	40.51693	0.3599
res3*res3	0.792942	0.503891	0.8969	34.88946	0.6141
res4*res4	0.916619	1.446472	0.3669	40.33125	0.3676
res5*res5	0.793245	0.504821	0.8963	34.90278	0.6134
res6*res6	0.730143	0.356009	0.9703	32.12631	0.7371
res2*res1	0.942788	2.168277	0.1975	41.48268	0.3214
res3*res1	0.959912	3.150707	0.1006	42.23615	0.2929
res3*res2	0.849922	0.745158	0.7322	37.39657	0.4972
res4*res1	0.914198	1.401948	0.3827	40.22473	0.3720
res4*res2	0.935439	1.906474	0.2438	41.15931	0.3340
res4*res3	0.725009	0.346906	0.9735	31.90040	0.7465
res5*res1	0.976894	5.563004	0.0315	42.98334	0.2663
res5*res2	0.796951	0.516437	0.8891	35.06584	0.6059
res5*res3	0.919264	1.498172	0.3496	40.44763	0.3628
res5*res4	0.812589	0.570507	0.8538	35.75390	0.5738
res6*res1	0.796234	0.514156	0.8905	35.03429	0.6073
res6*res2	0.924575	1.612927	0.3147	40.68131	0.3532
res6*res3	0.860291	0.810226	0.6877	37.85279	0.4762
res6*res4	0.793020	0.504130	0.8967	34.89289	0.6139
res6*res5	0.869020	0.872995	0.6464	38.23689	0.4587

Figure A.3
The Impulse Respond Function on Response of Variable NTP to other Variables

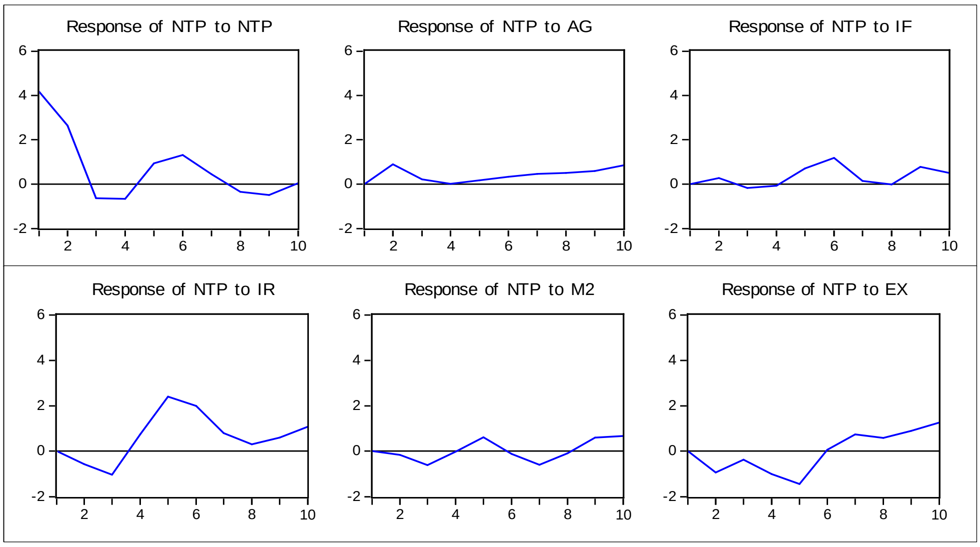


Figure A.4
The Result of Quadrant Analysis between Percentage of Poor People in Rural Area and the NTP Index by Province in 2008

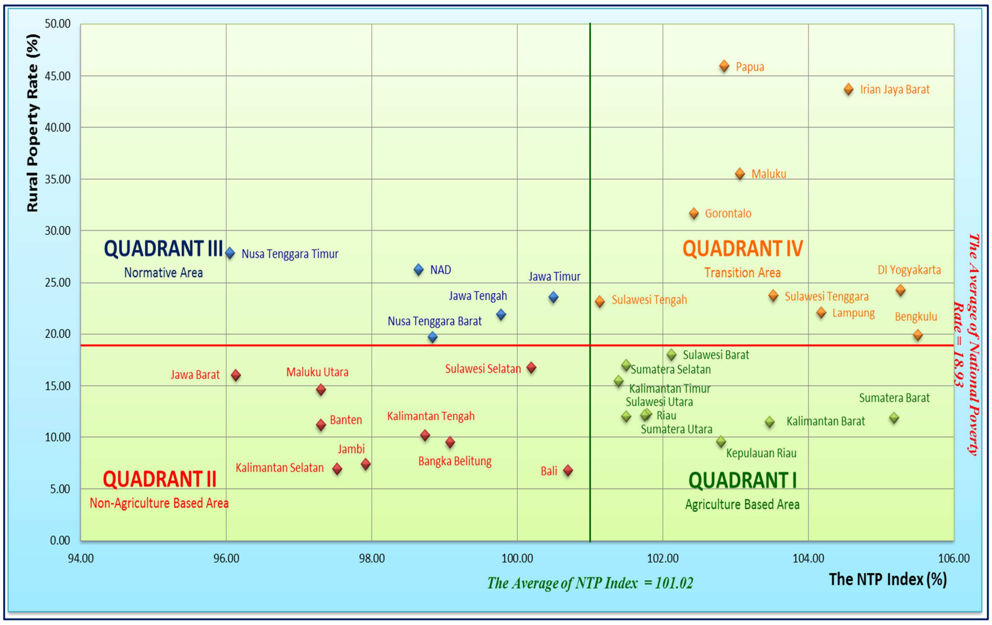


Figure A.5
The Result of Quadrant Analysis between Percentage of Poor People in Rural Area and the NTP Index by Province in 2009

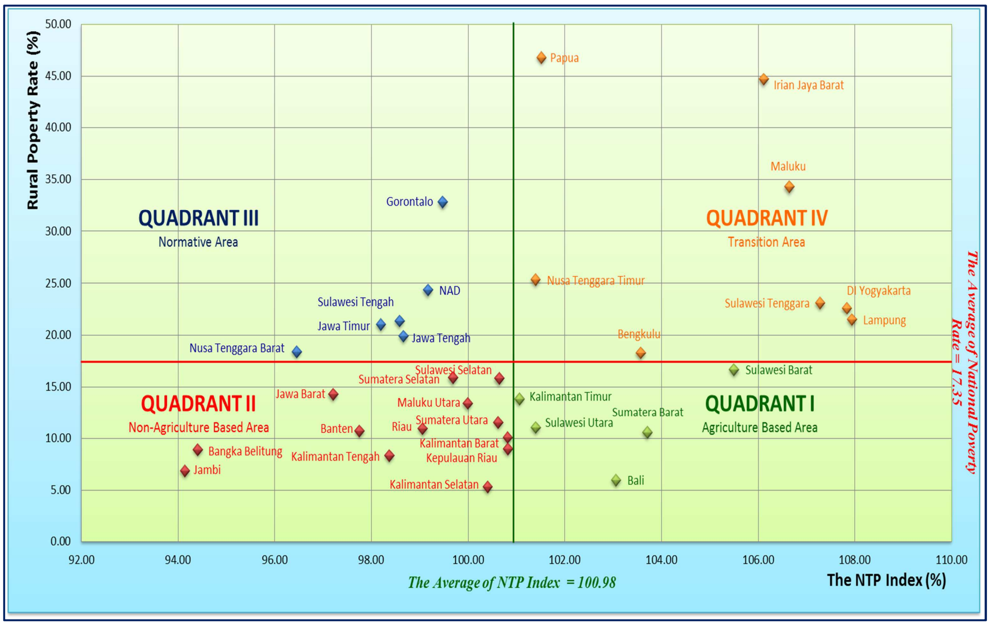


Figure A.6
The Result of Quadrant Analysis between Percentage of Poor People in Rural Area and the NTP Index by Province in 2010

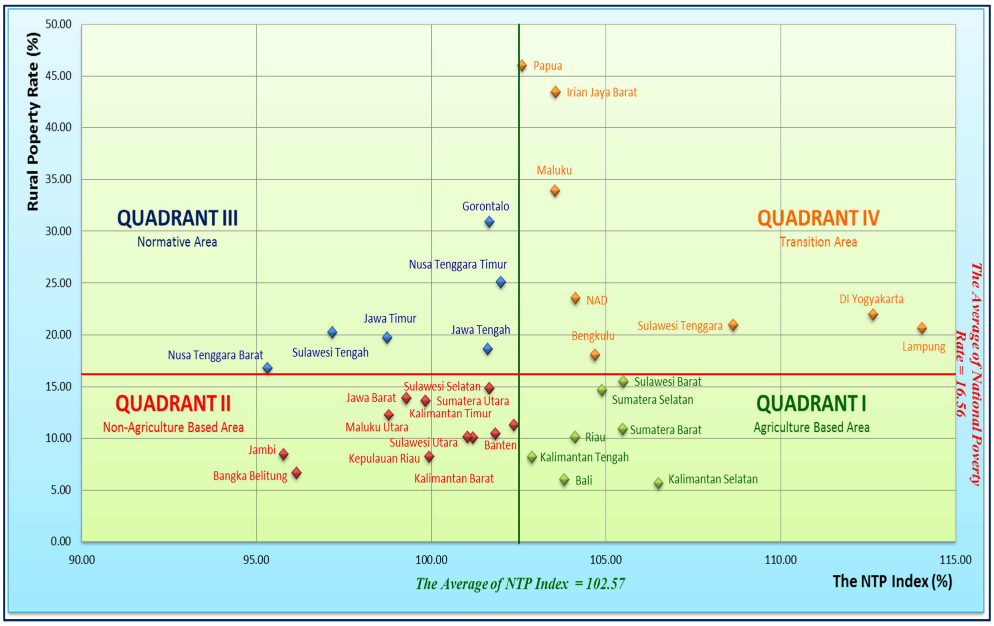
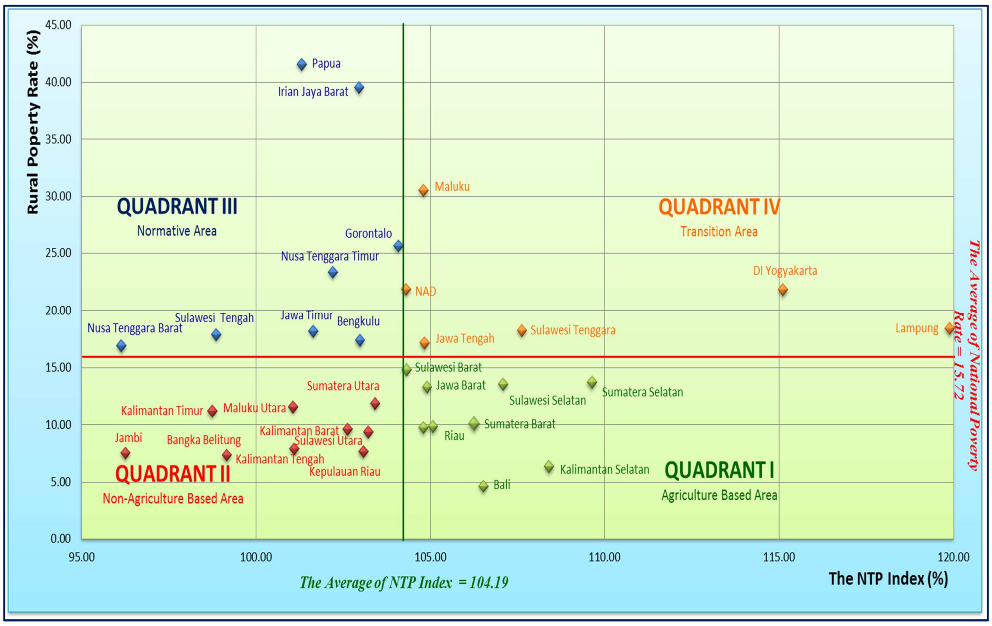


Figure A.7
The Result of Quadrant Analysis between Percentage of Poor People in Rural Area and the NTP Index by Province in 2011



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